Proceedings of the 32nd Annual National Conference of Technology Education Practitioners Association of Nigeria

(Formerly Nigerian Association of Teachers of Technology, NATT)

Theme:
Technical Vocational Education and Training (TVET) and Alternative Energy Sources for Sustainable Economic Recovery in Nigeria

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Theme:
Technical Vocational Education and Training (TVET) and Climate Change Information Needs for Sustainable Environmental Protection in Nigeria

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PREFACE

AKWANGA 2019 is the 32nd edition of the Technology Education Practitioners Association of Nigeria (formerly, Nigerian Association of Teachers of Technology) Annual National Conference and the association's Annual General Meeting (AGM). The essence of this conference is to establish a place where technical teacher educators, TVET experts, educational administrators, industry experts, government agencies and other academic researchers brainstorm and chart a way forward on improving the TVET and technical teacher educational systems in Nigeria.

Keynote speech comes up on the occasion of the conference opening ceremony. Lead paper presentations from leaders in various fields are normally scheduled at the beginning of each conference day's activities and during the lunch break. Exhibitions from various companies in the industry and the conference sponsors are show cased at the conference premises throughout the event. Last segment of the conference marks the peak of events featuring the dinner banquet in the evening and Annual General Meeting the following morning. Since inception, TEPAN (formerly NATT) Annual National Conference and Annual General Meeting holds regularly at different locations in the country after a fair bid for hosting right. At the conference, tutorials, technical paper sessions, and panel discussions are scheduled on various topics and subject areas within TVET and Technology Teacher Education. Over the years focus areas included Educational Infrastructure, Innovative Approaches to TVET, Global Economic Depression and Insecurity as they impact on educational administrative processes.

The Executive Council of the Technology Education Practitioners Association of Nigeria under the leadership of Prof. R. O. Okwori chose the theme of the 32nd Annual National Conference of the association as ***Technical Vocational Education and Training (TVET) and Climate Change Information Needs for Sustainable Environmental Protection in Nigeria***. This year's conference is hosted at the Hall 14, School of Education, Nassarawa State College of Education, Akwanga. Therefore, it is my pleasure to present to you **AKWANGA 2019** Book of Proceedings as an invaluable reference material based on the following sub-themes: *Policy and Legislation for Sustainable Environmental Protection, Funding TVET for for Sustainable Environmental Protection, TVET Curriculum for Climate Change Information Needs, Private-Public-Partnership (PPP) for Sustainable Environmental Protection, Science, Technology and Sustainable Environmental Protection.*

Finally, we are most sincerely express our gratitude to all participants and our sponsors for partnering with TEPAN to blend outputs from academic researches, reports, industrial experiences and lessons learned in the field implementations and cutting-edge technologies. Our special thanks go to the Local Organizing Committee for its valuable time and effort for making **AKWANGA 2019** a success.

Prof. A. S. Bappah
Editor – in – Chief

Proceedings of the 32nd Annual National Conference of Technology Education Practitioners Association of Nigeria

(Formerly Nigerian Association of Teachers of Technology, NATT)

On Technical Vocational Education and Training (TVET) and Climate Change Information Needs for Sustainable Environmental Protection in Nigeria

SUB – THEMES:

1. **Policy and Legislation for Sustainable Environmental Protection**
2. **Funding TVET for Sustainable Environmental Protection**
3. **TVET Curriculum for Climate Change Information Needs**
4. **Private-Public-Partnership (PPP) for Sustainable Environmental Protection**
5. **Science, Technology and for Sustainable Environmental Protection**

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WELCOME ADDRESS BY NATIONAL PRESIDENT OF TECHNOLOGY EDUCATION PRACTITIONERS ASSOCIATION OF NIGERIA (FORMERLY NIGERIAN ASSOCIATION OF TEACHERS OF TECHNOLOGY)

PROFESSOR ROBERT OGBANJE OKWORI FNATT, FHRD

AT THE OPENING CEREMONY OF THE 32ND ANNUAL NATIONAL CONFERENCE OF THE ASSOCIATION HELD AT COLLEGE OF EDUCATION AKWANGA, NASSARAWA STATE ON WEDNESDAY 16TH OCTOBER, 2019

Protocols

Distinguished guests, respected colleagues, ladies and gentlemen

It is with great pleasure and honour that I welcome all of you to the 32nd Annual National Conference of the Technology Education Practitioners Association of Nigeria (TEPAN) formerly called Nigerian Association of Teachers of Technology (NATT). I sincerely appreciate the Almighty God for granting us a safe trip to Akwanga, Nassarawa State. I am delighted to welcome you to this Opening Ceremony holding here today at the College of Education Akwanga, Nasarawa State.

We sincerely appreciate the presence of the distinguished personalities here who have made the sacrifice to create time to grace this annual occasion of the Association. Today, we are privileged to have the Chairman of the occasion, Hon. Dr. Peter Ibrahim Akwe who is a renowned scholar of high repute. Also, we deeply appreciate the presence of the workshop Facilitator, Prof. Paul S. Yaduma (Department of Vocational and Technology Education, Abubakar Tafawa Balewa University, Bauchi, Bauchi State); keynote and lead presenters namely; Dr. E. K. Ezema (former Ag. Provost, Federal College of Education, Pankshin, Plateau State) and Prof. Mathew Ukpongson (Department of Agricultural Extension, Federal University of Technology, Owerri, Imo State) respectively. I want to specially recognize and appreciate the encouragement, love and hospitality of Dr (Mrs) Rebecca Isaac Umoru, the Provost of this great College and his management team for giving us the permission to hold this conference here. We sincerely appreciate the members of the Local Organizing Committee for their relentless effort that made this conference a reality.

We are also grateful to have the former Presidents, Fellows of TEPAN, Professors, other dignitaries and all our academic fathers and leaders here today for Akwanga, 2019 TEPAN Annual National Conference.

The theme of the 32nd Annual National Conference of the Association is "Technical Vocational Educational and Training (TVET) and Climate Change Information Needs for Sustainable Environmental Protection in Nigeria" has been chosen after careful deliberation, to reflect the fact that there have been fundamental changes to both the nature and the dynamics of the world. This may in turn affect the way the industry addresses the challenges that lie before it. This has been principally apparent in the TVET and environmental sector. The persistent Climate Change during this period has been a symptom of this. Assessing the extent to which this really is a new climate change information era taking into cognizant of the fact that challenges, if mastered wisely, create new opportunities from which the world at large can and should benefit from it.

In the light of all this, perceptions about sustainable environmental protection have come under scrutiny, to the extent that analysts and decision-makers have been able to keep up with the changing tide of events which has not always been easy. Thus, there has been greater intensity in their efforts to study the way forward, and this has resulted in debates being pursued with renewed dynamism in the following key areas:

1. Policy and legislation for sustainable environmental protection
2. Funding TVET for sustainable environmental protection

3. TVET curriculum for climate change information needs
4. Public Private Partnership (PPP) for sustainable environmental protection
5. Sustainable environmental protection

During this conference, these and many other topical issues that relate to the day-to-day climate change information as well as its sustainable environmental protection development in the years ahead will be discussed. Furthermore, broad-based issues affecting the harmonious evolution of mankind generally, such as the environment, climate change information, sustainable environmental protection and how the provision of TVET can salvage the situation will also be discussed.

We shall benefit from the great strides that have been contributed since the 20th century and as well supported the sustainable environmental protection in Nigeria. Indeed, we expect such collaboration to continue in the future by fully utilizing the latest advances in technology to ensure the continued steady supply of information for sustainable environmental protection. In order to tackle this vast subject-matter, the conference theme has been divided into five (5) sub-themes.

We are privileged to have among in TVET i.e the speakers who will be sharing with us intellectually in this conference. They include top officers from intergovernmental bodies, chief executives of national and international organizations and renowned academics. We are deeply appreciative of their presence despite their tight schedules to participate in this conference. We are confident that, participants will benefit from their knowledge and experiences.

As part of the events in this year's conference, a pre-conference workshop was organized on the 15th October 2019, with the topic: "TVET and Innovative Pedagogies."

We welcome exchange of ideas in all our discussions, regardless of whether the expressed views are at variance with others. It is only with an open, wholehearted approach to issues that a meeting like this will be effective in improving knowledge and understanding of others.

On behalf of the National Executive Council of TEPAN, I wish to acknowledge the efforts of the Local Organizing Committee and others who have contributed towards making this conference a reality. We are also indebted to all the speakers, panelists and other participants, who have spent their time in preparing for this event.

Finally, since I know that all of you are keen to present your paper, we are to proceed to tour while paper presentation starts the following day.

Thank you for your time and God Bless you all.

Long live the Federal Republic of Nigeria.

Long live Kano State.

Long live Technology Education Practitioners Association of Nigeria (TEPAN).

God Bless you all.

CLIMATE CHANNGE: FAULTY VOCATIONAL PRACTICES; THEIR CONSEQUENTIAL EFFECTS AND A FEW MITIGATING PRACTICES DESIGNED TO SLOW DOWN THE HARM ON THE ENVIRONMENT

Dr Emele K. Ezema
Former Acting Provost, Federal College of Education, Pankshin, Plateau State

Being a Keynote Address Delivered at the 32nd Annual National Conference of Technology Education Practitioners Association of Nigeria (TEPAN) Held at Hall 14 Nasarawa State College of Education, Akwanga, Nasararwa State (on 15th October 2019)

Protocol

Introduction

The simple English Wikipedia, the free Encyclopaedia describes climate change as the difference in the earth's global climate or in regional climates over time. It is about abnormal variations to the climate, and the effects of these variations on parts of the earth. Among such variations are excessiveness in changes of precipitation (rain, snow, dew, etc.) heat, winds and other indicators. The Government of Canada (2019) highlighted the fact that the earth's climate is naturally variable on all time scales but the long-term state and average temperature are regulated by the balance between incoming and outgoing energy which determines the earth's energy balance. Any factor that causes a sustained change to the amount of incoming energy or the amount of outgoing energy can lead to climate change.

While man has been blamed for playing a major role in this gradual destruction of God's creation, nature has not been completely excused from contributing to the worrisome situation. For instance, the ocean currents or atmosphere circulation have been found to influence the climate for short periods of time. Volcanic activities, solar output and the earth's orbit around the sun have also been found to be culpable too. Some authorities of course differ as to the role of the solar output to the contribution of changes in the weather. Lean's (2010) work on "Cycles and Trends in Solar Irradiance and Climate" observed that since 1978 a series of satellite instrument have measured the energy output of the sun directly. The satellite data showed a very slight drop in solar radiance (which is a measure of the amount of energy the sun gives off) over the time period. That, led the researcher to conclude that the sun does not appear to be responsible for the warming trend observed over the past several decades. When NASA Jet Propulsion Laboratory (2019) made reference to longer term estimates of solar irradiance which was made using sunspot records and other indicators such as the amount of carbon in tree-rings, it was found as confirmed in most recent analyses of these proxies that solar irradiance changes could not plausibly account for more than 10 per cent of the 20th century warming.

It is of course doubtful how long the aforementioned studies and other similar to them can stand the test of time. This is because studies like those of Lockwood (2009), Edwards and Miller (2001), Mckibben (2011), Ruddimon (2003) and a host of others are agog with facts to prove that nature has a role in the changes of climate being experienced today. Lockwood (2009) blamed a decrease in solar activity coupled with an increase in volcanic activity as being responsible for triggering the Ice Age between approximately 1650 and 1850 when Greenland cooled from 1410 to 1720s and glaciers advanced in the Alps.

As the debate rages on, the Government of Canada (2019) has come out with the fact that since the Industrial Revolution there has been over 50 times that of changes than are associated to the sun's output. While of course not ignoring the contributions of nature, towards climate change, it is this latter aspect of the debate – man's contribution to the changes that this work will concern itself with.

Faulty vocational practices that enhance climate change

The burning of fossil fuel, that is fuel from pre-historic animals and plants now hardened like rock for example coal and even fuel from hydrocarbons like petrol etc. have been seriously blamed for the situation the world finds herself today. Until recently, coal was the moving force of many technological breakthroughs. Coal propelled the Industrial Revolution. It was used in the heating of water, which changed to steam which in turn was used to drive wheels. They turned turbines which were used in generating electricity. Trains and other machineries owed their movements to power from coal. While attempts are seriously being made to curtail its use, many developing countries still use it for their daily chores such as cooking, blacksmithing, goldsmithing, and so on. To the professional local metal worker in Awka, Bida, and so on, asking them to stop using coal to heat up their furnaces will be synonymous to asking them to commit suicide. What happens to the commercial food vendors, even most homes? A great percentage still depend on coal and wood in firing their local stoves. Can the various governments especially in the third world countries afford to ask their citizens to stop using this source of energy for now? The answer is likely to be NO!

Apart from the burning of fossils, carbon dioxide is released into the atmosphere through other means such as respiration, deforestation, overgrazing and land use. While respiration cannot be effectively classified as a faulty practice, deforestation and overgrazing are. Forests which serve to maintain the balance in the ecosystem are constantly being mowed down to make way for roads, agriculture, buildings and so on. In their places, new trees are rarely planted to take their place. The same goes for overgrazed grasslands. The result is an imbalance in the concentration of carbon dioxide (**CO_2**) in the atmosphere. Associated to problems emanating from faulty practices in agricultural practices is burning. This practice has been a worrisome one among agriculturalists but it seems little or nothing can be done about it now since it seems to be a cheaper method of clearing the land for farming and sometimes for killing of animals and even rodents for meat. In places where indiscriminate burning are forbidden, the practice has changed to gathering of leaves and wastes. They are stalked and allowed to decompose in landfills for agricultural purposes. This practice on its own produces one of the most dangerous causes of climate change – methane. On a molecule – for – molecule basis, methane has been found to be a more active greenhouse gas than carbon dioxide, but fortunately one which is much less abundant in the atmosphere.

Funny enough, methane production has also been traced to what many have for a long time been seeing as a saving grace agriculture. The United States Global Change Research Program (2009) fingered agriculture, especially rice cultivation, ruminant digestions, and manure management associated with domestic livestock as culprits in the emission of methane to the atmosphere.

Another gas that contributes to the warming of the globe is Nitrous Oxide (**N_2O**). This gas just like methane is released to the atmosphere in cause of man's agricultural practices especially in course of use of commercial and organic fertilizers, fossil fuel combustions, production of nitric acid and biomass burning.

The society's indiscriminate burning of synthetic compounds, while paying little or no attention to international laws, is another bane of climate change especially in the developing countries of the world. Chlorofluorocarbons (**CFC**s) is a synthetic compound which is entirely of industrial origin and used in a number of applications. They are currently being largely regulated in production and so is their release to the atmosphere by international agreement for their ability to contribute to the depletion or destruction of the ozone layer. They are also greenhouse gases.

Last among the defaulting gases that contribute to the warming of the earth is surprisingly water vapour. While it is the most abundant greenhouse gas, it importantly acts also as a feedback to the climate, in that they eventually fall back as rain and momentarily help cool the surface of the earth.

When man therefore clears forests exposing the earth to direct scorching of the sun and exposing bodies of water, and when they even create artificial bodies of water; they help increase the rate of water evaporation into the atmosphere. This, increases water vapour and consequently the possibility of clouds which luckily enough falls back to the earth as rain.

For those who may still doubt the efficacy of the aforementioned gases in warming the earth, a review of the atmospheric conditions of some other planets, may be a good way of driving home the point. The Earth Science Communication Team of NASA's Jet Production Laboratory (2019) did a comparative study of the atmospheric conditions of Mars and Venus. While the planet Mars was said to have a very thin atmosphere, nearly all carbon dioxide and with little or no methane nor water vapour to reinforce the weak greenhouse effect, Mars has a large frozen surface that shows no evidence of life. Venus on the other hand has an atmosphere that is nearly all carbon dioxide comparatively with that of the earth's atmosphere, Venus is said to have about 154,000 times as much carbon dioxide in its atmosphere as earth and about 19,000 times as much as the quantity in Mars atmosphere. The effect is a runaway greenhouse effect and a surface temperature hot enough to melt lead.

Effects of climate change

The effects of climate change are enormous. The American Climate Choices (2011) highlights the facts – that climate change has brought about possibly permanent alterations to earth's geological, biological, and ecological systems. These changes the study reveals have led to the emergence of a not so large-scale environmental hazards to human health such as extreme weather, ozone depletion, increased danger of wildlife fires, loss of biodiversity, stresses to food-producing systems and the global spread of infectious diseases. In addition, climate changes are estimated to cause over 150,000 deaths annually. Regrettably, far less research has been conducted on the impacts of climate change on health, food supply, economic growth, migration, security, societal change, and public goods, such as drinking water, than on the geophysical changes related to global warming. Bangladesh according to American Climate Choices (2011) is said to have experienced an increase in climate sensitive diseases such as malaria, dengue, childhood diarrhoea, and pneumonia.

Kabir, Rahman, Smith, Lusha and Milton (2016) while putting all the blame of climate change on man decided to pay more attention on some benefits of climate change. For instance, they observed that climate changes in Siberia, are expected to improve food production and local economic activities, at least in the short to medium term. On the 6th of August, 2019 the Nigerian TVC News on one of its footages carried the news that 10million tons of ice melted and got disengaged in one day in Greenland. This massive tonnage of ice is expected to give way for more land needed for agriculture and other social activities. Despite the few positive gains experienced as a result of climate change, Ghfgeneva.org (2011) affirms the fact that available studies on the topic, the current and future impacts of climate change on human society are and will continue to be overwhelmingly negative.

There is no doubt that majority of the adverse effects of climate change are experienced mostly by poor and low-income communities around the world who have much higher levels of vulnerability to environmental determinants of health, and much lower levels of capacity available for coping with environmental changes. In a work titled "Climate-Change; the Anatomy of a Silent Crisis" published 2009, it was estimated that more than 300,000 deaths and $125billion in economic losses are experienced each year. The work observed that most climate change induced mortality was due to worsening floods and droughts in developing countries. [The Abubakar Tafawa Belewa University, Bauchi was on the 6th of August 2019 temporarily closed down as a result of four students who were reportedly drowned as a result of flood. (TVC News 6th August, 2019)]

In the World Meteorological Organization Publication of 21 September 2015, it was noted that climate change threatens to slow, halt or reverse international progress towards reducing child under-nutrition, deaths from diarrheal diseases and the spread of other infectious diseases. Climate change, the work observed, acts predominantly by exacerbating the existing often enormous health problems, especially in the poorer parts of the world. These, they said are likely to be multiplied by the added stresses of climate change.

Attempts will be made to highlight these negative effects of climate change to clarify the enormosity of the problems:

1. ***Environment:*** Climate change as reported in Sahney, Benton, Falcon-Lang (2010) may dramatically impact habitat loss and may cause the deforestation of rainforests as has occurred in many parts of the world. The sub-Sahara region of Africa is a good example. It was therefore no surprise when on the 31st of July the Nigerian TVC News announced the planting of 15,000,000 trees in Ethiopia. This was in attempt to fight back the ravaging Sahara desert.
2. ***Temperature:*** A sustained temperature exceeding $35^{O}C$ as reported in John, Dunne, Stouffer, Jasmin, John (2013) is a threshold at which the resilience of human systems is no longer able to adequately cool the skin. The work also highlighted the fact that heat stress reduces labour capacity considerably. This has the capacity of impacting a country's economy and development. Excessive cold are not better either. Climate change similarly contributes to cold snaps due to disruptions in the polar region of the world which in turn causes a decline in Artic sea ice which in turn causes frigid, cold air to spill from the Artic into the areas of the Northern Hemisphere that usually does not experience such cold temperatures. As expected, such drops in temperature affect human output apart from the excessive damages that often go with such occurrences. A study by Ryan and Michael from 2013 to 2014 showed that of the most notable of winter storms, most of which were caused by the disruption of the polar vortex (i.e. a whirly fluid or wind) there was a damage of $263 million, 32 fatalities and 9 injuries. These were apart from infrastructural damages or disruptions in form of closed roads, shutting down of schools, airports and other civil functions.
3. ***Water:*** As the climate warms, it changes the nature of global rainfall, evaporation, snow, stream flow and other factors that affect water supply and quality. Specific impacts as reported in Kathleen, E.P.A (2009) and Harrison (2005) shows that warmer temperature affect water quality and accelerate water pollution. Sea level rise is projected to increase salt-water intrusion into groundwater in some regions. This reduces the amount of freshwater available for drinking and farming. Increased extreme weather means more water falls on hardened ground unable to absorb it, leading to flash floods instead of replenishment of soil moisture or groundwater levels. Increased evaporation will reduce the effectiveness of reservoirs. Human demand for water will grow for the purposes of cooling and hydration, Finally, increased rainfall or precipitation will lead to changes in water-borne and vector-borne diseases.
4. ***Displacement and Migration:*** Climate change causes displacement of people in several ways, the most obvious and dramatic being through the increased number and severity of weather related disasters which destroy homes and habitats causing people to seek shelter or livelihood elsewhere. The effect of climate change such as desertification and rising sea levels gradually erode livelihood and force communities to abandon traditional homelands for more accommodating environments. This is currently happening in areas of Africa's Sahel, the semi-deserts, and the belt that spans the continent just below its northern deserts. Deteriorating environments triggered by climate change can also lead to increased conflict over resources which in turn can displace people. Wilbanks (2007) predicted that about 150 million environmental migrants will exist by the year 2050, due mainly to the effects of coastal flooding, shoreline erosion and agricultural disruption.
5. ***Security:*** Climate change has the potential to increase existing tensions and create new ones – serving as a threat multiplier. Smith, Vivekananda, Janani (2007) in their article titled "Climate Change as a Security Risk" were of the opinion that climate change can be a catalyst for violent conflict, and a threat to international security. Burke, Marshall, Hsiang, Solomon (2015) on a similar topic "Climate and Conflict" found – that 1 standard deviation (1σ) change in climate towards warmer temperatures or more extreme rainfall, median estimates indicate that the frequency of under-group conflict rises 14%. The American Military Advisory Board (a panel of retired U.S. generals, and admirals, (2007) in their own submission titled "National Security and the threat of climate change" predicted that global warming will serve as a "threat multiplier" in already volatile regions. Al-Jazeera of 27th April, 2015 suggested climate change to be responsible for some major conflicts, such as:

- War in Dafur, where sustained drought encouraged conflict between herders and farmers.
- Syrian Civil War, preceded by displacement of 1.5 million people due to drought-induced crop and livestock failure.
- Islamist insurgency in Nigeria, which exploited natural resource shortage to fuel anti-government sentiments.
- Somali civil war in which drought and extreme high temperature have been linked to violence.
- Herder-farmer conflicts in Nigeria, Mali, South Sudan, and other countries in the Sahel region are exacerbated by climate change.
- Northern Mali conflict in which droughts and extreme high temperature have been linked to violence. (Al-Jazeera, 2015).

To put a seal on the argument of relationship between conflict and climate change, the work of Zhang et al (2007) will be handy. They cited the findings of researchers studying ancient climate patterns (paleoclimatology) which showed that long-term fluctuations of war frequency and population changes have followed cycles of temperature change since the pre-industrial era.

6. ***Social Impact:*** The consequences of climate change and poverty are not distributed uniformly within communities. Individual or social factors such as gender, age, education, ethnicity, geography even religion and language lead to differential vulnerability and capacity to adopt to the effects of climate change. Climate change effects such as hunger, poverty, and diseases like malaria and diarrhoea deaths are common among young children. A study by Barlett (2008) showed that children are 14 to 44 percent more likely to die from environmental factors again leaving them the most vulnerable. People in urban areas are more likely to be affected by lower air quality and overcrowding but are more likely to struggle the most to better their situation. They are also more likely to be affected by tropical cyclones, and so on, as a result of rising concentrations of population and infrastructure in coastal regions.

7. ***Human Settlement:*** A major challenge for human settlements is sea level rise, indicated by ongoing observation and research of rapid declines in ice-mass balance from both Greenland and Antarctica. The Copenhagen Diagnosis (2009) on the expected rise of sea-level by 2010 was put at about 2 meters. Depending on regional changes, increased precipitation patterns can cause more flooding or extended drought stresses. In a study on coastal systems and low lying areas the researchers projected confidently that:
   - Coastal and low-lying areas would be exposed to increasing risks including coastal erosion due to climate change and sea-level rise.
   - By the 2080s millions of people would experience floods every year due to sea level rise. The number affected were projected to be largest in the densely populated and low-lying mega deltas of Asia and Africa and smaller islands were judged to be especially vulnerable (Nicols et al, 2007).

   A study on "Environment and Urbanization" by MaGraham, Balk and Anderson (2007) reported that about two-thirds of the world's cities with over five million people are located in these low-lying coastal areas.

8. ***Energy:***

   - <u>*Oil, Coal, Natural Gas*</u> – Oil and natural gas infrastructure are vulnerable to the effects of climate change and the risk of disasters such as storms, cyclones, flooding and long-term increases in sea-level. Minimising these risks by building in less disaster prone areas, can be expensive and impossible in countries with coastal locations or island states. Such a move, can also be misinterpreted and resisted by indigenous people of such areas where oil are mined; who will see such moves as attempting to deny them of needed infrastructures. All thermal power stations depend on water to cool them down. While there are already shortage in the availability of fresh water, there is the likelihood of fall-outs from climate change such as drought worsening the situation.

- *Nuclear* – Just like the case of oil, coal and natural gas, nuclear energy can also be affected by extreme weather and natural disasters. However, the impact of water shortage on nuclear plants cooled by rivers will be greater than those of other power plants. This is because old reactor designs and water-cooled cores must run at lower internal temperatures and thus paradoxically must dump more heat to the environment to produce a given amount of electricity. Simi larsituation has forced some nuclear reactors to be shut down and will do so again unless the cooling systems of these plants are enhanced to provide more capacity (Urban & Mitchell, 2011).
- *Hydroelectricity* – Changes in the amount of river flow will correlate with the amount of energy produced by a dam. Lower river flows because of drought, climate change or upstream dams and diversions will reduce the amount of live storage in a reservoir, therefore reducing the amount of water that can be used by hydroelectricity. The result of diminished river flow can be a power shortage in areas that depend heavily on hydroelectricity power. Urban and Mitchell (2011) noted that Brazil in particular is very vulnerable due to the having reliance on hydroelectricity as increasing temperature, lower water flow, and alterations in the rainfall could reduce total energy production by 7% annually by the end of the century.

9. ***Transport:*** Roads, airport runways, railway lines, and pipelines may require increased maintenance and renewal as they become subject to greater temperature variation. Many roads in Nigeria have become impassable as a result of extreme weather changes and earth movement. Most of the resources that would have been available for the welfare of the citizens are gulped by road maintenance activities or in-activities.

What can be dome about climate change?

Just like the Acquired Immune Deficiency Syndrome (**AIDS**), climate change can only be controlled or slowed down but cannot be reversed or eradicated. Global warming or more generally climate change can only be slowed down by reducing global emissions of carbon dioxide from human fossil fuel combustion and industrial processes to zero. The bad news is even at that, the global temperature will remain essentially constant at its new warmer level. Apart from carbon dioxide, emission of all other substance that warm the climate must also be substantially reduced. This shows how difficult the challenge is. According to Oppenheimer et al (2014) climate change mitigation generally involves reductions in human emissions of greenhouse gases (**GHG**s). Mitigation they also noted may also be achieved by increasing the capacity of carbon sinks for example through deforestation. The United Kingdom (UK) Royal Society (2008), and Levine et al (2007) gave mitigating practices as reducing energy demand by increasing energy efficiency, phasing out fossil fuels to low carbon energy sources and removing carbon dioxide from earth's atmosphere, through for instance improved building insulation, and climate engineering.

Greenhouse emission can be reduced by using low-carbon technologies. One of the ways of achieving such as by converting fossil fuel driven vehicles to electric driven devices. http://www.fueleconmy.gov/fed (2006) is quoted as saying that the United States has the potential to supply electricity for 73% of light duty vehicles (**LDV**) using overnight charging. The US average $\mathbf{CO_2}$ emissions for a battery-electric car is said to be 180grams per mile versus 430 grams per mile for a gasoline car.

Energy conservation (which differs from energy efficiency) refers to the use of less energy to achieve a lesser energy demanding service, for example through behavioural change, as well as encompassing energy efficiency. Examples of conservation without efficiency improvements would be heating a room less in winter, driving less, or working in a less brightly lit room. Hebden (2006) saw reducing energy use as a key solution to the problem of reducing greenhouse gas emission. International Energy Agency (2006) opined that improved energy efficiency in building, industrial processes and transportation could reduce the world's energy needs in 2050 by one third and help control global emissions of greenhouse gases.

Another means of **GHG** reduction in electricity supply is through fuel switching – that is changing the type of fuel used to satisfy a need for an energy service. To meet deep decarbonisation goal of 80% reduction by 2050 as in California and European Union Conferences (2015) many primary energy change will be needed. Progressively, coal, oil and eventually natural gas for space and water heating in buildings will need to be reduced. "Natural Gas and the Environment" (2009) for example stated that for an equivalent amount of heat burning natural gas produces about 45% less carbon dioxide than burning coal. While agreeing with the findings of the aforementioned organization, a noted climate researcher, Tom Wigley found that in as much as $\mathbf{CO_2}$ may be reduced by using natural gas rather than coal, additional methane ($\mathbf{CH_4}$) another greenhouse gas from leakages adds to radiative forcing of the climate system offsetting the reduction in $\mathbf{CO_2}$**.**

Another method of reducing the emission of **GHG** is by taking recourse to Alternative Energy Sources. These are defined by the International Energy Agency (2002) as renewable energy derived from natural processes that are replenished constantly. In their various forms, they are derived directly from the sun, or from heat generated deep within the earth. Included in the definition is electricity and heat generated from solar, wind, ocean, hydropower, biomass, geothermal resources, biofuels and hydrogen derived from renewable resources. The Paris Observer (2012) noted that in 2011, the share of renewables in electricity generation worldwide grew for the fourth year in a row to 20.2%. Mark Z. Jacobson is quoted in Deluchi and Jacobson (2011) as saying that producing all new energy with wind power, solar power, and hydropower by 2030 is feasible while existing energy supply arrangements could be replaced by 2050. He said barners to implementing the renewable energy plan are primarily social and political and not technological nor economic. The IEA were more conservative in their projections. They were of the opinion that solar power generators may produce most of the world's electricity within 50 years (Sills, 2011). Critics of the 100% renewable energy approach of course have doubts about the efficiency of the aforementioned sources. Their doubts are mainly on the variable output of solar and wind power.

Some countries with favourable geography, geology, and weather that are well suited to an economical exploitation of renewable energy sources are Iceland that derives 100 per cent of her power from geothermal energy and countries like Brazil (85%) Australia (62%) New Zealand (65%) and Sweden (54%) have hydroelectricity as their source of power. The use of biomass for heating also continues to grow as well. In Sweden, national use of biomass energy has surpassed that of oil. Renewable biofuels for transportation, such as ethanol fuel and bio-dessel have contributed to a significant decline in oil consumption in the United States since 2006. The 93 billion litres of biofuels produced worldwide in 2009 displaced the equivalent of an estimated 68 billion litres of gasoline, equal to about 5% of world production (REN 21, 2018).

A low carbon energy that can also be called into play in reducing the GHG effect is Nuclear power. Since the 2011 Fukushima nuclear disaster in Japan and associated shutdowns of other nuclear facilities many questions among many commentators over the future of nuclear power have not been palatable. World Nuclear Association reported that nuclear electricity generation in 2012 was at its lowest level since 1999 (WNA, 2013). Several earlier international studies and assessments as reported in Sims (2007), IAEA (2008) IEA (2010) suggested that as part of other available low-carbon energy technologies, nuclear energy will continue to play a role in reducing greenhouse gas emission. As at 2013 nuclear power was estimated to have prevented the atmospheric emission of 64 gigatonnes of $\mathbf{CO_2}$ equivalent. While there are many concerns about the use of nuclear energy such as the fate of spent nuclear fuel, nuclear accidents, security risks, nuclear proliferation and of course their expensive native, these may not be discussed here because of the scope of the work. All the above problems not withstanding nuclear energy accounted for 10.6% of the world's electricity production in 2013 (Sim, 2007) and (IAEA, 2008).

A less worrisome method of removing or reducing the unwanted gas, $\mathbf{CO_2}$ in the atmosphere is through the use of carbon sinks. This is a natural or artificial reservoir that accumulates and stores some carbon-containing chemical compounds for an indefinite period. Naturally, it is achieved by growing forests and artificially it is achieved by a permanent removal of carbon dioxide out of the

atmosphere. The latter is achieved by direct air capture, enhanced weathering technologies such as storage the captured **CO_2** in geologic formations underground and biochar. The IEA says the carbon capture (**CCS**) is the most important single new technology for **CO_2** savings in power generation and industry. Simon (2010) said though it requires 40% or more energy to run a **CCS** coal power plant than a regular coal plant, **CCS** could potentially capture about 90% of all the carbon emitted by the plant. Very related to the new technologies of capturing carbon dioxide from the atmosphere is the CARBFIX project, which couples with the carbon capture and storage in power plants to turn carbon dioxide into stone in relatively short period of two years.

Apart from the above high-tech methods of reducing carbon dioxide in the atmosphere what roles can man play in his day to day sojourn on earth? The following four key "high-impact" actions have been suggested:

i. Do not have an additional child: if this, is adhered to it is assumed about 58.6 tonnes of **CO_2** – equivalent emission will be prevented from adding to the quantity already in the atmosphere every year.

ii. Live car-free. Cars are said to add 2.4 tonnes of carbon dioxide into the atmosphere per year.

iii. Avoid one round trip transatlantic flight; such trips are quoted as adding 1.6 tonnes of carbon dioxide into the atmosphere every year and finally

iv. Eat plant-based diet. Meat and dairy based meals are said to contribute about 0.8 tonnes of **CO_2** – equivalent emission per year. A 2014 study of the real-life diets of British people estimated their greenhouse gas contribution (**CO_2** e.g.) to be 7.19 kg/day for high meat-eaters through to 3.81kg/day for vegetarians and 2.89kg/day for vegans. It is said that a widespread adoption of a vegetarian diet could cut food-related greenhouse gas emission by 63% by 2050. China introduced new dietary guidelines in 2016 with the aim of cutting meat consumptions by 50% thereby reducing greenhouse gas emissions by 1 billion tonnes by 2030. (Wynes et al 2017); (Ceballos et al 2017); (Pimm et al 2014); (Harvey et al 2016); (Milman et al 2016).

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CLIMATE CHANGE INFORMATION NEEDS OF RURAL FARMERS FOR SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL PROTECTION IN NIGERIA

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Protocols

Preface

I count it a great privilege and an honour to be requested to present a lead paper at the TEPAN 32nd Annual Conference. It is a clear demonstration of the value of this great Association in bringing people together to share their views, ideas and experiences as well as disseminate information and expand our knowledge boundaries and horizons in areas of vital common interest. I do hope that the ideas and research interest to be discussed herein, and ultimately, decisions made herefrom, would impact positively on all of us and in particular, the Nigerian rural farmers and their occupation as well as the environment.

Introduction

There is a growing consensus in the scientific literature that in the coming decades the world will witness higher temperatures and changing precipitation levels. The effects of this will lead to low/poor agricultural products. Evidence has shown that climate change has already been affecting crop yields in many countries (IPCC, 2007; Deressa et al, 2008; BNRCC, 2008). This is particularly true in low-income countries, where climate is the primary determinant of agricultural productivity and adaptive capacities are low (SPORE, 2008; Apata et al, 2009). Many African countries, which have their economies largely based on weather-sensitive agricultural productions systems like Nigeria, are particularly vulnerable to climate change (Dinar et al, 2006). This vulnerability has been demonstrated by the devastating effects of recent flooding in the Niger Delta region of the country and the various prolonged droughts that are currently witnessed in some parts of Northern region. Thus, for many poor countries like Nigeria that are highly vulnerable to effects of climate change, understanding farmers' responses to climatic variations is crucial, as this will help in designing appropriate coping strategies.

Climate change will have significant negative impacts on the livelihoods of rural poor in developing countries. The Intergovernmental Panel on Climate Change report 2007 provides an extensive assessment on the expected effects of climate change on agriculture in the African region. It estimates that Africa will be the most vulnerable to climate change globally, due to the increase by between 1.5-4.0°C in temperature in this century. Projections on yield reduction show a drop of up to 50% and crop revenue is forecast to fall by as much as 90% by 2100. The agricultural sector is also expected to experience periods of prolonged droughts and/or flood during the El Nino events. Agricultural losses of between 2-7% of the GDP are expected by 2100 in parts of the Sahara, and 0.4%-1.3% and 2-4% in Western and Central Africa and Northern and Southern Africa respectively. Fisheries will be particularly affected due to changes in sea temperature that could decrease trends in productivity by 50-60% (Parry et. al., 2007). Furthermore, the Overseas Development Institute (2007) posits that productivity in agriculture will further be undermined by a reduction in fertile agricultural land availability and expansion in the coverage of low potential land (Racheal et. al., 2007). More so, in response to variations in temperature and precipitation, Africa is expected to experience an increase in crop pests and diseases in addition to altered soil fertility. Declining income and rising unemployment are expected to hit agricultural zones in combination to worsening health. A fall in nutrient access is likely to raise susceptibility to diseases such as malaria and HIV/AIDS (FAO, 2009)

Climate change information needs

No soils, ecological or agricultural zones or our immediate environment, indeed, the global village can be substantially, sustainably and adequately protected and conserved without the required and relevant information and technologies. Farmers, mostly in developing countries, are deeply and daily engrossed in their agricultural activities with attendant adverse and critical effects on the environment, most times, unaware of the enormous damage they cause. The trends and patterns may continue and matters made worse even in the face of current global warming and climate change threats if not checked. These farmers need vital and relevant information now more than ever before. Put in other words, given the adverse effects and impacts of climate change, there is need to guard against this phenomenon by ways of mitigation and adaptation. This is more important to farmers since their occupation heavily depends on climate for performance. Therefore, provision of information on climate change to farmers will serve as a critical factor that will help them to mitigate and adapt to climate change. Also, people living in climate sensitive areas are most in need of access to climate information and support service. Such group of people in those areas are yet to experience the full benefits of climate research, information services to enable them effectively cope and build adaptive capacity to the changing climate (O'Brien, Sygan, King-amlono and Hochabeb, 2008 in Okoro, 2012).

Cherotich, Saidu and Bebe (2012) expressed that the information sharing among climate change actors in Africa is limited and may be worse in semi-arid environments due to barriers like poverty, lack of infrastructure, illiteracy and socioeconomic factors. Most importantly, information on climate change especially on climate change and agriculture are generally too broad to apply on specific needs of most subsistent, resource-poor farmers with small holdings. Information on what climate change is information sources, effects, adaptation and mitigation because these agitate farmers' minds. An understanding of the concept of climate change- what it actually means is very important to the farmers especially when certain local/native languages do not have a direct meaning of what climate change is. Causes and effects are easily known, seen and conceptualized, but not the phenomenon itself. It becomes an "information need" to rural farmers to understand and be able to personally discuss clearly or communicate same to others in their environment. So, there is difficulty in communicating issues touching on climate to most rural farmers hence the need for adequate, relevant and timely information. A "need" actually refers to a gap or lack created as a result of absence of something. It refers to a gap between 'what is' and "what ought to be", "where we are and where we ought/should to be". In this case, the gap must be filled with climate change information to the farmer. Information on climate risks communicated timely in clear and relevant terms and through credible sources is essential for mobilizing decision makers across societies to take actions that will enhance their capacity and willingness to adapt to climate change. An informed public is better able to prepare for likely occurrence of climate disaster and thus, avert or cope with its attendant effects (Umunakwe, et. al., 2014)

Conclusively, to effectively adapt to the vagaries of climate change, rural farmers need information on climate change since information deficit in itself is a type of vulnerability as it is easy for the void (gap) to be filled with inaccurate and misleading information. Solomon (2002), asserts that information needs, if effectively met, will enable the user (farmer) to make appropriate decisions on any related problem (climate change) facing him or her. While many farmers are already coping with varying climate conditions, the weather is becoming less predictable, and some of their strategies may no longer work. Therefore, to a significant degree, the effectiveness and readiness with which farmers adapt to climate change depends on how well current and relevant information on climate change issues are made available to them timely and via credible sources and channels.

The major sources of information through which the rural farmers received information on climate change according to Okoro et. al. (2012), in their study area included: personal observation (98.1%), friends (83.8%), radio (57.1%), and television (26.6%) (Figure 1). Only 9.1% indicated extension as source of information on climate change. The high percentage of farmers relying on personal observation might be due to the observable changes on their farms and environment.

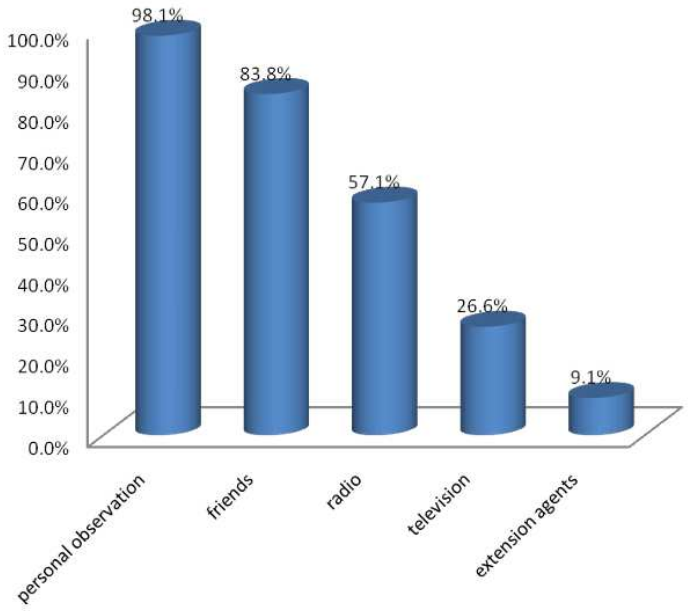


Fig. 1: Major Sources of Information

Tologbonse, Auta, Bidoli & Jaliya et. al. (2010) reported that farmers seem to have a thorough knowledge of the effect of climate change through personal experience because their livelihood seems to be seriously threatened. Similarly, friends (fellow farmers) equally discuss and share experiences on climate change. However, it should be of concern that only 9.1% of the farmers recognized extension agencies as their sources of information on climate change phenomena. This is probably because of poor extension services in the study area. Hence, sustainable development strategies need to be made more consistent with other national development policies through extension agents. Such strategies could be more effective than isolated policy options.

What then is climate change?

Climate change refers to any change in climate overtime, which may be due to natural variability or as a result of human activity (Inter-government Panel on Climate Change, IPCC, 2001). In Nigeria, particular threats are posed to agricultural production arising from changes in rainfall patterns which has resulted to increased desertification in the Sahel region and flooding in the southern part of the country (Spurgeon, Wasilewski, Ikpi & Foster, 2009). In Enugu state, the most significant impacts of climate change experienced by farmers as identified by Ozor & Nnaji (2011) are; soil erosion, lack of portable water for human consumption and livestock use, loss of vegetation/pastures, intense weed growth, incidence of pests and diseases distortion and destruction of wildlife ecosystems, decrease in soil fertility and health related issues of climate change which can affect production, drudgery and stress from heat. According to Enete, Madu, Mojekwu, Onyekuru, et. al., (2011), the biggest effect of climate change in the State include reduced farm yield and income, drying up of streams/rivers, reduction in storage quality of crops, loss of pastureland/vegetation and destruction of wildlife ecosystem. They noted that these effects are likely attributable to the fact that Enugu state has a drier weather; being closer to the North, and hence has inherent insufficient rain water for maximum crop yield. To effectively adapt to the vagaries of climate change, rural farmers need information on climate change; as information deficit, in itself, is a type of vulnerability as it is easy for the void to be filled with inaccurate and misleading information. Solomon (2002) asserts that information needs, if effectively met, will enable the user (farmer) to make appropriate decisions on any related problem (climate change) facing him or her. While many farmers are already coping with varying climatic conditions, the weather is becoming less predictable, and some of their strategies may no longer work. Therefore, to a significant degree, the effectiveness with which farmers adapt to climate change depends on how well current information on climate change issues is made available to them.

Rough estimates suggest that over the next 50 years or so, climate change may likely have a serious threat to meeting global food needs than other constraints on agricultural systems (IPCC, 2007; BNRCC, 2008). Specifically, population, income, and economic growth could all affect the severity of climate change impacts in terms of food security, hunger, and nutritional adequacy. If climate change adversely affects agriculture, effects on human are likely to be more severe in a poorer world. Wolfe et al (2005); Stige, (2006), and Orindi et al, (2006) worry that rising demand for food over the next century, due to population and real income growth, will lead to increasing global food scarcity, and a worsening malnutrition problems particularly in developing countries.

Recently, international tensions and concerns are heightening over what the impact of climate will have on the environment and agricultural produce (NEST, 2004; BNRCC, 2008; Apata, et al 2009). Also, how agricultural and food-distribution systems will be further stressed up by the shifting of temperatures and precipitating belts, especially if changes are rapid and not planned for (NEST, 2004). The crucial issue in this study is whether agricultural output supply can keep pace with population increase under this climate variability. This will depend; both on the scope for raising agricultural productivity (including reducing waste during distribution), availability of inputs used in the agricultural sector and having sufficient information on climatic variables for possible effective adaptation and mitigation strategies.

Areas of information needs

To ensure sustainable agriculture and environmental protection in the face of current climate change threats, it would be necessary to ascertain basic areas that farmers require information about climate change to enable them adapt appropriately. Umunakwe et. al. (2014) in their study noted that farmers indicated the following as shown in Table 1

Table 1: Distribution of Farmers According to Information Needs for Climate Change Adaptation

Areas of Information Need	M
Causes of climate change	4.06
Effects of climate change	4.15
Sources of information on climate change	3.93
Crops adaptable to climate change	3.96
Appropriate socio-cultural practices in climate change	3.99
Agroforestry practices	3.89
Flood/erosion control practices	3.85
Afforestation practices	3.75
Carbon trading	3.68
Alternative/complementary livelihood activities	2.93
Adaptation strategies	3.34
Vulnerable groups to climate change	4.03

However, Okoro, et. al. (2012) found out that rural farmers' areas of information needs in Enugu state were mostly in the area of mitigation and adaptation strategies viz, information on the use of improved varieties ($\bar{x}$=1.80), occupation diversification ($\bar{x}$=1.78); use of weed tolerant varieties and planting of trees ($\bar{x}$=1.77) each, change of timing of farm operation ($\bar{x}$=1.76); use of herbicides and use of pesticides ($\bar{x}$=1.68) each, and incorporating residue into the soil ($\bar{x}$=1.67). Increasing agricultural productivity requires technological advances in both crop and livestock yields. Selvaraju et. al., (2006) found out that the main adaptation strategies practiced by small-scale farmers were in form of modification practices and in the choice of crop varieties that tolerate the climate change effects on agriculture. The use of such varieties would enable farmers to diversify and produce profitably even under adverse conditions of climate change and by extension, sustainably conserve the soil as well as protect the environment. Iwuchukwu and Udoye (2014), revealed areas of climate change information needs by rural farmers in Enugu state as in Table 2.

Table 2: Areas of Climate Change Information Needs by Rural Farmers in Enugu State

Climate Change Information Needs	Mean ($\bar{x}$)	Standard Deviation
Causes of climate change		
Bush Burning	0.51	0.781
Paddy rice production	0.43	0.716
Deforestation	0.50	0.761
Overgrazing	0.48	0.763
Use of automobiles	0.45	0.726
Use of excess chemical	0.46	0.745
Effects of climate change		
Increase erosion	0.18	0.507
High mortality of livestock	0.18	0.507
Drying up of river and lakes	0.18	0.490
Loss of pastures	0.17	0.471
Harsh weather conditions	0.18	0.490
Abrupt change in weather condition	0.18	0.507
Poor yield of crops	0.18	0.507
Reduction in soil nutrient	0.18	0.507
Increase in pest	0.19	0.524
Mitigation and adaptation strategies		
Irrigation	0.77	0.842
Change in timing of farm operation	1.76*	0.575
Occupational diversification	1.78*	0.539
Herbicide use	1.68*	0.580
Use of weed tolerant varieties	1.77*	0.558
Change of enterprise	1.48	0.780
Use of Pesticide	1.68*	0.593
Use of improve/resistant crop and animal varieties	1.80*	0.532
Planting trees	1.77*	0.546
Incorporation of residue into the soil instead of burning	1.67*	0.607

*Major information needs

Sources of information on climate change

Rural farmers require information on climate change but also desire to be sure of the sources of such information. Viability, credibility, consistency and affordability of information sources are vital and crucial. In their study, Umunakwe et. al., (2014) found out that majority (61.6%) of farmers received information on climate change through radio, while the remaining 35.8%, 27.5%, 4.16% and 2.5% through newspapers, research institutions and corporate societies respectively. According to GOZ-UNDP/GEF (2010), farmers in Zimbabwe relied mainly on radio, newspapers and extension agents for information on climate change.

They however, lamented that the high cost of newspapers and fewness of extension agents constrained their access to climate change adaptation information. Timely reception of climate change information will enable farmers take necessary measures to avert or cope with impending impacts/effects of climate change. According to United Nation (2009), early warning system is crucial for preparedness for extreme weather events.

Climate change adaptation strategies

Certain natural occurrences and disasters in life are by far difficult for man to stop, avert or even combat with any reasonable success. To that extent, necessary means/strategies are often devised inorder to tolerate, cope or adapt with same so as to forge ahead in life inspite of such disaster(s). This truly is the case with climate change as rural farmers across the nation grapple with this global menace in a number of ways known and available to them. Climate change adaptation simply refers to farmers' response to the threats and risks of climate change phenomenon. It explains how they respond to and the various climate change adaptation strategies. These strategies are diverse, vary from one place or zone to another, some are location-specific whereas a lot others are common across zones Umunakwe et. al., (2014) in their study identified the following areas of information needs for climate change adaptation as show in Table 3:

Table 3: Areas of Information Needs for Climate Change Adaptation

Areas of Information Need	M
Causes of climate change	4.06
Effects of climate change	4.15
Sources of information on climate change	3.93
Crops adaptable to climate change	3.96
Appropriate socio-cultural practices in climate change	3.99
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Afforestation practices	3.75
Carbon trading	3.68
Alternative/complementary livelihood activities	2.93
Adaptation strategies	3.34
Vulnerable groups to climate change	4.03

Iwuchukwu and Udoye (2014) found out that movement into non-farm occupation was the only major strategy the respondents (pineapple farmers) used to adapt to climate change noting that, since agriculture is risky in the era of climate change, farmers need to adapt to climate change by way of diversifying their income sources via non-farm occupations. Thus, risk minimization was the motive of income diversification (Pieniadz, 2009). It was also noted that this adaptation option may not be ideal because movement of this category of farmers and farmers generally into non-farm occupations may lead to extinction of agriculture as a livelihood and may consequently cause or aggravate food insecurity. Other minor strategies identified in the study by Iwuchukwu and Udoye (2014) are shown below Table 4

Adaptive Strategies	Mean ($\bar{x}$)	Standard Deviation
Increase production of crops grown before	1.94	0.51
Production of crops not produced before	1.80	0.49
Movement into animal production	1.74	0.59
Expansion of animal farm	1.62	0.58
Movement into non-farm occupations	2.0	0.66
Reduction of pineapple farm size	1.75	0.54
Increase pineapple production farm size	1.21	0.52
Adoption of organic farming	1.38	0.64
Changing date of planting and other operations	1.29	0.51
Practice bush fallow	1.79	0.44
Practice crop rotation	1.85	0.48

Adaptation measures	Respondents (%)
Specialized crops under dry land	121 (8.97)
Specialized crop under irrigation	15 (1.11)
Specialized livestock under dryland	13 (0.96)
Specialized livestock under irrigation	5 (0.37)
Multiple crop under dryland	249 (18.46)
Multiple crops under irrigation	14 (1.04)
Mixed mono-crop/livestock under dryland	144 (10.67)
Mixed mono-crop/livestock under irrigation	25 (1.35)
Mixed multiple crop/livestock under dryland	208 (15.41)
Mixed multiple crop/livestock under irrigation	31 (2.30)
Practiced zero Tillage	47 (3.48)
Making ridges across farms	253 (18.75)
Cereal/legume intercropping	182 (13.49)
Number of observations	**1349***

*Multiple Responses indicated

Kandlinker and Risbey (2000) found out that in agriculture, adaptation helps farmers achieve their food, income and livelihood security objectives in the face of changing climatic and socioeconomic conditions including variability and extreme weather conditions such as drought and weather conditions such as drought and floods and volatile short term changes in local and large-scale markets. Farmers can reduce the potential damage made by climate change by making tactical response to these changes. Farmers' climate change adaptation is a function of knowledge and information made available and received by them.

Climate change mitigation measures

Climate has been on a constant state of change throughout the earth's 4.5 billion-year history, but most of the changes occur in astronomical and geological time scale and are too low to be observed on a human scale (Killiman, 2008). The author further stated that natural climate variation on these scales is sometimes referred to as climate variability as distinct from human induced climate change. Climate change refers to any change in climate overtime, whether due to natural variability or as a result of human activity (International Panel on Climate Change (IPCC), 2001). Climate change may be said to be one of the serious threats that hamper sustainable development and its adverse effects can be manifested on human health, food security and physical infrastructure and the environment (soil/land and aquatic organisms). Climate change is happening now: temperatures are rising, rainfall patterns are shifting, glaciers and snow are melting, and the global mean sea level is rising. It is expected that these changes will continue, and that extreme weather events resulting in hazards such as floods and droughts will become more frequent and intense (Alley, 2014). The author further stated that impacts and vulnerabilities to these changes will differ across geographical locations, gender, socio-economic. Hence, the need for farmers whose occupation heavily depends on climate, to design strategies to mitigate its adverse effects. Iwuchukwu and Udoye (2014) found out that avoidance of bush burning and avoidance of deforestation were major strategies used by the respondents to mitigate climate change. Also, avoidance of use of fertilizer and other agro chemicals, avoidance of use of animal manure, avoidance of rearing of animals especially ruminants and avoidance of mixed farming were minor strategies used by the respondents to mitigate climate change. These practices that the respondents engaged may be ideal. Although they will not reverse existing global warming/climate change but will prevent or mitigate further changing of climate. Generally, Africa has been described as one of the most vulnerable continents to climate change and climate variability (IPCC, 2007).

Local knowledge indicates that climate change impacts are leading to significant negative effects on livelihood in Africa, particularly among subsistence and small scale agricultural communities (Simms, 2005; Margrath, 2006). In Nigeria, as in numerous countries around the world, the poorest sections of the society are often disproportionately represented by women, young children and the elderly, and these groups will accordingly be most vulnerable to climate change (United Nations International Children Emergency Fund(UNICEF, 2007). Also the group of people who bears much of the burden of its impacts is rural farmers, who practice rainfed agriculture and hence depend on adequate rainfall for good crop yield (Okoro, 2012). Given the adverse effects and impacts of climate change, there is need to guard against this phenomenon by ways of mitigation and adaptation. This is more important to farmers whose occupation heavily depend on climate for performance. Such group of people in those areas are yet to experience the full benefits of climate research; information and support services to enable them effectively cope and build adaptive capacity to the changing climate (O'Brien, Sygan, Kingamlono and Hochobeb, (2008) in Okoro (2012)). Cherotich, Saidu and Bebe (2012) expressed that information sharing among climate change actors in Africa is limited and may be worse in semi-arid environments due to barriers like poverty, lack of infrastructure, illiteracy and socioeconomic factors. .Most importantly, information on climate change especially on climate change and agriculture are generally too broad to apply on specific needs of farmers like pineapple farmers.

Concept of sustainability/sustainableagriculture

Sustainability focuses on meeting the needs of the present without compromising the ability of future generations to meet their needs- composed of 3 pillars: economic, environmental and social sustainable development is a way for people to use resources without the resources running out. Sustainable agriculture sustains farmers, resources and communities by promoting farming practices and methods that are profitable, eventually sound, environmentally friendly and good for communities. Sustainable agriculture fits into and complements modern agriculture which focuses on producing long-term crops and livestock while having minimal effect on the environment and also, finding a good balance between the need for food production and the preservation of the ecological system within the environment. Sustainable agriculture also intends to use the soil/land maximally but maintain soil quality, reduce soil degradation and erosion, save water, increase bio-diversity of the area by providing a variety of organisms with healthy and natural environment to live in. Leaving things (the soil, land, ecosystem, etc.) better then we found them hence, farming in sustainable ways (meeting society's food and textile needs in the present without compromising the ability of future generations to meet their own needs) based on an understanding of ecosystem services and the study of relationships between organisms and their environment.

Conclusion

The earth is the most suitable and habitable planet for humans and all human livelihood activities take place here particularly agriculture, which often places significant pressure on earth natural resources and the environment especially now that global warning and climate change risks are on the increase. The threats of climate change have grown worse lately hence, across the globe, there have been protest marches for perceived government inactions over situations. The overall climate change poses substantial challenge to Nigerians, indeed, Africa's agricultural development. From food security, nutrition to sustainable development, climate change is a significant threat to the welfare of millions of the continent's rural poor. Contending with this challenge therefore requires the development of intensive research and policy frameworks to enable the development of proper adaptation measures which will reduce the continent's vulnerability. This however, is dependent largely on the generation, dissemination and adoption of useful information on climate change(Umunakwe et. al., 2014) they further noted that adaptation to climate change has remained a viable option for dealing with the impacts and effects of climate change. However, this will remain ineffective and unsustainable without the timely generation and dissemination of useful information on climate change to the rural farmers whose livelihoods are mostly affected.

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SUB-THEME 1

POLICY AND LEGISLATION FOR SUSTAINABLE ENVIRONMENTAL PROTECTION

EDUCATION POLICY INITIATIVES NEEDS FOR IMPROVING TVET PROGRAMS TOWARDS ACTUALISING SUSTAINABLE ENVIRONMENTAL PROTECTION

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Abstract: *The paper set out to find out education policy initiatives needs for improving TVET programs towards actualizing sustainable environmental protection. The study adopted descriptive survey research design. Data were obtained using structured questionnaire from the sample of 118 consist of 73 TVET lecturers and 45 training officers in OPS in Lagos state. The collected data were analyzed using mean, standard deviation and independent sample t-test to test hypotheses at 0.05% level of significance. The findings revealed that implementation of TVET policy could be achieved through partnership between government, employers, professional associations, industry, and employees. The findings showed that there is no significant difference between the mean responses of TVET lecturers and training officers in OPS regarding: (i) policies aimed at increasing multi-stakeholder support and participation in environmental protection; (ii) environmental resources management policies needed to stimulate entrepreneurship among TVET graduates; and (iii) proposing strategies for improving sustainable use of natural resources towards environmental protection. Based on the findings, it was recommended that collaboration among stakeholders should be supported to ensure that the training provided meets the needs of the economy; and environmental policy framework is needed to support green growth developments, which will make it clearer how governments can best ensure that students and workers acquire the green vocational skills they will need in workplace using local resources.*

Keywords*: Education Policy, Initiatives, TVET Programs, Sustainable Environmental Protection*

Introduction

Man is a product of his environment. He lives and survives on the environment, due to growth in population, coupled with improvement in technology; the environment is being overexploited leading to its devastation and degradation. However, for the world to continue to sustain itself there is a need to manage the environmental resources properly. A man needs to acquire appropriate skills and developmental, physical and social abilities and competencies as equipment for the individual to live in and contribute to the development of his environment. To achieve these noble objectives, a functional policy should be advocating for TVET which will create a better link between general education and technology education that geared towards the labor market. There are no educational programs that are not based on policy. The national policy on education is the government's way of realizing the national goals which come from the identified national philosophy which can be achieved using education as an effective tool. Business Dictionary (2019) explains policies as principles, rules, and guidelines formulated by an organization to guide decisions towards achieving its long-term goals and usually printed in a booklet or other forms that are generally accessible.

Policies are designed to influence and determine all major decisions and actions, and all activities take place within the limits set by organizations. While procedures are the specific methods employed to express policies in action in day-to-day operations of the organization. Succinctly put, policies and procedures ensure that the point of view held by the management of the TVET program is translated into steps that result in an outcome compatible with that TVET vision. Policy differs from rules or law. While a law can compel or prohibit behaviors, policy merely guides actions toward those that are most likely to achieve the desired outcome. Policy statements serve to protect an organization from misunderstandings that might lead to unauthorized behavior. Each policy statement should include its purpose, terminology definitions, the statement itself and the steps to implement it (Duff, 2019). Policies can assist in both subjective and objective decision making, policies to assist in subjective decision making would usually assist senior management with decisions that must consider the relative merits of several factors before making decisions and

as a result, are often hard to objectively test Duff added. In contrast, policies to assist in objective decision making are usually operational and can be objectively tested. Education policies can be defined as definite courses of action proposed by the government in power or executive authority and adopted as expedient to issues and problems of TVET.

Technical Vocational Education and Training policy refers to specific goals arrived at that must be pursued through TVET institutions. It can refer to a proposal, an on-going program, or the goals of a program, or major decisions, TVET policy concerns the formulation of a decision, its implementation, and evaluation. TVET policy should be formulated and administered in support of the general objectives adopted for the educational process as well as for national and, if possible, the regional social and economic requirements of the present and the future, and an appropriate legislative and financial framework adopted, the policy of TVET can be found in section five paragraph eighty-one and one hundred and two C and D of national policy of education, 2013 which is based on the desire that Nigeria could achieve some of her national goals. This is to give training that impacts the necessary skills for the production of technicians, technologists, and other skilled personnel who shall be enterprising and self-reliant, and train people who can apply scientific knowledge to solve environmental problems for the convenience of man. The policy should be directed to both the structural and the qualitative improvement of TVET. In Nigeria, it is believed that there is a need for TVET for the provision of progress towards environmental protection. To this end, the school curriculum needs to be relevant, practical and comprehensive to conserve natural resources.

Environmental Encyclopedia (2019) defined environmental policy as a management's chosen course of action to address issues such as pollution, wildlife protection, land use, energy production and use, waste generation, and waste disposal. In reality, the way a particular government handles environmental problems is most often not a result of a conscious choice from a set of alternatives. More broadly, the government's environmental policy may be characterized by examining the overall orientation of its responses to environmental challenges as they occur, or by defining its policy as the sum of plans for, and reactions to, environmental issues made by different arms of government. Environmental policy is any measure by a government, organization or other public or private sector concerning the effects of human activities on the environment, particularly those measures that are designed to prevent or reduce harmful effects of human activities on environments. Putting succinctly, the environmental policy seeks to achieve the desired goal that is considered to be in the best interest of all members of society. Think of policies as a starting point for the government to take a course of action that makes a real-life change. Therefore, educational policies are initiatives mostly by governments that determine the direction of educational programs (Okoroma 2000); such is the process by which knowledge contents are transmitted to students by the most effective methods that can be planned. The policy is therefore among the tools used in running TVET programs.

Environmental protection is the practice of protecting the natural environment by individuals, organizations, and governments. (Environmental-protection dictionary, 2018) Its objectives are to conserve natural resources and the existing natural environment and, where possible, to repair damage and reverse trends (The law dictionary, 2012) Environmental protection in views of Clive and Simone (2019) is the prevention of unwanted changes to environments and their fundamental parts, which includes the protection of environments and their essential parts from changes associated with human activities; and the prevention of undesirable natural changes to environments and their fundamental parts. Environmental protection is concerned with the relationship between people and the natural environment rather than the relationships between people and communities. Another issue is whether environmental protection relates to preservation, conservation, or both. Preservation refers to the protection of the natural environment from change, while conservation is generally associated with the sustainable use of natural resources. The objective of conservation is to ensure the conservation of a stock of renewable resources that are being exploited for human purposes rather than the protection of the natural environment from any anthropogenic adjustments.

The National Environment Policy of 1997 acts as a framework for environmental decision making in Tanzania. The policy objectives are to: Ensure sustainable and equitable use of resources without degrading the environment or risking health or safety; prevent and control degradation of land, water, vegetation and air; conserve and enhance natural and man-made heritage, including biological diversity of unique ecosystems; improve condition and productivity of degraded areas; raise awareness and understanding of the link between environment and development; promote individual and community participation; promote international cooperation and use environmental resources. Sustainability is based on a principle that everything we need for our survival and well-being depends, either directly or indirectly, on our natural environment. To pursue sustainability is to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations, sustainability looks to protect our natural environment, human and ecological health while driving innovation and not compromising our way of life.

ILO and UNESCO (2002) suggest that TVET policy should be formulated and administered towards general objectives adopted for the educational process as well as for national and, if possible, the regional social and economic requirements of the present and the future, and an appropriate legislative and financial framework be adopted. UNESCO and ILO (2002) suggests further that policy should be directed to both the structural and the qualitative improvement of TVET as stipulated in Article 2 of the Convention on TVET (1989) and further described in the recommendations of the Second International Congress on TVE (1999) which states that, while governments carry the primary responsibility for TVET, in a modern market economy TVET policy design and delivery should be achieved through partnership between government, employers, professional associations, industry, employees and their representatives, the local community and non-governmental organizations (NGOs). This partnership according to ILO and UNESCO must create a coherent legislative framework to enable the launching of a national strategy for change. Within this strategy, the government, apart from actually providing TVE, can also provide leadership and vision, facilitate, coordinate, establish quality assurance and ensure that TVE is for all by identifying and addressing community service obligations.

Secondly, TVET according to ILO and UNESCO is best served by a diversity of public and private providers. The appropriate mix can be found in many ways, with the responsibility of governments being to facilitate choice while ensuring quality, and thirdly, government and the private sector should recognize that TVET is an investment, not a cost, with significant returns, including the well-being of workers, enhanced productivity and international competitiveness. Therefore funding for TVET should be shared to the maximum extent possible between government, industry, the community and the learner, with the government providing appropriate financial incentives. Furthermore, the governments of the least developed countries, in particular, should seek bilateral and multilateral capacity-building cooperation in TVET. UNESCO further introduces frameworks to improve monitoring and evaluation of the quality and relevance of national TVET systems with a focus on how policies can stimulate entrepreneurship, multi-stakeholder partnerships, and national qualifications systems.

Statement of the problem

Environmental protection is the practice of protecting the natural environment by governments, organizations, and individuals. Its objectives are to conserve natural resources and the existing natural environment and, where possible, to repair damage and reverse trends. (Environmental-protection dictionary, 2018) The debate concerning environmental protection often focuses on the role of government, legislation, and law enforcement. However, in its broadest sense, environmental protection should be seen to be the responsibility of all the people and not simply that of government. Decisions that impact the environment will ideally involve a broad range of stakeholders including industry, indigenous groups, and environmental group and community representatives. Collaboration among education bodies, employers and economic-development officials should be supported to ensure that the training provided meets the needs of the economy

as a whole and different local labor markets in particular. UNESCO (2014) emphasized the need to introduce frameworks to improve monitoring and evaluation of the quality and relevance of national TVET systems with a focus on how policies can stimulate entrepreneurship, multi-stakeholder partnerships, and national qualifications systems. Therefore, effective policies aimed at improving teaching and learning processes are to be developed. Specifically, policies and frameworks for professionalizing TVET staff, students, and strengthen teaching standards for all levels should be developed as the environmental policy framework needed to support green growth develops, it will become clearer how TVET programs can best ensure that students and workers acquire the green vocational skills they will need in the workplace. Environmental protection is the primary concern of the future of humanity, as it describes how to study and protect environments, air quality, integrity and sustainability of resources and focusing on the elements that place stress on the environment (Environmental Protection Dictionary, 2018). TVET institutions must co-ordinate closely with employers and trade unions to assure that the training offered corresponds to evolving labor-market needs.

Purpose of the study

The main purpose of the study is to determine education policy initiatives' needs for improving TVET programs towards actualizing sustainable environmental protection. Specifically, it sought to; determine policies aimed at increasing multi-stakeholder (private sectors) support and participation in environmental protection; identify environmental resources management policies needed to stimulate entrepreneurship among TVET graduates; and propose strategies for improving sustainable use of natural resources towards environmental protection.

Research questions

1. What are the policies aimed at increasing multi-stakeholder (private sectors) support and participation in environmental protection?
2. What are the environmental resources management policies needed to stimulate entrepreneurship among TVET graduates?
3. What are the proposing strategies for improving the sustainable use of natural resources towards environmental protection?

Hypotheses

H_{O1}: There is no significant difference between the mean responses of TVET lecturers and training officers in organized private sectors regarding the policies aimed at increasing multi-stakeholder (private sectors) support and participation in environmental protection.

H_{O2}: There is no significant difference between the mean responses of TVET lecturers and training officers in organized private sectors regarding environmental resources management policies needed to stimulate entrepreneurship among TVET graduates.

H_{O3}: There is no significant difference between the mean responses of TVET lecturers and training officers in organized private sectors concerning the proposing strategies for improving the sustainable use of natural resources towards environmental protection.

Methods

The research employed a descriptive survey research design. One hundred and twelve (125) TVET practitioners comprised of (76) TVET lecturers and (49) training officers in organized private sectors in Lagos State, Nigeria participated in the study. The instrument for data collection was a structured questionnaire. The instrument had four sections A to D. Section A sought information on personal data of the respondents such as status, years of experience and sex. Section B, C & D sought information on the three research questions. The questionnaire was subjected to face and content validation by three experts. The internal consistency of the instruments was determined

using Cronbach Alpha. The reliability coefficient was α = .86. The instrument was administered to the respondents through research assistants and personal contact. Out of 125 questionnaires administered, 118 were duly filled and returned. These represented 92% rate of return. Data generated from the questionnaire were analyzed using mean and t-test statistics at .05% level of significance.

Table 1a: Policies Aimed at Increasing Multi-Stakeholder Participation in Environmental Protection (N = 118)

S/N	Item Statement	Mean	SD	Remarks
1.	Policies on financial resources and physical facilities from public or private sources should be made available to TVET institutions	3.71	0.48	Agreed
2.	TVET institutions should have the autonomy to design programs with the involvement of business and industry to suit local needs	3.63	0.49	Agreed
3.	The policy should focus on curriculum development, teaching and learning methods and materials, and, where the need exists, on environmental protection	3.65	0.49	Agreed
4.	Policy on planning, construction and equipping of facilities should be carried out in collaboration with specialists from industry, teachers and educational architects	3.58	0.51	Agreed
5.	While the TVET institutions should have primary responsibility, relevant stakeholders should be actively associated in policy formulation and the planning process	3.66	0.48	Agreed
6.	Design and implementation TVET policy should be achieved through a partnership between government, employers, professional associations, industry, employees, and their representatives.	3.55	0.50	Agreed
7.	Policy on funding TVET should be shared to the maximum extent possible between government, industry, the community and the learner	3.68	0.51	Agreed
8.	Formulate policy to establish private TVET institutions and create an effective partnership with the private sector, and promote TVET for the benefit of all stakeholders.	3.71	0.46	Agreed
9.	Policy on quality assurance should be established and ensure that TVET is for all by identifying and addressing community service obligations	3.76	0.45	Agreed
10.	Research policy on TVET should be carried out at national and institutional levels through industry, employers and individual initiative.	3.63	0.48	Agreed
11.	Positive results of research and experiment carried out should be widely disseminated using all available media to all stakeholders	3.80	0.40	Agreed
12.	the policy should ensure quality and smooth operation of TVET by continuous review and action directed to monitoring progress and maintaining standards through constant improvement of staff, facilities, programs, and student achievement	3.51	0.56	Agreed

Benchmark Mean=3.50

Result as can be seen in the data presented in Table 1a, revealed that the mean responses of TVET lecturers and training officers in organized private sectors regarding the TVET policies aimed at increasing multi-stakeholder (private sectors) support and participation in environmental protection. The mean score for each policy aimed at increasing multi-stakeholder support in environmental protection ranges from 3.51 and 3.88 indicated that policies are essential to support environmental protection. Among which include: Policies on financial resources and physical facilities from public or private sources should be made available to TVET institutions; TVET institutions should have the autonomy to design programs with the involvement of business and industry to suit local needs; design and implementation of TVET policy should be achieved through partnership between government, employers, professional associations, industry, employees and their representatives; research policy on TVET should be carried out at national and institutional levels through industry, employers and individual initiative

Table 1b: Independent Samples t-test Statistics of Mean Responses of Respondents Concerning TVET Policies Aimed at Increasing Multi-Stakeholder (Private Sectors) Support and Participation in Environmental Protection (N = 118)

Variables	N	Mean	SD	Df.	T	Significance
TVET Lecturers	73	69.41	4.05			
				73	1.05	0.17
Training Officers	45	41.94	4.02			

As shown in Table 1b, Technical lecturers had a relatively higher mean score of 69.41 than training officers/personnel managers in organized private with a mean of 41.94 vis-à-vis policies aimed at increasing multi-stakeholder support and participation in environmental protection. There was a statistically significant difference between technical lecturers and training officers' mean score on policies aimed at increasing multi-stakeholder support and participation ($t=1.05$ $\rho > 0.05$). With this result, the null hypothesis (H_{O1}) was rejected at 0.05% level of significance.

Table 2a: Environmental Resources Management Policies (N = 118)

S/N	Item Statement	Mean	SD	Remarks
1.	Develop a policy that will ensure coordination from planning to implementation stages to smooth the pace of training to provide competent skilled entrepreneurs	3.63	0.49	Agreed
2.	Policy-makers to commit resources for skills development through active training market policy measures	3.61	0.50	Agreed
3.	Formulate policy objectives to improve resource allocation to make TVET graduates more efficient, and to mobilize resources to develop entrepreneurial skills.	3.61	0.49	Agreed
4.	Develop frameworks for human resource development involving government, employers, and institutions to facilitate the exchange of information towards entrepreneurial skills development	3.64	0.51	Agreed
5.	Understand the entrepreneurial potential of the economy and the corresponding needs in education and training policy to steer skills development systems towards meeting environmental needs	3.66	0.48	Agreed
6.	There is an urgent need for a more rigorous approach to the analysis and anticipation of demand for a competent entrepreneur for new job skills in establishing the business.	3.54	0.51	Agreed

S/N	Item Statement	Mean	SD	Remarks
7.	Setting up task forces to monitor and evaluate TVET activities in resource development programs incorporating skills and competencies required of entrepreneurs.	3.79	0.51	Agreed
8.	The government should identify environmental protection skills, develop curriculum and formulate policies to empower TVET institutions in effective implementation towards training competent entrepreneurs.	3.71	0.46	Agreed
9.	TVET programs should be linked directly to the management of environmental resources by analyzing the skill implications for establishing business ventures.	3.76	0.44	Agreed
10.	Competency-based training on occupational standards, use of qualified instructors, better use of examination systems and regulations should be adopted towards developing entrepreneurial skills.	3.63	0.49	Agreed
11.	Formulate a policy for provisions of modern information technology in TVET programs, whether it takes place within a formal or non-formal education system for developing entrepreneurial skills.	3.89	0.46	Agreed

Benchmark mean=3.50

Table 2a presents the mean and standard deviation of TVET lecturers and training officers in organized private sectors regarding environmental resources management policies needed to stimulate entrepreneurship. The close look at the mean score of each item shows that respondents agreed with all the identified environmental resources management policies needed to stimulate entrepreneurship among TVET graduates. Among which include: Develop policy that will ensure coordination from planning to implementation stages to smooth the pace of training so as to provide competent skilled entrepreneurs; policy-makers to use environmental resources to developing entrepreneurs' skills by means of active training market policy measures; develop frameworks for human resource development involving government, employers and institutions to facilitate the exchange of information towards entrepreneurial skills development. With means values ranging from 3.54 to 3.89 above the cut-off, it was evident that respondents considered resources management policies needed to stimulate entrepreneurship among TVET graduates.

Table 2b: Independent Samples t-test Statistics of Mean Responses of Respondents Regarding Environmental Resources Management Policies Needed to Stimulate Entrepreneurship Among TVET Graduates (N = 118)

Variables	N	Mean	SD	Df.	T	Significance
TVET Lecturers	73	43.81	3.09			
				73	1.39	0.17
Training Officers	45	41.94	2.30			

As revealed in Table 2b, Technical lecturers had a relatively higher mean score of 43.81 than Training officers with a mean of 41.94 regarding the environmental resources management policies needed to stimulate entrepreneurship among TVET graduates. There was no statistically significant difference between Technical lecturers and Training officers' mean score on environmental resources management policies ($t=1.39$ $\rho > .05$). It was apparent that the respondents considered the environmental resources management policies needed to stimulate entrepreneurship among TVET graduates.

Table 3a: Strategies For Improving Sustainable Use of Natural Resources (N = 118)

S/N	Item Statement	Mean	SD	Remarks
1.	Awareness should be made by TVET institutions to educate the community on how to conserve environmental resources.	3.91	0.81	Agreed
2.	Efforts should be made to educate industries and individuals on the value of environmental resources and make people more environmentally friendly	3.89	0.46	Agreed
3.	Management policy should ensure that local resources used are properly managed and environmentally friendly	3.80	0.61	Agreed
4.	Policy should be directed to both the structural and the qualitative improvement of TVET for environmental protection programs	3.84	0.85	Agreed
5.	TVET Policy should be formulated and administered in support of the general objectives of the educational process as well as environmental programs	3.79	0.40	Agreed
6.	Policy should be there to address the regional, social and economic need s of the present and the future workforce	3.71	0.45	Agreed
7.	Prevention, protection, and, when necessary, control measures against wildfire, disease, and insects should be put in place in the environment	3.87	0.46	Agreed
8.	Natural and artificial reproductive methods, intermediate cuttings to achieve optimal tree growth should be encouraged by fosterers.	3.69	0.40	Agreed
9.	TVET Policy should ensure that TVET institutions seek to meet international standards on the environmental protection program	3.58	0.67	Agreed
10.	National policy should foster research related to TVET, with particular emphasis on its potential within environmental protection	3.69	0.46	Agreed
11.	Particular attention should be given to use of local material resources required for production and service	3.71	0.45	Agreed
12.	The institutional framework for the conservation and sustainable use of natural resources towards environmental protection should be emphasized	3.87	0.46	Agreed

Benchmark mean=3.50

Table 3a revealed the perception of respondents concerning proposing strategies for improving sustainable use of natural resources towards environmental protection. The proposing strategies for improving sustainable use of natural resources towards environmental protection identified from the study among others includes: awareness should be made by TVET institutions to educate community on how to conserve environmental resources; efforts should be made to educate industries and individuals on the value of environmental resources and make people become more environmental friendly; national policy should foster research related to TVET, with particular emphasis on its potential within environmental protection and The institutional framework for the conservation and sustainable use of natural resources towards environmental protection should be emphasized . With means values ranging from 3.58 and 3.89 above the cut-off point of 3.50, it was apparent that the respondents considered the proposing strategies for improving the sustainable use of natural resources towards environmental protection.

Table 3b: Independent Samples t-test Statistics of Mean Responses of Respondents Concerning Proposing Strategies for Improving Sustainable Use of Natural Resources Towards Environmental Protection (N = 118)

Variables	N	Mean	SD	Df.	T	Significance
TVET Lecturers	73	42.90	3.08			
				73	1.38	0.17
Training Officers	45	41.58	2.29			

As shown in Table 3b, Technical lecturers had a relatively higher mean score of 42.90 than Training officers with a mean of 41.58 regarding the proposing strategies for improving the sustainable use of natural resources towards environmental protection. There was no statistically significant difference between Technical lecturers and Training officers' mean score on proposing strategies for improving the sustainable use of natural resources ($t=1.38$ $\rho > .05$). Thus, the null hypothesis was accepted that there is no significant difference between the mean responses of Technical lecturers and Training officers concerning the proposing strategies for improving the sustainable use of natural resources towards environmental protection was accepted.

Findings and discussion

1. The first null hypothesis sought to determine whether any significant difference exists between the responses of TVET lecturers and training officers in organized private sectors regarding TVET policies aimed at increasing multi-stakeholder (private sectors) support and participation in environmental protection. Consequently, the null hypothesis was accepted ($t=1.05$ $\rho > .05$). It was therefore concluded that there was no significant difference between the mean responses of TVET practitioners and training officers in OPS regarding the TVET policies aimed at increasing multi-stakeholder (private sectors) support and participation in environmental protection. The findings in respect of hypothesis one support previous studies OECD (2012); ILO (2011a); and Clive and Simone (2019) who observe that strategic approach to skills policies needs to take into consideration local environment, particularly in emerging economies where these differences can be large and National policy goals can be better achieved by allowing greater differentiation locally. Collaboration among education bodies, employers and economic-development officials should be supported to ensure that the training provided meets the needs of the economy as a whole and of different local labor markets, in particular, environmental differences in skills needs can be equally important and need to be taken into consideration when designing skills strategies. The findings is also in support of Quintini (2011) who emphasized that skills development is more effective if the world of learning and the world of work are linked, compared to purely government-designed curricula taught exclusively in schools, learning in the workplace allows young people to develop hard skills on modern equipment, and soft skills, such as teamwork, communication, and negotiation, through real-world experience.
2. The second hypothesis that sought if differences exist between mean responses of TVET lecturers and training officers in OPS on environmental resources management policies needed to stimulate entrepreneurship among TVET graduates was accepted ($t=1.39$ $\rho > .05$). The findings in respect to hypothesis two agreed with the findings of previous studies CEDEFOP (2010); OECD (2010a); Quintini (2011); Desjardins and Rubenson (2011); and Destefanis (2012), which emphasized that countries can foster the creation of new jobs and increase the demand for skills by encouraging entrepreneurship. Authors stressed that entrepreneurs are made, not born so, TVET institutions should be indirectly involved in creating higher-skilled jobs by helping their students to develop the skills necessary to become entrepreneurs. To be successful, these students need to know how to identify opportunities, turn them into successful ventures, and recognize and respond to difficulties and obstacles that may emerge. Teaching entrepreneurship in TVET institutions can help instill these skills and competences in students.

Olabiyi and Raji (2006) suggests that in promoting entrepreneurship among TVET graduates, TVET institutions need to be entrepreneurial and innovative; making information on entrepreneurship easily accessible to students and access to entrepreneurial learning opportunities inside and outside their courses of study, also entrepreneurship activities can be promoted by organizing entrepreneurship contests and by offering entrepreneurship certificate programs and courses in TVET to instill a culture of entrepreneurship among secondary school and undergraduate students.

3. The t-test analysis between the mean responses of TVET lecturers and training officers in OPS concerning the proposing strategies for improving sustainable use of natural resources towards environmental protection did not differ significantly, hence the third null hypothesis was accepted ($t=1.38$ $\rho > 0.05$). It was therefore concluded that there was no significant difference between the mean responses of TVET lecturers and training officers in OPS on strategies for improving the sustainable use of natural resources towards environmental protection. The findings in respect to hypothesis three agreed with the findings of OECD (2010b); OECD (2012) who emphasized that environmental policy framework needed to support green growth develops, which will make it clearer how governments can best ensure that students and workers acquire the green vocational skills they will need in the workplace using local products, local personnel, and selling locally will enabled the businesses to develop customer loyalty despite having higher prices for similar products available from non-local providers. Developing skills and making them available to the labor market will not have the desired impact on the economy and society if those skills are not used effectively. Skills policies need to support TVET graduates in making better use of the skills available to them. This can be achieved if TVET graduates, aligning business strategies with skills development in their environment (OECD, 2012).

Conclusion

Based on the findings of this study, the conclusion was made TVET institutions should have the autonomy to design programs with the involvement of business and industry to suit local needs; design and implementation of TVET policy should be achieved through partnership between government, employers, professional associations, industry, employees and their representatives; research policy on TVET should be carried out through industry, employers and individual initiative; develop policy that will ensure coordination from planning to implementation stages to smooth the pace of training so as to provide competent skilled entrepreneurs; policy-makers to use environmental resources to developing entrepreneurs' skills by means of active training market policy measures; awareness should be made by TVET institutions to educate community on how to conserve environmental resources; efforts should be made to educate industries and individuals on the value of environmental resources and make people more environmental friendly.

Recommendations

1. Cooperation among education bodies, employers and economic-development officials should be supported to ensure that the training provided meets the needs of the economy as a whole and different local labor markets in particular.
2. TVET institutions should be indirectly involved in creating higher-skilled jobs by helping their students to develop the skills necessary to become entrepreneurs.
3. Environmental policy framework is needed to support green growth develops, which will make it clearer how governments can best ensure that students and workers acquire the green vocational skills they will need in the workplace using local products.

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TVET EDUCATORS' INVOLVEMENT IN CLIMATE CHANGE MITIGATION THROUGH SOLAR ENERGY INSTALLATION AND MAITENANCE IN NIGERIA

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Abstract: *Effects of climate change are felt in every facet of life. These include increased heat, decreased agricultural yield, consistent seasonal variations, flooding and droughts. Climate change is caused by human activities that generate greenhouse gases, such as burning biofuels for electricity generation. Measures are taken to either adjust to climate change (adaptation) or/and reduce greenhouse gases (mitigation). In line with such measures, Nigerian governments commissioned many solar energy plants. Studies revealed that technical and vocational education and training educators have the knowhow in climate change mitigation. This study was meant to appraise the status, functionality of selected solar plants in Nigeria and whether TVET educators were involved in the projects. Results revealed that most of the projects studied failed and out of 385 persons involved in the project, only four are TVET educators. Recommendations were made for a greater success.*

Keywords*: TVET, Climate Change Mitigation, Greenhouse Gases, Global Warming, Solar Energy*

Introduction

Climate change has been a matter of urgent attention in recent times. The climate system comprises five interacting parts, the atmosphere (air), hydrosphere (water), cryosphere (ice and permafrost), biosphere (living things), and lithosphere (earth's crust and upper mantle) (Intergovernmental Panel on Climate IPCC, 2014). It receives nearly all of its energy from the sun, with a relatively tiny amount from earth's interior. The climate system also gives off energy to outer space. The balance of incoming and outgoing energy, and the passage of the energy through the climate system, determines Earth's energy pattern. When the incoming energy is greater than the outgoing energy, earth's energy pattern is positive and the climate system is warming. If more energy goes out, the energy pattern is negative and earth experiences cooling. As this energy moves through Earth's climate system, it creates Earth's weather and long-term averages of weather are called "climate". Such changes can be the result of "internal variability", when natural processes inherent to the various parts of the climate system alter Earth's energy pattern. Examples include cyclical ocean molds such as El Niño–Southern Oscillation and less familiar Pacific decadal oscillation and Atlantic multidecadal oscillation. Climate change can also result from "external forcing", when events outside of the climate system's five parts nonetheless produce changes within the system. Examples include changes in solar output and volcanism. Climatic conditions may vary when alteration in Earth's climate system result in new weather patterns that last for at least a few decades, and maybe for many decades of years. This condition is called climate change. Climate change is therefore an alteration in the statistical properties of the ambiance system when considered over long periods of time, regardless of cause (IPCC, 2001). Climate change may be used to denote specifically to anthropogenic atmospheric variations also known as global warming. Global warming is caused by human activity, as opposed to changes in climate that may have resulted as part of Earth's natural processes (United Nations Framework Convention on Climate Change, 1994). Intergovernmental Panel on Climate (2007) defines climate change as a change in the state of the climate that can be identified by changes in the mean and /or the variability of its properties, and that persists for an extended period typically decades or longer. To many, especially in the context of environmental policy, the term climate change has become synonymous with anthropogenic global warming. However, global warming refers to surface temperature increases while climate change includes global warming and everything else that increases greenhouse gas levels and their affects (NASA, 2011). Fluctuations over periods shorter than a few decades do not represent climate change. The word evolved from "climatic change", proposed by the World Meteorological Organization (WMO) in 1966 to encompass all forms of climatic variability on time-scales longer than 10 years, but regardless of cause.

Presently, the term climate change has replaced climatic change to focus on anthropogenic causes, as it became clear that human activities had a potential to drastically alter the climate (Clarke, July 2007). Climate change is now used as both a technical description of the process, as well as a noun used to describe the problem. Climate change especially indicated by global warming, can no longer be explained by natural causes but instead resulted in a significant influence of human activities. Climate change has been linked with increase in the emission of greenhouse gases (GHG). The impact of change in the level of carbon dioxide in the atmosphere as a result of burning of fossil fuels like coal, oil, gas and other green house gas (GHG) emissions are the reasons that the globe is steadily heating up (Umoru & Okeke, 2010). Human activities generate major emissions of carbon dioxide, nitrous oxide, methane and all greenhouse gases that are contributing to climate change. Over a billion people around the world rely on traditional fuels like coal and wood to meet their basic energy needs. This is not only harmful to the environment but can also lead to premature deaths for millions of people, especially women and children. According to Watson, Zinyoera, and Moss (2007), Africa is the continent most vulnerable to the impacts of projected changes because widespread poverty limits adaptation capabilities. Human-induced climate change effects are already evident in Nigeria with increased desertification in the north, droughts and persistent flooding in all parts of the country, decreased agricultural yield, seasonal variations such as constant change in the beginning and end of seasons, unpredictable rainfall patterns. Others include temperature variation (Buba & Ibrahim, 2017), increasing evapotranspiration, decreasing rainfall amount in the continental interiors, increasing rainfall in the coastal areas, increasing disruption in climate patterns and increasing frequency and intensity of unusual or extreme weather related events such as; thunderstorms, lightning, landslides, floods, droughts, bush fires, sea level rise, increase desertification and land degradation, drying up of rivers and lakes and constant loss of forest cover and biodiversity (Odjugo, & Ikhuoria, 2003;Odjugo, 2007 ;Nigerian Environmental Study/Action Team (NEST), 2003; Ikpe, Sawa & Ejeh, 2017). Carbon dioxide (CO_2) emissions from fossil fuel combustion and industrial processes contributed about 78 per cent of the total greenhouse-gas emission increase (IPCC, 2014).. If greenhouse-gas emission levels continue to increase, extreme changes are likely to occur, with millions of people displaced by rising sea levels and global food shortages. Since climate change and its effects are prevalent in Nigeria, ways of response becomes imperative. Responding to climate change involves: mitigation and adaptation. According to the IPCC's 2014 assessment report, Mitigation is a public good. Effective climate change mitigation will not be achieved if each agent acts independently in its own selfish interest, the need for collective action is essential.

Climate change mitigation consists of actions to limit the magnitude or rate of long-term global warming and its associated consequences. Climate change mitigation generally involves reductions in human (anthropogenic) emissions of greenhouse gases. Mitigation may also be achieved by increasing the capacity of carbon sinks, e.g., through reforestation. Mitigation policies can substantially reduce the risks associated with human-induced global warming (International Atomic Energy Agency, 2008). Mitigating climate change is about reducing the release of greenhouse gas emissions that are warming the planet. The many mitigation strategies include retrofitting buildings to make them more energy efficient; adopting renewable energy sources like solar, wind and small hydro; helping cities develop more sustainable transport such as bus rapid transit, electric vehicles and biofuels; and promoting more sustainable uses of land and forests. Mitigation, which connotes reducing climate change, involves reducing the flow of heat-trapping greenhouse gases into the atmosphere, either by reducing sources of these gases (for example, the burning of fossil fuels for electricity, heat or transport) or enhancing the "sinks" that accumulate and store these gases (such as the oceans, forests and soil). The goal of mitigation is to avoid significant human interference with the climate system, and "stabilize greenhouse gas levels in a timeframe sufficient to allow ecosystems to adapt naturally to climate change, ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner. Examples of mitigation include reducing energy demand by increasing energy efficiency, phasing out fossil fuels by switching to low-carbon energy sources, and removing carbon dioxide from Earth's atmosphere (Gallup International, 2011).

According to Klein, Midgley, Preston, Alam, FBerkhout, Dow, and Shaw, (2014) the report of Intergovernmental Panel on Climate Change showed that reducing carbon emissions from electrical generation is one of the most cost-effective ways to reduce climate change. Electricity generation by burning fossil fuel has contributed so much to the production of carbon dioxide which is an active component causing climate change. Nigeria depended heavily on fossil fuels for power generation. Nigeria has topped the list of generator-importing countries for the fourth year in a row, having surpassed others since 2002 (Jibueze, 2014). United Nations Statistics showed that manufacturers of generators brought into the country different brands of generators worth over N10 billion in 2014/2015, and the figure is projected to hit N163trillion by 2020. This has injected heavy measure of greenhouse gases into the atmosphere to increase climate change. According to Punch News (2017, December 28), the continued heavy reliance on fossil fuel-powered generators in Nigeria by government institutions, businesses and households for electricity supply constitutes a major threat to the nation's climate change plans. At the time of this study, Nigerian power generation stood at about has about 4,000 MW, of which about 3,500 MW were supplied by gas-fired plants. Despite political uncertainty, renewable sources have continued to grow rapidly and per-kilowatt prices are falling to near-parity with fossil fuels. States play a central role in the growth of renewable such as wind and solar Over the next 20 years, annual investments in renewable energy for nuclear and electricity generation with carbon capture and storage are projected to rise, while those for fossil-fuel electrical generation capacity will decline.

Intergovernmental Panel on Climate Change (2014) asserted that various levels of governments are getting better at climate change mitigation. Climate change is starting to be factored into a variety of development plans: how to manage the increasingly extreme disasters we are seeing and their associated risks, how to protect coastlines and deal with sea-level encroachment, how to best manage land and forests, how to deal with and plan for reduced water availability, how to develop resilient crop varieties and how to protect energy and public infrastructure. Nigeria has initiated efforts to reduce climate change. This includes solar energy projects, such as 100MW Solar PV Power Plant in Bauchi State, the 75MW solar photovoltaic power project in Katsina State, 1,000MW Pan Africa solar projects in Abuja Nigeria, 25MW solar plant planned for Dutse, a 13MW and a 30MW solar power station in Niger, a $767,512 worth of solar energy lighting for 25 communities which included Brass in Bayelsa and Magboro in Ogun State, Ilajera and Gbokoda in Ondo State and other isolated communities in Osun State,5MW Lagos solar power project to education and health facilities for 172 schools and 11 public health centres and solar street lighting projects on several Nigerian roads, to mention but a few. In some countries, Technical and Vocational Education and Training (TVET) educators handle such technical projects.

Technical and Vocational Education and Training is usually defined as the type of education that emphasizes the application of skills, knowledge and attitudes required for employment in a particular occupation or cluster of related occupations in any field of social and economic activity (Fien, Rupert, & Man-Gon, 2009). Olaitan (2010) defined TVET as education given to an individual in order to enable him or her to develop the creative and scheming potentials inherent in him or her for the use of man. It is seen as any education, training and learning activity leading to the acquisition of knowledge, understanding and skills which are relevant for employment or self-employment (Rubagiza, 2010). Technical and Vocational Education and Training educators are those who teach skills, knowledge and attitudes required for employment in a particular occupation or cluster of related occupations in any field of social and economic activity. TVET educators and researchers are expected to reduce human activity's contributions to climate change and identify practices that can help adapt to the heating planet (University of California, 2019) Technical and Vocational Education practitioners can play a major role in supporting governments, schools and communities through building capacity for the promotion of environmentally sustainable programs, such as installation and maintenance of solar energy. Mbonyinshuti, (2019) advised that solar energy installation be committed in hands of TVET educators, especially those in the field of electrical/electronics technology education. This is because skills taught in this aspect of TVET cover every aspect of solar energy installation and maintenance. TVET educators

successfully carried out climate change mitigation programmes with solar projects and other measures in Bangladesh, India (Singh, 2012), Brazil (Energypedia, 2018), Pakistan (Raj, 2019) and Rwanda (Mbonyinshuti, 2019). The level of TVET educators' contribution to solar energy for climate change mitigation will depend on their involvement by the client-mostly government.

Research questions

1. What is the status of solar energy projects in Nigeria for climate change mitigation?
2. What are the reasons for solar energy failures in Nigeria for climate change mitigation?
3. What is the level of involvement of TVET educators in solar energy projects in Nigeria for climate change mitigation?

Methodology

The study adopted a survey research methodology based on three research questions. Fifty-six solar projects randomly selected from the federal capital territory (FCT) Abuja, and 19 out of the 36 states of Nigeria were used for this study. Each project site was visited to ascertain its completion and generation levels. A five point Likert type checklist on 9 causes of solar energy project failures was distributed to contractors and members of communities where selected projects were located. A total of 500 checklists were distributed and 486 were retrieved for analysis. The remaining four copies were rejected due to incompleteness. Trained research assistants were used to reach distant states. Personal data of project personnel in each solar plant was also reviewed.

Results

Table 1: Status of Solar Energy Projects in Nigeria

S/N	State	Total Projects	Completed Projects	Functional Projects
1.	FCT	4	3	1
2.	Kano	4	2	0
3.	Kaduna	4	2	1
4.	Katsina	3	1	1
5.	Sokoto	4	1	0
6.	Ebonyi	2	2	1
7.	Enugu	4	2	1
8.	Delta	4	2	1
9.	Lagos	6	3	1
10.	Kebbi	1	0	0
11.	Bauchi	3	2	1
12.	Osun	1	0	0
13.	Bayelsa	3	2	1
14.	Jigawa	1	1	0
15.	Niger	1	1	0
16.	Ogun	2	1	1
17.	Adamawa	1	1	1
18.	Imo	2	0	0
19.	Oyo	3	1	0
20.	Rivers	3	2	1
Total	**20**	**56**	**28**	**12**

Table 1 showed that out 56 solar projects sampled across Nigeria. 28 projects were completed out of which only 12 were functional at the time of this study. It was also found that among the functional solar energy projects in Nigeria, only very few generate electricity at full capacity.

Table 2: Reasons for Solar Energy Failures in Nigeria

S/N	Item Statement	Mean	Decision
1.	Cost of installation	3.52	Significant
2.	Manpower	4.01	Significant
3.	Corruption	2.18	Insignificant
4.	Political Instability	1.37	Insignificant
5.	Improper Planning	3.65	Significant
6.	Sun Hour	0.81	Insignificant
7.	Low Patronage	1.24	Insignificant
8.	Host Communities	1.09	Insignificant
9.	Cost of Maintenance	1.42	Insignificant

Table 2 shows that manpower is the major reason for solar energy project failure in Nigeria. Other reasons were improper planning and cost of installation. However, rest were not significant causes of solar project failures.

Table 3: Involvement of TVET Educators in Solar Energy Projects in Nigeria

S/N	State	Total Projects	Completed Projects	Functional Projects
1.	FCT	4	28	0
2.	Kano	4	31	1
3.	Kaduna	4	24	0
4.	Katsina	3	23	0
5.	Sokoto	4	37	0
6.	Ebonyi	2	15	0
7.	Enugu	4	21	0
8.	Delta	4	18	0
9.	Lagos	6	32	1
10.	Kebbi	1	11	0
11.	Bauchi	3	20	0
12.	Osun	1	7	0
13.	Bayelsa	3	14	0
14.	Jigawa	1	9	1
15.	Niger	1	13	1
16.	Ogun	2	18	0
17.	Adamawa	1	10	0
18.	Imo	2	15	0
19.	Oyo	3	21	0
20.	Rivers	3	18	0
Total	**20**	**56**	**385**	**4**

Table 3 reveals that out of 385 experts involved in the construction and maintenance of 56 solar energy projects in Nigeria, only four are TVET educators. This indicates that TVET educators were not involved in solar energy projects for mitigating climate change in Nigeria. Synergy has not been found between TVET educators and government, which will engender a mutual understanding and working relationship.

Findings and discussion

The study established that most of the solar energy projects initiated in Nigeria were not completed. Some were not commenced at all, while some were stopped at various stages. This leads to waste of resources and continuous burning of fossil fuel for energy, which engenders climate change. The study also revealed that most of the completed solar energy projects were not functional. Some of the functional solar plants did not generate electricity to full capacity. All these were attributed to three factors; inefficient man power, poor planning and cost of installation. These results are in line with the findings of Adeye (2013) who discovered that man power as a major challenge to adoption of solar energy for climate change adaptation in Nigeria and added that such works were given to the wrong people. The study also identified that the composition of those involved in each project. This revealed that TVET educators were not involved by governments in solar energy installation and maintenance to mitigate climate change in Nigeria.

Recommendations

1. Climate change adaptation and mitigation workshops should be organized in TVET departments of Nigerian institutions with government officials as special guests. This will create a relationship between TVET educators and government, which will engender a mutual understanding and working relationship.
2. Solar energy installation and maintenance should be officially included in TVET curriculums in Nigerian institutions.
3. TVET educators should form solar clubs. This will create awareness regarding their potentials in solar installation and maintenance for climate change mitigation.
4. TVET educators should bid for government contracts in solar energy installation and maintenance. This will bring their skills to the knowledge of Nigerian governments.

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INTEGRATING MOBILE PHONE RADIO FREQUENCY RADIATION HAZARD AND ITS PRECAUTIONARY MEASURES IN TVET CURRICULUM FOR SUSTAINABLE ENVIRONMENTAL PROTECTION IN NIGERIA

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Abstract: *This conceptual study focuses on integrating mobile phone radio frequency radiation hazards and precautionary measures in TVET curriculum for sustainable environmental protection in Nigeria. The study highlighted that, mobile phone radio frequency radiation causes a lot of harm and side effects to human body especially brain when making call or living in an RF vicinity. This is due to rapid increase in number of mobile phone subscriptions around the world which caused the phone and its base station to emit an intense radiation of Radio frequency in an electromagnetic field of a wireless telecommunication system. The precautionary principle has been reviewed accordingly. Furthermore, the measures were identified from different studies conducted globally on exposure to mobile phone radio frequency radiation which aroused considerable public attention by researchers. Therefore, curriculum planners in Nigeria should appropriately review the RF concepts and measures for the purpose of avoiding or reducing the exposure of radiation and to integrate them into TVET curriculum. By doing so, researchers and students in Nigeria may improve their environmental education and also the non-iodizing radiation would be integrated into radiation protection act of Nigerian Nuclear Regulatory Authority for sustainable environmental protection.*

Keywords: *Radio Frequency Radiation, Environmental Protection, Sustainability, Curriculum Relevance*

Introduction

Sustainable environmental protection can be effectively implemented in TVET curriculum through environmental education. Environmental education is very essential as it involves learning both natural and artificial systems that that sustain life and how those systems affect human beings. The underlying assumption of integrating sustainable environmental protection in TVET curriculum is to provide awareness to students through environmental education about needs and ways of protecting environment against any harmfulness (Ijaz & Sadar, 2015). Furthermore, studies have shown that, TVET curriculum needs a proper review concerning guidelines on how to identify the harmful concepts so that teachers can create awareness and develop attitude/skills among students in order to protect themselves against environmental hazards which include: pollution, sewage disposal, nuclear energy waste, gas leak, wind power waste, mobile phone radio frequency radiation etc. Therefore, this study is restricted to only mobile phone radio frequency radiation hazards and their precautionary measures. Mobile phone networks employ large numbers of low power transmitters from mobile-based stations which are scattered throughout a coverage area of electromagnetic field. This is because communications are two-way (duplex) in cellular networks, with each user requires their own dedicated communication channels, both for the uplink (phone to base station) and for the downlink (base station to the phone). Each base station has limited capacity in terms of the number of calls it can serve simultaneously, so the transmitters are closer together in locations where there is a high density of users. For example, the transmitters may be about 10 km apart in sparsely populated areas, but 100 m or less apart in city centers. An important consideration in the design of mobile networks is that operators have a limited spectrum window available and have to reuse their frequency channels to provide coverage everywhere. International Commission on Non-Ionizing Radiation Protection, (2009) stated that signals that use the same frequency in different cells can potentially interfere with each other, but the signal strength diminishes with increasing distance from base stations and frequencies are not reused in adjacent cells/sectors. Hence, services can be provided without interference, provided that the radiated power and base stations are minimized during calls. This principle has important consequences for the RF exposures of people using phones and living near base stations.

Mobile phone radio frequency (RF) involves non-iodizing radiation that occurs between a range of 30KHz to 300KHz in electromagnetic spectrum that is being emitted from wireless telecommunication system (mobile phone, antenna & mobile phone based station). Exposure to mobile phone radiation is prevalent in this era of technology, due to high utilization of phones. Therefore, the possible health consequences of exposure to mobile phone radio frequency radiation have aroused considerable public attention by researchers and governments worldwide. Exposure of human being to RF radiation depends on the distance of the RF source from the human body. World Health Organization (2013) stated that the RF radiation strength is proportional to the time averaged radiated power and inversely proportional to the distance from the source. In addition to distance, the efficiency of emitting RF radiation by mobile inside the human body depends on the properties of the electromagnetic field such as frequency, polarization, direction of incidence and anatomical features of exposed person like height, structure of outer ear, body mass index, posture and Specific Absorption Rate (SAR). The number of mobile subscription has been increasing rapidly around the world. For example, the number of mobile-phone subscribers in the USA has risen from 0.34 million in 1985 to 109 million in 2000, and 263 million in 2008 (InfoPlease, 2011). WHO has estimated that at the end of 2009 there were 4.6 billion mobile-phone subscriptions globally (WHO, 2010). Simon (2019) stated that, At presence i.e in the year 2019 there are 5.1 billion subscribers worldwide. Time increase in mobile-phone subscriptions over the past 15 years is well documented in Heinavaara, Tokola, Kurttio and Auvinen (2011) where less is known about changes in call frequency and duration over that time. One study in Finland found that the median duration of calls per month was 186 minutes in 2007, increasing to 221 minutes in 2009, while the average monthly number of calls increased slightly from 52 to 57 calls.

Magnitude of penetration of RF radiation inside the brain when mobile phones are held against the ear during voice call often depends on the design of the phone and its antenna, its position relative to the head, the anatomy of the head, how the hand holds the phone and quality of the connection between the mobile phone based station and the phone. Henderson and Bangay (2006) show that, GSM 900 that operates at 900MHz when held next to ear induces high spatial-averaged Specific Absorption Rate (SAR) values in the brain. This is due to the adaptive power control that only reduces the output power to about 50% during call, but this varies depending on the network software (Vrijheid, Mann & Vecchia, 2009). In addition, analogue phones which ceased to be used by the year 2000, produced higher absorption energy in the brain for two reasons: the phones had higher output powers than modern phones and antenna led to a greater diffused pattern of energy absorption in the head. Therefore, fourth/fifth generation (4G/5G) phone technologies are much effective due to their reduction of SAR in the brain by almost two orders of magnitude compared to that of analogue phones (1G). Another research conducted by Institute of Electrical and Electronics Engineering (2003) stated that the daily local RF exposure of the general public has increased by several orders of magnitude with the introduction and proliferation of mobile handsets. This has triggered concern among health agencies and the public, since the tissue with the highest exposure is the brain. Therefore, the main objectives of this study are to highlight the globally identified hazards of mobile phone radio frequency and their precautionary measures from different studies in order to integrate them into the curriculum of TVET through careful review so that environmental protection can be sustained in Nigeria and also to identify the diseases obtained from such hazards.

Diseases caused by mobile phone radio frequency radiation

1. Berg, Spallek and Schuz (2006) identified Glioma and Meningioma as diseases caused by RF radiation.
2. Baldi, Coureau and Jaffre (2011) identified Brain/CNS as disease obtained when human is exposed to RF radiation.
3. Degrave, Meeusen and Grivegnee (2009) identified three diseases caused by RF radiation hazards which include cancers of the eye, brain and nervous system.

Precautionary principle

Precautionary principle states that when human activities may lead to morally unacceptable harm that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm. COMEST (2005) provided explanation to the above principle as follows:

1. ***Morally Unacceptable Harm*** refers to harm to human or environment that is:
   (a) Threatening to human life or health.
   (b) Serious and effectively irreversible.
   (c) Inequitable to present or future generation.
   (d) Imposed without adequate consideration of the human right of those affected.
2. The judgment of ***Plausibility*** should be grounded in scientific analysis.
3. ***Uncertainty*** may apply to causality or the bound of the possible harm.
4. ***Actions*** are undertaken before harm occurs that seek to avoid or diminish the harm.

Precautionary measures against radio frequency exposure and radiation

Vrijheid, Mann and Vecchia (2009) explained that, since radiofrequencies radiation from mobile phones are man-made hazards, safety precautions should be documented in order to protect human against all known hazards. Based on the above, the researchers compiled some precautionary measures that are extracted from different studies. Exposure to mobile phone radio frequency is prevalent to most of the Nigerians living in urban and semi-urban areas due to emission of unhealthy radio frequency by mobile phone on our body while using it. Therefore, it is important to take precautionary measures in order to protect the mobile phone users against such RF radiation and its consequences. The following are precautionary measures extracted from different studies in order to limit exposure to mobile phone RF radiation hazards:

1. ***Use Text Message More*****: T**ext messaging involves considerably less exposure than voice calls. Because the distance creates a much larger buffer between the user and the powerful near field radiation from the phone. This is due to the closer proximity of the phone to the brain (Gati, Hadjem, Wong & Wiart, 2009).
2. ***Use Speaker mode or Wired Headset:*** The use of hands-free kits and earpiece during call lowers exposure from mobile phones RF to less than 10% of the value resulting from use at the ear (Kuhn, Cabot & Christ, 2009). This is because speaker mode/earpiece reduces the amount of near field radiation the user is exposed to. On contrary to this, when using earpiece, SIM card should be removed while listening to audio as it creates higher damage to the brain.
3. ***Avoid Body Contact with Mobile Phone:*** - the manufacturer's manual of mobile phone warns that the user should avoid carrying mobile phone against their head or body at all times. Experts recommend that, at least 10mm of space should be provided between the mobile phone user and his phone(Jung, Kim, & Kim, 2008). That clearly indicates that the user should not keep the mobile phone in a pocket and women should not keep it in their bandeau.
4. ***Use Shorter Calls:*** Vrijheid, Cardis and Armstrong (2006) stated that user should limit the length of his mobile phone conversations. Less time talking with a phone against user's head equals less radiation going into your body.
5. ***Limit Kids' Mobile Phone Use-Time by Using Phone Setting:*** Parents should use settings to set the call time to a shorter one. The time children should only use mobile phones for a short while and for emergencies or strictly in speaker mode at a safe distance (ICNIRP, 2010). The average exposure from the use of the same mobile phone is higher by a factor of 2 in a child's brain due to their thin skull and dielectric properties of bone marrow change with age. The marrow progressively incorporates more fat and the bone itself increases in thickness, hardens and losses water overtime. Both these tissues have higher conductivity in children than in adults and they receive a higher energy deposited from RF sources.

6. ***Switch Sides of Head When Talking:*** Switch sides regularly during a mobile phone call to reduce radiation exposure to just one side of your head (Djafarzadeh, Crespo-Valero & Zefferer, 2009). Try to switch to your other hand and it will help so that one side of your head does not always get all the radiation. But emphasis should be given to left ear, because the cochlea concentrates in the right ear.
7. ***Stop Making Call once You Perceive a Sharp Pain in Your Ears:*** Hadjem, Lautru and Gadi (2005) emphasize that, the user should immediately stop making a call when he perceives a sharp pain in his ears due irregular RF radiation which may cause damage to his cochlea.
8. ***Avoid Call When The Signal Is Low/Weak:*** Avoid using mobile phone when the signal is weak (say one bar) or when moving at high speed, such as in a car or train(Finkel, 2003). These scenarios cause mobile phones to increase their transmitting power in an attempt to connect to the nearest cell tower. Thus, the user gets more radiation and battery drains faster.
9. ***Use a Landline (if available):*** Use a corded landline phone if available as it has less RF radiation hazard compared to mobile phone (Schuz, Bohler & Schlehofer, 2006). So also, do not use a cordless phone for long conversations.
10. ***Wait for Call Connection before Placing it Next to the Ear:*** When making a call, wait for the call to connect before placing the phone next to the ear. The phone emits the most intense radiation during the initial connection, then lowers its power once a connection is established (Hillert, Ahlbom & Neasham, 2006). A of couple extra seconds are sufficient for this connection.
11. ***Use Airplane Mode:*** The user should turn the mobile phone off or put it in airplane mode when he intends to sleep or when not in use (Rong, 2015). If the user must leave mobile phone on at night, he should keep the mobile phone away from his head and body. The phone continues to emit radiation even when you are not making a call.
12. ***Be Careful About What Case You Use:*** Do not use a cell phone case unless it has been proven *not to increase SAR* or weaken your cell phone signal (Rong, 2015). Many standard cases can weaken the cell phone's signal, shorten battery life, or increase radiation emissions.
13. ***Be Careful About 'Shielding' Products: -*** Follow experts advice to avoid using products on user's cell phone that claim to 'shield' cell phone emissions, because they may interfere with the phone's signal. This may cause it to draw even more power and possibly emit more radiation as it is working harder to communicate (Radon, Parera & Rose 2001).
14. ***Minimize the Use of Analogue Phones:*** Avoid the use of analogue phones as much as possible because they generate higher RF radiation than modern phones (Nielsen, 2010).
15. ***Avoid Making a Calling When the Phone is Charging:*** High RF Radiation which may cause damage to the body is reported when the phone is charging (Radon, Parera & Rose, 2001)
16. ***Reduce the Use of Phone During Pregnancy:*** **P**regnant women are advised to avoid/reduce using a phone as it may affect her unborn baby (Nagaoka, Togashi & Saito, 2007).
17. ***Distance of Antenna/Tower from Vicinity:*** The antenna should have a safe distance from the buildings (where people live). Table 1 shows antenna per required/safe distance:

Table 1: Antenna and the Required/Safe Distance (Source: Chinmay & Ankita 2013)

Antenna(e) pointed in the same direction	Building's safe distance from Antenna(e) at the same height
1	20
2	35
4	45
6	55

Conclusion

Mobile phone radio frequency radiation causes a lot of harmful diseases and side effects to human body especially brain. This is due to rapid increase in number of mobile subscriptions around the world. The precautionary principle has been reviewed in order to find solutions and measures to such harm caused by radio frequency radiation. Furthermore, the measures were identified from different studies conducted globally so that curriculum planners will appropriately review them for the purpose of integrating the RF concepts and measures into TVET curriculum. By doing so, researchers and students in Nigeria may improve their environmental education (EE) and sustainable environmental protection.

Recommendations

1. Ministry of communication, Nigerian Nuclear Regulatory Authority and Ministry of health should invite resource persons including electrical engineers, computer scientists and medical doctors in order to organize a workshop on radio frequency radiation and its precautionary measures in Nigerian context.
2. Sustainable environmental protection should be a separate subject in the curriculum of TVET in order to overcome related environmental conserns.
3. Nigerian nuclear regulatory authority should incorporate non-iodizing radiation of RF in their nuclear safety and radiation protection act of 1995 in order to contribute more on sustainable environmental protection.

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NEED FOR INNOVATIVE CHANGES IN TECHNICAL VOCATIONAL EDUCATION AND TRAINING CURRICULUM FOR SUSTAINABLE ENVIRONMENTAL PROTECTION IN NIGERIA

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Abstract: *The paper look at the concept; curriculum change why creative innovative are necessary in TVET, why TVET curriculum should be innovated. It outlines ten (10) innovative techniques if enshrine in its curriculum will enhance the achievement of sustainable environmental protection in Nigeria. The paper also look at the pre-requisites for sustaining environmental protection in Nigeria, the challenges and Government roles to sustainable environmental protection are to work in Nigeria. It highlights the aim and objectives of TVET, the processes of developing sustainable environmental protection, the need for healthy Ecosystem and possible solution to sustainable environmental protection. It also provides Government roles to sustainable environmental protection, conclusion, suggestion and references are added to complete the paper.*

Keywords: *Curriculum Change, Healthy Ecosystem, Environmental Protection, Sustainability*

Introduction

Innovative changes are not new concept in societies and organizations; innovation is linked to positive changes in efficiency, productivity, quality, competitiveness and innovative activities to improve performance. Basically, curriculum deals with the real acts of ensuring that teaching and learning yield the desired benefits through:

1. Translation of educational goals into school and classroom attainable objectives, based on clear situational analysis of the immediate educational context with regard to the community, the learners, the educational facilities available etc.
2. The derivation from objectives of appropriate content learning opportunities, teaching strategies and teaching and learning materials.
3. Building into the entire process appropriate strategies for systematically determining the extent to which curriculum related activities are yielding the expected results. Curriculum is expected, through the above processes, to meet the needs of its recipient and the society. Where the above become impossible, the ultimate issues on:
   (a) What exactly should the school, classes, teachers, learners, parents and communities do to ensure that the desired changes by curriculum reform really take place in terms of improved learning.
   (b) How should teaching and learning be promoted to ensure that the desired improved learning takes place.
   (c) What should be the most appropriate materials for promoting the desired types of teaching and learning, and finally
   (d) What should consisted the body of knowledge, the values, attitudes and societal desirable behaviour patterns to be inculcated in the learners, which curriculum changes would give attention to educational financing, educational infrastructures and facilities and the like, their implementation has to go a step further and attempt to answer the above basic curriculum questions. That would attempt ensuring the overall goals of educational curriculum changes are attained.

Curriculum changes by definition according to Wikipedia (2017) is the process of making changes to the curriculum with the intent of making teaching and learning more meaningful and effective. It can also be said to be act of forming changes to the subject content, style of delivery and

assessment of curriculum it involves changes, update and improvement in the courses of study by an institution. It is the process of modifying learning content so as to meet the need of the society. It brings about re-shaping, re-configuration and to make improvement to better the lots of the society in terms of achieving desirable educational outcome. TVET on the other hand is education and training which provide knowledge and skills for employment. It uses formal, non-formal and informal education and training and sometime both to achieve its objectives. As human population and per capital consumption grow, so do the resource demands imposed on ecosystems and the effects of the human ecological footprint. Natural resources are vulnerable and limited. The environmental impacts of anthropogenic actions are becoming more apparent. Problems for all Ecosystems include:- Environmental pollution, climatic changes and biodiversity loss. Further threats include, air pollution, soil degradation and deforestation. For aquatic ecosystem, threats include, unsustainable exploitation of marine resources (for example over fishing of certain species) marine pollution, microplastic pollution, water pollution, the warming of oceans and building on coastal areas (Smith & Smith, 2012). Society is increasingly becoming aware that ecosystem services are not only limited but also threatened by human activities. There is need to consider long term ecosystem health and its role in enabling human habitation and economic activity urgently. Many Ecosystem services are being assigned economic values, often based on the cost of replacement with anthropogenic alternatives. The ongoing challenges of prescribing economic value to nature, for example through biodiversity banking, is prompting trans-disciplinary shift on how we recognize and manage our environment; social responsibility, business opportunities and our future existence as human race.

Furthermore, according to Christensen et al (1996) Ecosystem provide variety of goods and services on which people depend. These include: Tangible construction materials, food, medicinal plants. Others, Brown, Thomas, Bergstrom et al (2007) added tourism and recreation and genes from wide plants and animals that can be used to improve domestic species. Ecosystem services improves conditions of location of things of value like Hydrological cycle, cleaning of air and water, maintenance of oxygen in the atmosphere, crop pollination and even things like beauty, inspiration and opportunities for Research Works. Materials from Ecosystem are known and recognize as being the basis for things of Economic value and should not be toiled with rather should be protected. Ecosystem by definition according to Smith and Smith (2012) is a community of living of living organism in conjunction with non-living components of their Environment interacting as a system. This ecosystem is being threatening by human activities such that its goods and services to humanity and its habitation now require urgent attention.

Aim and purposes of TVET

Technical vocational education and training serves multiple purposes. According to Billet (2011) the key purpose is preparation of youth for work.The rapid technological changes demand that workers continuously update their knowledge and skills as a role for continuous professional development. The TVET knowledge today depend globally on economy characterized by rapid changes in technology and related mode of work. TVET today has the responsibility of re-skilling workers in their practices for personal development and emancipation. TVET like all other form of education also facilitates socio-economic development by enhancing the capacity of individuals to adopt practices that are socially worthwhile (Kathrin, 2008) TVET. also aims at developing capacities for effective communication and effective interpersonal relations (Macleanet al, 2009). The supply of skills for the society with changing needs information technology has introduce into occupations in the world of work. Innovatives techniques in TVET that will contribute greatly to sustainable Environmental protection are:

(a) Designing TVET curriculum to embrace and accommodate modern technology development.
(b) Providing human resource training scheme to update workers' performances.
(c) Be carious, gather information and recognize innovative opportunities.
(d) Development broader ideas beyond the industrial ideas that are currently in practice or in use.
(e) Developing futuristic visionary attitude.

(f) Develop and anticipating disruptive technologies and changing trend.
(g) Developing good ideas from consumer in the society.

Developing sustainable environmental protection

Sustainability is the ability of a system or phenomena to exist constantly (Capra, 2015) explained that it refer to the capacity for the biosphere and human civilization to co-exist. It can also be defined as the process of people maintaining change in a balance environment in which the exploitation of resources, the direction of environment, the orientation of technological development and institutional changes are all in harmony and enhance both current and future potential to meet human needs and aspiration (Capra). Developing sustainable environmental protection is the process of determining resources, causes of environmental pollution human activities creates and find ways to prevent, control or fix the damage caused by that pollution where the causes of pollution are not known, samples of water, oil and food and others are collected for testing and analysis to identify potential environmental threats and developing plans to correct or avoid the pollution problems. Sometimes, when these causes are discovered, the polluted areas can be declared "no longer fit for habitation". Also, proactive decision can be taken to change human behaviours to prevent harm to the environment. Sustainable development is that organized working principle that meet the need of the present without compromising the ability future generations to meet their own needs (William, et al 2004).

Need for healthy ecosystem

Healthy environment are necessary to the survival of human and other organism. Developing ways of reducing negative human impact are environmental friendly (Wandemberg, 2015) the Ecosystem is an interacting system between the living, non-living and the environment. Moving towards sustainability is a social challenge that entails international and national laws, Urban planning and transport, supply chain management, local and individual life style and ethical Consumerism. He continued that these calls for sustainable architectural design, sustainable agriculture, sustainable municipal cities. In light of environmental degradation, climate changes, over consumption, population growth and societies pursuit of unlimited economic growth in a close system has to be controlled for healthy ecosystem.

Solution to sustainable environmental protection

The problem created by human activities are not new or limited to Nigeria situation. Many countries, societies, organization have come out with do and don't so as to prevent, control human activities and maintain their environmental protection. CIPA (2001) stated that every approach to environmental protection should aim at considering the complex inter-relation in decision rather than simply responding to specific issues and challenges. Ideally, CIPA (2001) insisted that decision making involving ecosystem should be a planning collaboration that involves a broad range of stakeholders across all relevant Governmental departments, industrial representative, environmental groups and affecting communities.

Government roles to sustainable environmental protection

Many constitutions acknowledge the fundamental right to environmental protection and many international treaties also acknowledge the right to live in a healthy environment. There is need according to Jonathan (1993) that many countries have organization and agencies delegated or devoted to environmental protection. Environmental protection is not simply the responsibility of Government protection acts, most people view these agencies as being of prime importance in establishing and maintaining standard that will protect both the environment and people interacting with it. It is expected that Government set up agencies that will formulate policy co-ordinating and monitoring environmental issues, planning and policy oriented environmental research. The agencies has the role to advice Government and international community on a range of environmental issues such as:

(a) Providing technical advice.
(b) Coordinate technical activities.
(c) Developed enforcement guidelines and procedures.
(d) Assess, monitor and evaluate activities that impact the environment.
(e) Promote and assist environmental information and communication.
(f) Seek advancement of scientific knowledge (Tanzania Govt, 2011).

Like in Tanzania, their environmental policy of 1997, acts as a frame work of environmental decision making the policy objectives are to achieve the following:
(a) Ensure sustainable and equitable use of resources without degrading the environment or risking health or human safety.
(b) Prevent and control degradation of land, water vegetation and air.
(c) Conserve and enhance natural and man-made heritage including biological diversity unique ecosystem.
(d) Improve condition and productivity of degraded areas.
(e) Raise awareness and understanding of the linkage between environment and development.
(f) Promote individual and community participation.
(g) Promote internation co-operation and use eco-friendly resources.

Sustainable environmental protection is the practice of constant protecting the natural environment by individuals, organizations and Government to conserve natural resources and the existing natural environment, to repair damage caused by pollution and reverse the trends. Pollutions caused by over-consumption, population growth, industrial production waste and biophysical environment is being degraded. Sometimes, these environments are permanently destroyed and such areas habitation and economic activities become impossible. Government in such situation as expected to place restriction on activities that cause environmental degradation.

Conclusion

For sustainable environment protection to be possible, there must be those to maintain the system and these are inevitably the product or recipient of the change TVET curriculum under continuous supervision, sustainable environmental protection will be achieved in Nigeria.

Recommendations

1. TVET institutions to be satisfaction supported to provide skill manpower personnel to maintain. Every set up to sustain environmental protection.
2. Government to set up agency for Environmental protection for consultation on issues related to environmental problem.
3. The set up agency to have different department to handle the various aspects of environmental specialties.
4. The set up agency to be properly funded, so that those working in the establishment can feed their families and be responsible for their assignment.
5. The TVET curriculum for Environmental protection must satisfied the needs of the society, industrialists, environmental group and the affecting communities.
6. The TVET innovated curriculum must satisfied the need and aspiration of its learner or trainees for self-actualization.

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EFFECTIVE ENVIRONMENTAL SUSTAINABILITY DEVELOPMENT IN TECHNICAL AND VOCATIONAL EDUCATION FOR NIGERIAN EDUCATIONAL SYSTEM

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Abstract: *This paper seeks to examine the effective Environmental Sustainability Development in Technical and Vocational Education for Nigerian Education system. The paper opined that the achievement of sustainable development required changes in industry process through Technical and Vocational education. Issues concerning environment sustainability such as intergenerational decision making, long term of ecosystem, renewable resources, preventing the consequences of manmade global warning, prevention of species diversity and ecological structure, treating environmental resources and target social welfare were mention. The study revealed that sustainability is concern with how resources will be protected and maintained for future generations. The paper also discussed the role of Technology in sustainable development which includes, public infrastructure, energy, nuclear power, food increase, water treatment and re-use, mining and manufacturing as well as information technology. The integration of sustainability in Vocational and Technical Education were also discussed. The study also forward useful suggestions to the authorities concerned in the development of Vocational and Technical Education curriculum.*

Keywords: *Environmental Sustainability, Industrial Development, Technical and Vocational Education*

Introduction

Achieving sustainable economic growth will require changes in education, through the amount and type of resources used and in the products which are manufactured. The world must move to more energy-efficient society, one that uses resources more responsibly and organizes industrial process in ways that minimize and re-use wastes. Environmental sustainability is concerned with whether environmental resources will be protected and maintained for future generations. Environmental sustainability focus on issues such as:

(a) Intergenerational decision making.
(b) Long term health of ecosystems.
(c) Renewable resources.
(d) Prevent the consequences of man-made global warning.
(e) Protection of species diversity and ecological structure.
(f) Treating environmental resources as if they have intrinsic rights and value.
(g) Targeting social welfare/happiness and environmental sustainability above crude measures of progress such as GDP measures of economic welfare (Jejvan Pettinger, 2018)

United Nations world commission on environment and development 1987 defined sustainability as the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs. International union for conservation of Nature (IUCN) 2008 defined sustainability as the capacity to improve the quality of human life while living within the carrying capacity of the Earth's supporting ecosystems. Paul Hawken, 2018 said that sustainability is about stabilizing the currently disruptive relationship between earths two most complex systems-human culture and the living world. The above definitions lead us to even more questions about the universe. For example, what if we, an evolutionary species, change the way we live, learn, love and conduct other activities on this planet?

Developmental role of technology on sustainability

As technology affects all, societal activities must reflect the goals of sustainable economic development. The following are among the importance of Technology to environmental sustainable development:

1. ***Public Infrastructure:*** Public infrastructures are essential to the efficient functioning of society and its ability to achieve sustainable development. These include transportation and communication facilities, power systems, water resources and supply systems as well as road and bridges. If the technologies are well developed the essential challenge will lies in the diffusion and use of such technologies to develop the nation.
2. ***Sustainability Depends on the Evolution of Energy Technologies:*** The world will need to reduce the use of fossil fuels. Technological effect must be directed to increasing the efficiency of energy supply and this may play an important role in the transition to an economy much or less depend on fossil fuels. In the long term, there are varieties of possibilities for securing the world's energy future. These include renewable energy sources, which are fast becoming economic. For instance, there is rapid advances in efficient solar cell-based power generation. Wind, biomass and other sources of renewable energy which are also becoming realistic options for rich uses.
3. ***Acceptance of Nuclear Power:*** Public acceptance of nuclear power will depend on the safe operation of nuclear plants and the safe management of the radioactive wastes produced by these facilities. Nuclear fusion is a possible future of energy.
4. ***Increased Food Production and Improved Means of Storage and Distribution:*** Biotechnology has produced new strains of crops resistant to disease and drought. This depends on advances in technological way of producing crop varieties naturally. The negative environmental consequences of farming have been reduced in recent years and environmentally sustainable farm practices appear to be within the reach. Pest resistant will also permit a further reduction in toxic chemical used as pesticides. The chemical industry is now producing pesticides that degrade more quickly, which has more focused effects and can be applied in lower concentrations. The good management practices include the use of computers to guide chemical use, crop rotation systems and integrated pest management. These practices lead to a sustainable future in the agricultural sector.
5. ***Water Treatment and Recycling:*** Water recycling can reduce and prevent pollution. Water treatment and re-use will have a desire role in sustainable development in industrial, public and agricultural sectors water treatment and transportation must be chosen accordingly. Technologies now exist for controlling many types of pollutants. For the agricultural sector, new technologies for irrigation will be needed to minimize water consumption and to prevent unsustainable ground water extraction. The future challenge will be the control of heavy metals and micro pollutants. In public health, securing of public health will remain the basic feature of urban water systems.
6. ***Mining and Manufacturing:*** Mineral extraction industry is adopting environmentally sound practices and it developing approaches and technologies for remediating past environmental damage. Manufacturers have also begun to reduce, recycle and re-use products and materials in a search for industrial ecosystems that will imitate natural ones. Companies design in ways that give the environment the same level of consideration as worker safely and the quality and cost of products.
7. ***Information Technology:*** Information Technologies allow precise control of industrial process, which improves our ability to minimize pollution and improve energy efficiency, it has the potential to alter how and where people work and live, and thus the nature of urban areas of the future. It is improving the efficiency of air-land-and-water-based transportation systems, among other sectors of the economy. Examples of such is the systems of Earth orbity and networks of fiber optic cables which has ability to survey and protect the environmental conditions.

Based on the contributions of Technology to sustainable development, it has become necessary to include Environmental Sustainable Development in Technical and Vocational Education into Nigerian educational curriculum. Technical and Vocational Education (VTE) is defined as the

aspect of education which leads to the acquisition of practical and applied skills as well as basic science knowledge (NPE 2004). Federal ministry of education (2002) mandates greater integration of academic and Vocational and Technical Education and an emphasis on all aspects of the industry. So attention to the more generic skills is a growing priority for Vocational and Technical Education. According to Pavlova (2018) Technical and Vocational Education has a potential to reduce green house gas emissions and combat climate change. This will be made possible by given the subjects learning out comes focusing on recycling product design and conservation process. This allows TVET to be a positive contributor to the goals of sustainable development. Teaching about TVET offers abundant opportunities to incorporate sustainability into the classroom. Sustainability topics are a natural fit with numerous areas of vocational and Technical Education which includes architecture, construction, natural resources, marketing, communication, business, finance, governmental regulations, health sciences, pubic administration and more. To this end Pavlova (2018) mention countries such as New Zealand when integrate teaching of sustainability in TVET. According to him New Zealand's TVET is comprise of six strands three of which incorporate sustainability as indicators of expected student performance. These strands are design in technology, manufacturing design and visual communication.

Conclusion

Technical and Vocational Education (VTE) focused on provision of relevant skills to youth for work, is designed to be inclusive and support lifelong learning. It has the scope for supporting transition of economics and societies to become low carbon and sustainable. The integration of VTE in environmental sustainability development can together create an enabling atmosphere for society to transform themselves into sustainable societies.

Recommendations

To achieve this, the following should be considered.

1. Economic growth must be inclusive to provide sustainable jobs and promote equality.
2. Government should ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
3. Protecting of resources so that they will not be damaged and become unavailable for use.
4. Cultural changes must be made in the nation's environmental research programmers.
5. Government should provide good health and well being as well as affordable and clean energy.

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EFFECT OF COMPUTER SIMULATION AND ANIMATION TECHNIQUE ON TECHNICAL COLLEGE STUDENTS' INTEREST IN AUTOMECHANICS

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Abstract: *The study was carried out to determine the effect of computer simulation and animation on the interest of students in automechanics. Two research questions were answered in this study and one null hypothesis was tested at 0.05 level of significance. The study adopted quasi experimental research design. Specifically, the pretest, posttest nonequivalent design was used. The study was carried out in the Federal Capital Territory, Abuja using the Technical Colleges. The two Technical Colleges offering automechanics in Abuja are Government Science and Technical College, (GSTC) Garki and Federal Science and Technical College (FSTC) Orozo. The population for the study is 102 NTC students in these Technical Colleges offering automechanics. There are 57 students in GSTC Garki and 45 students in FSTC Orozo. Random sampling was used to assign school to treatment groups. GSTC Garki was assigned to be taught using computer simulation while FSTC Orozo was assigned to be taught using animation. No sampling was conducted in selection of students because intact classes were used for the study. Automechanics Interest Inventory (AMII) was used for data collection. The instrument was face validated by five experts from the faculty of Vocational and Technical Education, University of Nigeria, Nsukka. The instruments were trial tested with 20 students of Government Technical College Suleja and Cronbach Alpha was used to determine the internal consistency and 0.79 was obtained. The data collected was analyzed using mean to answer the research questions. While, the hypothesis was tested at 0.05 level of significance using Analysis of Covariance (ANCOVA). The finding of the study showed that students taught automechanics using computer simulation have a higher interest rating than students taught using animation. Female students taught using simulation have higher retention than male students. The hypothesis tested showed that $p < 0.05$ implying a significant difference in the effect of computer simulation and animation on the interest of students taught automechanics. Based on the findings, it was recommended that computer simulation should be preferred in teaching of automechanics in the Technical Colleges because it has a greater effect on the interest of students.*

Keywords: *Computer Simulation, Animations, Technical Education, Automechanics*

Introduction

There is a global shift from the traditional talk chalk method of instructional delivery to a computer based instruction. This shift is due to the emergence of a new generation that have been described as digital natives. This generation of learners according to Prensky (2001) were born in the age of digital technologies and live in an environment where they are inured daily in digital technologies such as video games, cartoons, digital media and so on. These generation of learners are creating a shift in educational discourse and attention is being shifted globally to integrating computer technologies in the delivery of learning instruction. The advent of computers into everyday life is changing the landscape of education globally. Mishra and Khoeler (2006) noted that education in the 21st century is a paradigm shift from what it used to be. Teachers now need more than knowledge of their subject matter or pedagogical skills for effective teaching, they require functional knowledge on how to use technology in the classroom to create effective learning. According to Prensky (2001) a new generation of learners have emerged from the early 2000 and he referred to them as digital natives. They are a generation of learners who were born or brought up during the age of digital technology and are so familiar with computers and the internet from an early age and they tend to be more comfortable using these digital technologies for learning. Ozdemir and Oner (2015) noted that computer simulations and animations have emerged as a result of the advancement in computer technologies and gradually becoming an important part of today's classroom.

Simulation and animation are based on multimedia but they also differ greatly. Animation is an illusion of motion and change created by means of a rapid display of a sequence of static images that minimally differ from each other. Beal (2016) described animation as simulated movement created by displaying a series of pictures, or frames. Animation on computers is one of the chief ingredients of multimedia presentations. Animations have been defined as images in motion (Dwyer & Dwyer, 2003). Animations according to Anglia (2009) are film sequences or videos containing moving, drawn or modelled images. They are constructed by running together thousands of separate photographed images, to convey an impression of movement. Traditionally, each image is hand drawn or models or puppets are used. The models are placed in a set and moved, and each movement is photographed. Sound effects, including speech, may also be incorporated into the final film. Nowadays, animations are often produced much more quickly using specialist computer software packages. Images of models or drawings can be scanned into a computer and manipulated, or the images can be computer-generated. Computer animation has developed rapidly in recent years, helped by advanced digital technology. The capable features of Animation can enliven the learning experience. Martindale (2007) noted that today's generation of learners are very fascinated with animations, reason they stay glue all day watching cartoons. Martindale further noted that animation seems to attract learners' attention and increase their motivation to learn. According to Riber (1994) animation that combines visual and verbal knowledge help students to store information into long-term memory facilitating encoding and retrieval process. Although animation seems to attract learners' attention and increase their motivation to learn, whether or not instructions using animation can facilitate students learning interest in automechanics still remains a question. Aside from the use of animations, advancements in technology have also brought to fore the use of computer simulation for teaching and learning. Unlike animations, computer simulations allow students to be able to personalize instruction by being able to manipulate and get feedback from simulation.

Computer simulation is beginning to receive attention among educators especially in the teaching and learning of skills. Simulation involves recreating reality, real world situation or events using computer codes. Hartley (2006) defined simulation as a technology enabled environment created to facilitate learning through immersion, engagement, and adaptive surroundings that ultimately provide guidance and constructive feedback to the learner. Alessi and Trollip (2001) stressed that simulation provides the learner with the ability to interact with a model of a real world situation or activity. Marks (2002) argued that in science courses, classroom simulations potentially have an important and valid role in creating virtual experiments and problem-based microworlds that allow students to use instruments and monitor experiments, test new models, and improve their intuitive understanding of complex phenomena. Through simulation the learner is given the opportunity to practice with a variety of situations which resemble real-life problems which they might face in the future. The need to use simulation and animation in the Technical College is imperative. The technical colleges in Nigeria are established with the aim of producing skilled labour for the nation. Hence, method of instruction in the classroom must be one that is most effective in helping students learn. Technical colleges in Nigeria have been training people to become craftsmen and technicians. Training qualifies them for jobs in both public and private sectors of the economy. Both sectors, according to Ndomi (2005), require well-trained and competent technicians who can operate and maintain the available technical equipment. Therefore, there is a need for qualitative training so as to produce graduates that can perform competently in their chosen vocation without a need for pre-employment training. Technical Colleges according to Arowolo (2017) are vocational institutions principally responsible for producing craftsmen and master craftsmen in Nigeria. The Technical Colleges offers courses leading to the award of a National Technical Certificate (NTC) or Advanced National Technical Certificate (ANTC). The National Technical Certificate (NTC) is awarded for craftsmen while the Advanced National Technical Certificate (ANTC) for master craftsmen. Technical Colleges offers training in various trade area among which is the automechanic trade. Automechanics offered in the technical colleges is aimed at producing craftsmen and master craftsmen who should be competent and skillful to carryout routine services and repair works on all kind of vehicles.

Students specializing in automechanics according to the National Board for Technical Education (NBTE, 2001) are to be exposed to training in repairs and maintenance of brakes, transmission, engine, fuel, cooling, lubrication, steering, differential, ignition and suspension systems of a vehicle. Training of students for these tasks demands an instructional method that will help them learn effectively. Aduwa-Ogiegbaen and Iyamu (2005) found out that in Nigeria, computer based technologies are yet to be integrated in the delivery of instruction, rather chalkboard and text books continues to dominate classroom activities in most of the colleges. Oyenuga (2010) also stated due to the continual advancement in vehicle technology, integrating computer based technologies in training of automobile craftsmen becomes imperative so as to produce skilled men fit for the automobile industry. Hence, instructional method that will improve the interest of student in learning automechanics need to be adopted in the Technical Colleges. Interest is an important motivational construct that influences students' engagement and achievement in learning. Chukwu (2002) described interest as a persisting tendency to pay attention and enjoy some activities. It is an emotionally oriented behavioural trait which determines students' vim and vigour in tackling educational programmes or other activities. Hidi and Renninger, (2006) were of the view that interest influences students' attention, goals and level of learning. They described interest as a motivational variable. Panksepp (2002) noted that although interest is said to have a highly energizing positive affective character, it can also be operative in many effectively negative situations. Interest according to Hidi (2003) is the outcome of an interaction between a person and a particular content, thus, the potential for interest is in the person but the content and the environment define the direction of interest and contribute to its development. The way learning is presented has the potential to stimulate the interest of the students. Prensky (2001) noted that the major problem of education today is teaching a generation of learner he described as digital natives with tools and methods alien to them. Hence, this study sought to determine the effect of computer simulation and animation on students' interest in learning automechanics.

Purpose of the study

The purpose of this study is to determine the effect of computer simulation and animation on Technical College students interest in learning automechanics. Specifically, the study sought to determine:

1. the effect of computer simulation and animation on Technical College students interest in learning automechanics.

Research question

1. What is the effect of computer simulation and animation on Technical College students interest in learning automechanics?

Hypothesis

H_{O1}: There is no significant different between the mean interest rating of students taught Automechanics with computer simulation technique and those taught using animations

Methodology

A quasi-experimental design was used in this study. Specifically, the pretest, posttest, non-equivalent control group design was adopted for the study. Quasi-experimental research design is a research design where the researcher randomly assigns intact classes to treatment and control group. According to Rubin and Babbie (2011) quasi-experimental design can be used when it is not feasible to use randomization to determine which participants are assigned to treatment groups. This study was conducted in Technical Colleges offering automechanics in Abuja (FCT). There are two Technical Colleges offering automechanics in Abuja (FCT), Government Science and Technical College Garki (GSTC) and Federal Science and Technical College (FSTC)Orozo. Abuja was selected for this study because the city being the federal capital of Nigeria has had much infrastructural development over the years which are comparable to other major cities in the world.

The population for this study is 102 students in NTC II in the technical colleges in Abuja (FCT). The population was drawn from the two Technical Colleges offering Automechanics within the FCT education zone. There are 57 students in GSTC Garki and 45 students in FSTC Orozo in year two class offering automechanics. The sample size for this study is hundred (102) students. Random sampling was used to assign one of the schools to the treatment group and other school to the control group. Government Science Technical Colleges Garki was assigned to the treatment group (computer simulation) while Federal Science Technical Orozo was assigned to the control group (animation). No sampling was conducted in selection of the students, because intact classes was used in each of the schools. The instruments used in this study is the Automechanics Interest Inventory (AMII). The instrument is a 20-item inventory designed to elicit students' likes and dislikes that could arouse their curiosity and desire to learn as the teacher teaches. Basically, the AMII is students' self report inventory to measure their interest in Automechanics. To determine if the students are answering the questions or merely checking responses at random, the same question is reworded in different ways. The Automechanics Interest Inventory (AMII) is made up of 20 items using a five-point scale as follows;

- Strongly Agreed - 5
- Agreed - 4
- Undecided - 3
- Disagreed - 2
- Strongly Disagreed- 1

The AMII was validated by five experts. Three of the validates were drawn from the Industrial Technical Education (ITE) Department, University of Nigeria, Nsukka and two are from Industrial Technology Education Department, Federal University of Technology, Minna. The instrument used for this study AMII was trial tested on 20 NTC II students of Government Technical College, Suleja. Cronbach alpha was used to establish the reliability of the interest inventory and a reliability co-efficient of 0.79 was obtained. The automachemics teachers and their workshop assistants administered the interest inventory. The students were taught automechanics for four weeks using computer simulation and animation after which the interest inventory was administered. Mean ($\bar{x}$) and standard deviation was used to analyse the data collected. The hypothesis formulated for the study was tested at .05 level of significance using Analysis of Covariance (ANCOVA). The null hypothesis was rejected if p-value is less than 0.05 while null hypothesis was accepted if p-value is greater than 0.05.

Result

Table 1: Mean Interest Rating of Students taught Automechanics using Computer Simulation and Animation

S/N	Question item	Simulation		Animation	
		X	SD	X	SD
1.	It will be lovely if automechanics is taught every day	3.98	0.92	4.11	1.03
2.	Automechanics task is not boring	1.49	0.73	1.69	1
3.	I am always eager to be in the automechanics class	4.42	0.57	4.2	0.73
4.	Lectures in automechanics is so exciting	4.47	0.54	4.42	0.66
5.	I feel so free to interact in automechanics class	4.3	0.71	4.44	0.66
6.	I would like to start up an engine repair shop and automechanics is important to me	3.96	0.8	4.27	0.75
7.	I like my automechanics lecturer because of the way he delivers his lectures	4.28	0.8	4.24	0.71
8.	I am always at ease in automechanics class	2.46	1.13	2.38	1.27

S/N	Question item	Simulation		Animation	
		X	SD	X	SD
9.	I love tuning to sautomobile channels for latest in engine design and construction	4.49	0.71	3.21	0.67
10.	My passion leads me to go online to search for more information in engine servicing and repairs	4.35	0.67	3.02	0.74
11.	Automechanics assignments areinteresting	2.04	1.02	2.29	1.18
12.	The technique used by my teacher has made me positive about practicing professionally in the automobile industry	4.04	0.91	3.12	0.72
13.	I don't have to cram my notes because learning in the automechanics class is interesting to me	4.04	0.98	4.36	0.71
14.	Identifying components of an engine is simplified because of the teaching approach of my teacher	4.14	0.72	4.2	0.89
15.	I love asking and answering questions in the automechanics class	4.16	0.75	3.24	0.88
16.	I advise my friends in the lower class to specialize in automobile technology because of the method by which automechanics is taught in the classroom	4.04	0.8	3.02	0.88
17.	Method adopted by my teacher has made Automechanics very easy for me to learn	4.28	0.88	2.38	0.83
18.	The method of teaching makes me at ease in the class	4.14	0.79	2.28	0.71
19.	I don't feel sleepy because of the method used in teaching automechanics	4.02	0.94	4.13	0.84
20.	The automechanic class is very interactive	2.02	1.04	2.95	1.49
	Total	**3.76**	**0.82**	**3.40**	**0.87**

Table 1 shows the mean interest rating of students taught automechanics using computer simulation and animation. From the table, the student taught using computer simulation have a higher mean interest rating of 3.76 while those taught using animation had a mean interest of 3.40.

Table 2: Analysis of Covariance (ANCOVA) of Students' Interest in Automechanics Taught Using Computer simulation and Animation

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	0.953[a]	1	0.953	13.372	0.000
Intercept	1356.610	1	1356.610	19032.329	0.000
Method	0.953	1	0.953	13.372	0.000
Error	7.128	100	0.071		
Total	1375.164	102			
Corrected Total	8.081	101			

a. R Squared = .118 (Adjusted R Squared = .109)

Table 2 shows the F-calculated values for effect of computer simulation and animation on students' interest in automechanics. The F-calculated value for treatment is 13.372 with a significance of F at 0.00 which is lesser than .05 level of significance. Hence, the null-hypothesis is rejected. The finding presented in table 2 implies that there is a significant difference between the mean interest rating of students taught Automechanics with computer simulation technique and those taught using animations.

Findings and iscussion

Findings from research question 1 showed that students taught automechanics using computer simulation have a higher mean interest rating than students taught using animation. The findings from hypothesis 3 further confirmed that there is a significant difference between the mean interest rating of students taught Automechanics with computer simulation technique and those taught using animations. This finding agrees with the result of a study carried out by Hussain and Ali (2012) where they found students taught with computer simulation to have showed more interest in learning. Motivation and interest of the students play an important role in the teaching learning process. In comparison of computer simulation with the traditional lecture method, Iqbal (1999) found that the lesson becomes interesting with the use of computer programming to motivate the students and arouse their interest in teaching learning process. Ozdemir and Oner (2015) also carried out a study on the effects of simulations and animations on students' motivation and found that students taught with simulations were more motivated than those taught using animation. The high interest rating when simulation was used could be attributed to the fact that computer simulation is interactive, unlike in animation where the students are passive learners watching animated objects.

Conclusion

Computer based technologies are today deployed to all aspects of human endeavors and the classroom is not left behind. Computer simulations and animations have emerged as a result of the advancement in computer technologies and gradually becoming an important part of today's classroom. However, the efficacy of these tools in helping students learn depends largely on how much it stimulates the interest of the students to learn. This study has found out that computer simulation technique improved students' interest in automechanics than animation. As many tools of the digital age such as video tutorials, animations and so on are finding their way into the classroom, these results have shown that computer simulation helps student achieve more in automechanics than animation because it provides a more interactive and engaging learning environment for teachers and learners.

Recommendations

1. Computer simulation should be adopted for teaching of automechanics in the Technical Colleges.
2. The curriculum specification for the Technical Colleges should include the use of simulation for teaching of other skill based modules aside from automechanics.
3. The government should support and encourage the development of computer based simulation for teaching other vocational subjects.

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RESTRUCTURING VOCATIONAL AND TECHNICAL EDUCATION FOR ECONOMIC RECOVERY AND NATIONAL DEVELOPMENT

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Abstract: The National Policy on Education document in Nigeria attaches great importance to Vocational and Technical Education having seen it as the prime mover for achieving the desired technological and economic development in Nigeria. Built on this premise, this paper examines the above topic by: defining Technical and Vocational Education; stating the aims and objectives of Vocational and Technical Education; concept of National Development; Role Vocational and Technical Education plays in National Development; and how its restructuring can assist in economic recovery and national development. It concludes by briefly examining the challenges that still faces Vocational and Technical Education in Nigeria and then gives salient recommendations.

Keywords: *Restructuring, Vocational and Technical Education, Economic Recovery, National Development*

Introduction

To re-structure is to organize a thing, an organization or a system in a new and different way or manner. Thus, to restructure vocational and technical education for economic recovery and National development entails taking new measures or methods in manipulating vocational and technical education such that it could assist in very meaningful ways the economic recovery and development of the nation. There is the popular reasoning that the development of any country is directly proportional to the educational attainment of her people. It is also widely believed globally that Technical and Vocational Education have become tools for empowering people, especially the youths for sustainable livehood and socio-economic development. This statement is supported by Yusuff and Soyemi, (2012) who opined that UNESCO and ILO recommendations of 2000 defined Technical and Vocational Education Training as the aspects of education process which involves general education, the study of technologies and related sciences and the acquisition of practical skills, attitudes, understanding and knowledge related to occupations in different sectors of economic and social life. This singular view of vocational and technical education simply covers the work that is being examined in this paper.

Definition of technical and vocational education

Various definitions of Technical and Vocational Education have been given by different scholars. Okoro (1999) saw it as experiences, organized or unorganized in which individuals learn to carry on successfully any useful occupations. It means that it is education that helps an individual to work and prepare for a living. Masaruf (2015) in his own view saw Vocational Education as the education that develops human abilities as regards knowledge, skills, understanding that would effectively assist the recipients in the chosen jobs. In other words, it is a tool that develops skills, abilities, understanding attitudes, work habits and appreciation that covers knowledge and information needed by the workers to get employed and progress in their work places. These definitions will hang on the fact that having the knowledge of Vocational Technical Education has great links with acquiring skills, abilities, attitudes, habits, understanding and effective livelihood. Ovbiagde (2015) saw Technical Education as the aspect of education which assists in the acquisition of practical and applied skills which assists in the acquisition of practical skills with basic scientific knowledge for recipients empowered to transform a country in a technical world of work. Osayomuanbor and Edokpayi (2008) saw Vocational Technical Education as the education that assists in equipping individuals for employment in specified occupations or trades. Oluwalola (2008) also was of the opinion that Technical and Vocational Technical Education is acquired by individuals to prepare for the world of work. It is glaring here that Technical and Vocational Education prepares individuals for the world of work or employment.

Other definitions of Technical and Vocational Education emphasize that it helps one to be productive and self-dependent. In support of this, Abdulrahaman (2013) opined that Vocational and Technical Education is the type of education that equips people with practical skills that would effect changes within their society and live independent lives. To top these definitions is the definition by the current Nigeria National Policy on Education (Federal Republic of Nigeria, 2004) which stated that it is a type of education that comprehensively involves general education, study of technology and the acquisition of practical skills, attitudes, understanding and knowledge related to jobs in different segments of economic and social life. This education should therefore, be geared towards having productive citizens who would end up being majorly job creators.

Aims and objectives of vocational and technical education

Having noted the different definitions of Vocational Technical Education, I wish in this section, to take a close look at the goals or aims and objectives of Technical and Vocational Education in Nigeria. The National Policy on Education (Federal Republic of Nigeria, 2004) outlines Nigeria's aims and objectives for Vocational and Technical Education as:

i. To provide trained manpower in the applied science and technology and business, particularly at craft, advanced craft and technical level.
ii. To provide the technical knowledge and vocational skills necessary for Agriculture, Commerce and Economic development.
iii. To give training and impact the necessary skills to individuals who shall be self-reliant economically.

These aims and objectives if well noted, have given Vocational and Technical Education the sole role of a tool that can be employed to assist in economic recovery and national development. To restructure Technical and Vocational Education, then, would go a long way in assisting the nation recover from economic disgrace as well as get rapidly developed. Nigeria's ecpnomy revolves around Vocational and Technical Education as long as the current socio-economic, scientific and technological development of Nigeria is concerned. Impliedly, restructuring the educational system at all levels to respond effectively to the challenges and managing the impact of the information age, and in particular, the allocation of development fund to education at all levels.

Concept of national development

Mundi (2008) saw National Development as a socio-economic process that seeks to reach a more equitable distribution of resources and income within the society. National development could also be perceived as the transformation that happens to a community socially, economically, politically, educationally, orderly and materially such that these lead to improvement of the quality of lives of the people. Ohagwu (2010) is of the view that development has to do with the choice of goals for attaining human potentials. Adebisi (2016) saw development as encompassing attempts to improve the conditions of human livelihood in all ramifications. This means there would be improvement in material well-being of all shades of people, whether poor, rich, powerful, weak or disabled. While Adenle and Olukayo (2007) saw development as any position changes, which bring about desirable benefits to the individuals and the society. Hence, development in human society as complex, which means different situations to different thinkers. It could refer to development of infrastructures such as roads, hospitals, airports, dams, schools, as well as development of the people in the area of education, health-care, sports and others. Thus, the definitions of National development has also brought us close to what Vocational and Technical Education has capacity of doing, bringing transformation to human beings of all categories in a given nation. To support this Ovbiagde (2015) expressed that Vocational Education serves as a gateway to real growth and development of Nigeria as a nation. In other words, with proper handling or restructuring of vocational education, national development and economic recovery can be enhanced in the nation. And if Vocational and Technical Education is restructured in the country, it can bring about the sort of development which Olukayo (2007) and others described in the aforementioned paragraphs.

Role of vocational and technical education in national development

It is quite pertinent to discuss here too, the role Vocational and Technical Education plays in National Development as seen from different perspectives of various scholars. Abdurahaman (2013) gives the following as the vital role played by Vocational and Technical Education in National Development:

1. It generates employment or gives birth to the creation of job opportunities. It would be employed to develop marketable skills in students/youths so as to easily get them employed.
2. It assists in industrial development. Technical and vocational education has the capacity to assist a nation develop industrially and technologically. It will produce graduates equipped to develop and utilize technologies that would develop the nation industrially and economically.
3. Technical and Vocational Education plays the role of producing entrepreneurs who would become self-reliant, job creators and employers of labour.
4. Another role Technical and Vocational Education plays is to eradicate poverty in a nation. Skills acquired through Technical and Vocational Education could be put to use in time of employment crises. If all citizens of a nation have this education, all would be gainfully engaged and poverty would be driven away.
5. Technical and Vocational Education also plays the role of promoting Nigerian economy through foreign exchange by exporting our locally made products. With the knowledge of Technical and Vocational Education, the recipients could convert the local raw materials to finished products that could then be exported.
6. Technical and Vocational Education promotes Nigerian culture and values. Aso-oke work in Okene and other south western parts of Nigeria has become work appreciated nationally and internationally.

Thus, looking critically at the roles Technical and Vocational Education play in the foregone paragraphs, it is clear that with its right direction and focus in the country, it can lead greatly to economic recovery and national development in Nigeria. This view is rightly supported by Yusuff and Soyemi, (2012) who stated that repositioning or restructuring Technical and Vocational Education as best as we can, can improve economic opportunities for the teaming unemployed youths as well as enhance economic development of Nigeria.Two vital roles of Technical and Vocational Education on National development can be identified as:

1. It assists in enterprise productivity and profitability as well as for national productivity and wealth creation. National enterprise and growth go along with technical skills.
2. It assists in individual prosperity. The individuals who have acquired technical and vocational education are enabled to increase productivity and income, thus developing the nation economically.

Role of restructuring of technical education in economic recovery and national development

Vocational and Technical Education has been an integral part of national economy development. Van Ark (1992) cited the Dutchs school system as paying attention to high standards in Mathematics and the provision of technical education at ages 14-16 for a third all pupils and widespread vocational education at 16+. If Nigerians could follow suit, giving Vocational and Technical Education the attention they deserve, graduates of such educational experience would contribute greatly and positively to improve the nation's economy. Asogwa and Diogwu (2007) support this view by stating that there is the urgent need for people's attention to be re-directed towards self-reliant and sustainable means of livelihood provided by Vocational and Technical Education. Presently, Nigeria offers education in general subjects, but in order to attain economic recovery and national development, it must offer a variety of courses for disciplines in technical, vocational, professional and agricultural, so as to have a balanced distribution of manpower for all

professions (Alam, 2003, 2007). This too is a measure meant at restructuring Technical and Vocational Education to contribute to the economic growth as they participate in different professions. Technical and Vocational Education could be restructured to adequately provide unique experiences such as research design and actual construction of projects, practicing problem solving with materials and gaining information on the world of work places in line with global standard and challenges. The course should be made to teach occupational clusters, general conceptual knowledge, foster acceptability, build technical and literacy and provide leisure skills via experience. With this the nation would have more people in the work force and productivity would lead to economic growth and national development.

In addition, Technical and Vocational Education can be restructured to assist in economic recovery and national development if the education is geared towards empowerment, job creation and self-reliant of Nigerian citizens. The course should be made to teach a variety of sellable useful skills, imbibing good maintenance culture for a few machines or tools available, thus, leading to technological as well as national development. Furthermore, according to UNESCO Nigeria TVE, (2008) these efforts were made. The Federal government through the National Board for Technical Education in 2000 and 2007 signed an Aide Memoire with UNESCO for the development of new curricula, e-books and training manual for use in polytechnics, monotechnics and other specialized institutions. To this effect, the NBTE had produced 200 new curricula for National Diploma (ND), Higher National Diploma (HND), Post Higher National Diploma (PHND) programmes offered in polytechnics, monotechnics and Colleges of Technology. The board too has produced 20 new curricula for ND programmes offered in innovation enterprise institutions and developed 356 e-books. These were all meant for restructuring of Technical Education for sustainable national development. To widen access to Technical and Vocational Education and encourage private participation in skills training, the Federal Ministry of Education approved the establishment of private sector-led vocational enterprise institutions and innovation enterprise institutions.

Finally, the Federal Government released N15bn Trust fund for the supply and institution of science laboratory and workshop equipments in 51 beneficiary polytechnics and monotechnics, the $42 million five – years Technical and Vocational Education Training Project for upgrading of 10 Technical and Vocational Training Institutions and re-structuring the present supply – driven Technical Vocational Education Training into demand-driven system that responds to the needs of private sector financed by the Federal Ministry of Education African development bank, the establishment of 6 additional staff development centres in six –geo-political zones of the country for polytechnic staff development. The centres were as follows:

i. South-South-Delta State Polytechnic, Otefe, Ogharra
ii. South-East- Akanu Ibiam Federal Polytechnic, Unwara
iii. South-West-Federal Polytechnic, Ilaro
iv. North-East-Federal Polytechnic, Damaturu
v. North-West-Kano State Polytechnic
vi. North-Central-Federal Polytechnic, Idah (UNESCO-Nigeria TVE, 2008)

Challenges

Despite the vast potentials inherent in programs championed by the government on how Vocational and Technical Education could be enhanced to assist in economic recovery and national development of the nation, there are still some challenges yet to be surmounted. These challenges, according to Yusuff, and Soyemi, (2012) are these:

1. Negative perception of Technical and Vocational Education as a career path for less academically endowed.
2. Discrimination against graduates of Technical institution.
3. Lack of linkage between formal and non-formal Technical and Vocational Education Training.
4. Poor implementation of Staff Development Training policy.

5. Insufficient laboratory and workshop equipment .
6. Low enrolment in technical schools.
7. Issue of partnership between training institutions and industries.
8. Low Quality Training.
9. Mismatch between training and labour market skills demand.
10. Inadequate Financing

Conclusion

Restructuring Vocational and Technical Education for the purpose of economic recovery and national development entail a lot of things as discussed thus far. Serious challenges still faced by Vocational and Technical Education in Nigeria linger on despite all efforts put in place to restructure it such that it could serve effectively the purpose it is created for. The quality of training for Technical and Vocational Education students is low and emphasis is unduely placed on theory and certification rather than skills acquisition and proficiency tests. As a result of training received not rhyming with what labour market skills demand, graduates of Technical and Vocational Education especially from formal school system, face unemployment. Furthermore, there is no collaboration between the training institutions and the industries. With the report given by UNESCO and Nigeria TVE, 2008, it could be seen that there have been a restructuring of Technical and Vocational Education to assist in meeting the current technological trends in the country and the world at large. And these are very much likely to improve the nation's economy and lead to national development. Restructuring the educational system at all levels paves way to effectively to the challenges and managing the impact of the information age, and in particular, the allocation of development fund to education at all levels.

Recommendations

The following recommendations are however given to further assist those interested in this subject matter to take greater leaps into making the restructuring more realistic and attainable in securing economic recovery and national development for the nation:

1. Government should introduce and maintain sustainable financial scheme for Technical and Vocational Education. Trainees of this course in higher institutions should be assisted in terms of grants, sponsorship and loan, considering the costly nature of the course.
2. There should be a strong linkage and collaboration between Technical and Vocational Education Training Institutions and the industries. This will provide ample opportunities for Technical and Vocational Educators to regularly update their work place experiences and develop curricula relevant to employees needs.
3. There should be enforcement of good staff development training programme in staff development centres where staff could be made to develop and improve themselves regularly.
4. Technical and Vocational Education as a subject should be made compulsory and not elective at all levels of learning.
5. Adequate and modern facilities should be provided in our schools, colleges, polytechnics / monotechnics and Universities. Equipment and facilities for training technology students should be the replica of what is obtainable in the industries.
6. Adequate and qualified staff should be made available at all levels. Competitive salaries and other incentives could be made available to attract staff. And these staff should be upgraded regularly through the provision of workshops, seminars and conferences.
7. Policies on Technical and Vocational Education should be left in the hands of specialists who would formulate as well as implement the policies.

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GREENING THE ENVIRONMENT FOR SUSTAINABLE ECONOMIC DEVELOPMENT

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Abstract: *The paper highlighted what it will take to "green the environment" for sustainable economic development. It provided insights to the concepts of "green technology, green TVET, green economy, green jobs and sustainability. It opined that it is only when the above attributes are addressed, that one can make bold to say the above objective is in sight. However, the human elements which is significantly central to achieving the above goals must be taken into perspective, meaning that individuals must pragmatically begin to missionalize green, vissionalize green, think green and act green; for the above goals to be achievable. in so doing our economy will blossom, our natural resources is conserved, our technology will be transformed, workplaces clean and green and our environment clean and healthy.*

Keywords: *Greening Environment, Sustainability, Economic Development*

Introduction

The major challenge globally is to find ways of living and working sustainably, so that reasonable needs and wants of people from all walks of life and in all countries can be satisfied without over-exploiting the natural resources upon which all life depends that the ability of future generations to meet their needs and wants is threatened. Also, changes in physical environment such as global warning, changing weather patterns, floods, draught, rising sea levels and scarcity of natural resources require adaptation measures. These changes are being felt all over the world especially where sustainable development is compromised. Sustainable development can be seen as development which meets the needs of present generation without compromising the ability of future generation to meet their own needs. To make sure that our focus towards ameliorate the above challenges, a green technological transformation is needed.

What is greening the environment?

Greening the Environment connotes green economy, green technologies, green TVET, green jobs – green ideas which seems to have an important effect on a variety of political, Social and Ecological processes (UNESCO UNEVOC, 2012). Green economy is defined as activities which produce goods and services to measure, prevent, limit, minimize or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-system. This includes technologies, products and services that reduce environmental risk and minimize pollution and resources (OECD, 1999).

Green Technology (GT) concepts

Green Technology (GT) aspires to tackle the challenges of; encouraging development and poverty reduction, creating vibrant economies based on clean technologies and securing an increasingly greener world. Globally, cities account for about 70% of CO_2 omissions, which comprise a significant share of global greenhouse gas emissions, the bulk of these being generated in the building and construction, Urban transportation and energy sectors (Jahunga, Ngore & Muramba, 2015). GT is a method of practical application from environment science to conserve the natural environment and resources in harmony with Mother Nature and ecology. It intends any economy without harming the environment. It is a new development paradigm that creates new growth engines. These green transformations in the economy, also known as greening the economy will ultimately affects skill needs and consequently the training needs. According to Johunga etal, (2015), GT is a friendly solution aims at reducing environmental damage created by products and technologies for human conveniences. It promises to increase farm profitability while reducing environmental degradation and conserving natural resources, provide cheap renewable energy from wind, sun and tides and waves, bio-gas and bio-fuels. Such applications are used to minimize environmental exploitation and degradation.

Greening of TVET concepts

Greening TVET basically involves new green knowledge' to provide basis and new 'green methods' for developing new competencies in TVET. Greening TVET on one hand, can be seen as issue that cross all sectors, occupation, qualifications, and training. On the other hand, greening TVET is more important in some sectors than in others. These include renewable energy and energy efficiency at the household and industrial levels (energy supply, electricity generation), recycling, agriculture, forestry, building and construction, transportation, and basic industry (including iron, steel, alluminium, cement, pulp and paper production).

Greening TVET curricular and Training methods also has consequences for the TVET teacher training New education programmes need to be designed or the old ones need to be adapted to focus on strengthening to learn, on developing emotional, social, and spiritual intelligence, and on strengthening competencies to understand and exercise collective learning. According to Majumdar (2010), greening TVET will not be a bed of roses, and the process will not be easy. According to him, greening strategies need to consider the conflict that may arise because green innovations will disrupt existing work processes and economic interests. TVET Planners, teachers and trainers need to be aware of these possible difficulties. Existing structures could also pose problems because they are not ready for new developments. Also, problems may come from existing deficiencies in TVET system, programmes that do not match work and job system, outdated materials and methods, lack of awareness of new innovations regarding greening TVET issues, missing links or lack of communications between green TVET and technical experts and shortage of experts in the greening TVET chain. In all, greening TVET indicates hope, growth and prosperity for the future. At the moment, however, greening TVET must be seen as a basic idea for an essential process and should be embraced by all.

Sustainable development concepts

Sustainable Development connotes, finding approaches to development that balance economic and social progress, address cultural differences, conform to global, national and local needs, and respect ecological values and limits etc are key to sustainable development, (UNESCO, 1997). To appreciate what sustainable development is, one must take into consideration, the varying nature/conditions that exist among nations globally. Thus sustainable development is not a fixed concept, rather it is a culturally directed search for a dynamic balance in the relationship between social, economic and natural systems, a balance that seek to promote equity between the present and future, and equity between countries, races, social classes and gender. The interdependence of people and the environment requires that no single development environmental objective should be pursued to the detriment of others. The environment cannot be protected in a way that it leaves half of humanity in poverty. Likewise, there cannot be long term development on a depleted Appropriate sustainable strategies must be developed and evolve for both rich and poor nations. planet. Appropriate sustainable strategies must be developed and evolve for both rich and poor nations. Thus, the above makes sustainable development more of a moral precept than a scientific concept, and links it as much with notions of peace, human rights, and fairness as it does with theories of ecology, or global warming. Indeed, while sustainable development involves the natural sciences, policy and economics, it is primarily a matter of culture. It is concern with the values people cherish and with the ways in which we perceive our relationship with others and with natural world (UNESCO, 2012)

TVET and sustainable development concepts

TVET is a complex and distinctive character with regard to sustainable development. This is because, both directly and Indirectly – TVET produces and consumes resources, as well as affects attitudes towards sustainability held by future workers in all nations. TVET has always included elements of sustainability especially, in the way scarce training materials were conserved and waste materials were dispose. This historical commitment gives TVET a foundation upon which to build future commitments to sustainable practices.The manner in which production and consumption

are managed can either contribute to sustainability or to practices and conditions that are not sustainable. During classroom interventions (education and training), the greater the exposure of trainees to sustainable concepts, practices and examples, the more likely the desired workplace culture change will take place in future. Moreover, the delivery of sustainable practices must universal; that is, encompassing not only per-service TVET, but also on the job learning and worker upgrading and retraining (Salim, 2002). As both a consumer and producer of resources, or more accurately, a sector involved in transformation of resources, TVET has multiple concerns about sustainability. The over exploitation of natural resources, ill-health and grinding poverty can threaten the ability of future generations to satisfy their needs and wants.

The challenge for TVET is therefore, to re-orient and re-direct the curricular to avail students and trainees with respect for the conservation and sustainable use of resources, social equity and appropriate development competences to imbibe sustainable tasks at the workplace of today and tomorrow. These will in-turn, produce responsible citizens who give consideration to preserving the environment and the welfare of others, (UNESCO, 1999). Application of Sustainability to TVET implies that their economic and social trends suggest that the education and training of workers must promote an understanding of sustainability for the stewardship of resources, the environment, and health to become more effective. Trends in the productive and service sectors suggest that both basic and portable skills and competences will be sustainable in the long-term for job shifts and technological changes. In summary, sustainability in TVET involves the renewal of individual skills, labour market skill requirements and the transformation of the world of work.

TVET and economic sustainability concepts

Unfortunately, TVET in many countries remains locked into the role of being a supplier of skilled labour to industry, and is thereby, unable to respond effectively to the needs of the emerging information age. Anderson, (2000) attributes this to the culture of ''productivisim'' in TVET'' which presupposes that economic growth is permanent and necessary feature of human existence, regardless of its environment impact and consequences, (Anderson, 2000). Giving precedence to economic interests, production can subordinate the needs of individual learners to those of industry and priorities ''work and employ ability''over the non-economic outcomes of TVET. This has resulted in TVET been seen as 'training for growth' and 'skills – for-work', two goals for TVET that are architectical to the needs of the Information Age and that TVET also needs to serve. Nevertheless, the economic aspects of sustainability are very important as they look to TVET system, institutions and instructors, to ensure that individuals have developed a different, wider, set of economically-related knowledge, skills and attitudes. These include, but not limited, to:

- Economic literacy,
- Sustainable Production,
- Sustainable Consumption and,
- Managing small and medium scale enterprises.

Inputs to greening the environment for sustainable economic development

The key to greening the environment is addressing all issues pertaining to:

- Green Technology
- Greening TVET
- Greening Jobs
- Greening the Industries
- Greening Productions, and
- Greening the economy; not forgetting the human elements that must
- Missionalize green
- Vissionalize green
- Think green, and
- Act green.

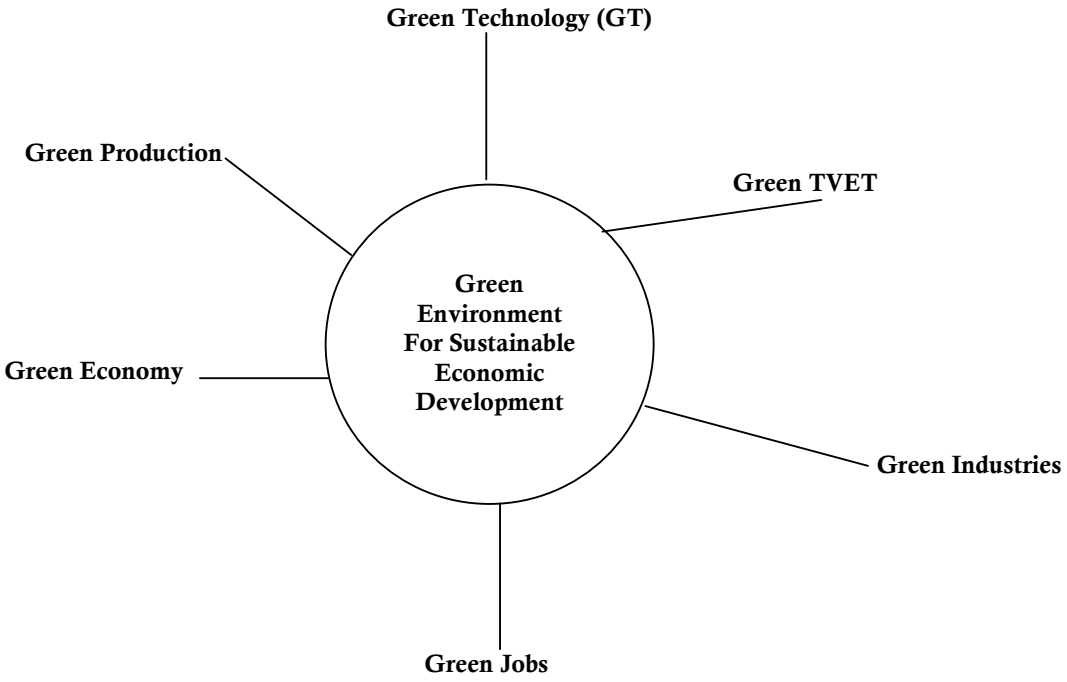


Fig.1: Inputs **for Greening the Environment for Sustainable Economic development**

Conclusion

Certainly, this paper has aroused the consciousness of many towards ''greening the environment for sustainable economic development and my believe is that the discussions this will continue. The diagram coined ''Inputs to greening the environment for sustainable economic development'' presented below, conceptualize what it takes to green the sustainable economic development.

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SUB-THEME 2

FUNDING TVET FOR SUSTAINABLE ENVIRONMENTAL PROTECTION

FUNDING TECHNICAL VOCATIONAL EDUCATION AND TRAINING FOR ENVIROMENTAL SUSTAINABILITY

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Abstract: *This paper examines the funding Technical Vocational Education and Training (TVET) and its impact on environmental sustainability. Technical Vocational Education and Training (TVET) faces huge demands globally due to the high level of unemployment and the quest for technological development, industrialization and economic growth. For TVET to achieve its objectives of enabling leaners to catch up with the ever-changing living standard in a fast growing technological world and creating jobs for sustainable living, it must be strengthened through alternative sources of funding because government cannot singlehandedly shoulder this enormous task. It is with this understanding that this paper examined the need for adequate alternative funding for TVET for environmental sustainability. It looked the effect of climate change on the socio-economic lives of Nigerians. The paper recommends that to alleviate the socio-economic lives of the citizens caused by climate change, government should embark on a rigorous form of TVET programme that would engage all categories of people for sustainable growth and development of the nation.*

Keywords: *Climate Change, Environmental Sustainability, Socio-Economy, Funding TVET, Job Creation*

Introduction

The amazing world in which we live has huge variety and richness. However, humans are increasingly damaging what God has created. Our actions as a result of technological development, industrial pollution and increasing consumption are causing environmental degradation and climate change. The climate naturally changes over time, but in recent years climate change has accelerated and the world's leading scientists now agree that this is caused by human activity such as the use of fossil fuels and deforestation. Climate change is affecting weather patterns, by increasing global temperatures, causing erratic rainfall distribution, raising sea levels and intensifying cyclones. Environmental degradation has a huge impact on the lives of poor people because they depend more directly than the wealthy on resources from the natural environment. The effects of climate change are already being felt most in poor countries, due to their geographical location and lack of capacity to cope. Excessive consumption and large unregulated industries certainly have a negative impact on the environment. However, there is also a need for development organizations to respond effectively and to ensure that their own work does not negatively impact the environment.

Technical Vocational Education and Training (TVET) is globally recognized for its role in preparing people for dynamic engagement in occupations of functional value and effective source of skilled workforce. TVET is essential because it creates job for sustainable living and provides training that individuals require to catch up with the dynamic and ever-changing living standard in a fast growing technological world. TVET is a training that any nation requires to foster its socio-economic development. The UNESCO and ILO intervention with relevant recommendations has in recent times compelled thorough-going reforms globally towards revamping TVET for sustainable skill development. What countries need mostly is how to successfully enforce implementation of their policy initiatives to make TVET effective through skill development towards reducing unemployment. This requires revamping TVET through rigorous and realistic alternative sources of funding, making huge investment, showing repeated commitment to the cause of TVET and for TVET to gain proper public image. This paper examined the funding of TVET for effective environmental sustainability

The term 'environment' is used to describe our surroundings – both the natural physical surroundings such as the land, water, climate, plants and animals that we can see, and the places in which we live with their social, cultural, economic and spiritual dynamics (usually called the

human environment). People depend on the natural environment for survival. Our food, medicines, shelter, fuels and clothing are all sourced from it. For example, a farmer's crop relies on adequate water, sunshine, fertile soil, unpolluted air and soil, and balanced insect life and micro-organisms. Without any one of these, the crop is threatened and the farmer may not have enough food to feed the family or to sell in the market. People in urban areas also depend on the environment but perhaps in a less direct way. Their food may come indirectly through markets and shops. They usually buy rather than collect fuel for cooking. Manufactured products rely on the environment for:

(1) *Raw Materials* – such as wood or plant fibres.

(2) *Energy* – usually from fossil fuels such as oil or diesel, to work the machinery.

(3) *Water* – factories often use a lot of water for manufacturing processes.

(4) *Transport* – over land by road and rail, across oceans or along rivers to customers.

Human interaction with the environment often has a negative impact. Sometimes poor management of one resource leads to other environmental problems. For example, over-exploitation of forest reserves increases deforestation which can lead to landslides, flooding and soil erosion. There could be a loss of biodiversity or soil fertility if the cleared land is not managed properly.

Poverty and the environment

Since the industrial revolution in Europe in the 19th century, human economic activity has consumed resources at a faster rate than the earth can replenish them, causing damage to ecosystems, decreased biodiversity, and climate change. The ongoing desire to become wealthier and consume more has meant that people have used the environment for their own benefit without considering the negative effects. For example

(1) Land is being farmed too intensively, which can result in lower crop yields, loss of soil nutrients and increased desertification.

(2) High demand for water is drying up many rivers and lakes.

(3) Industry is causing pollution. This includes liquid waste (often disposed untreated into rivers and oceans, affecting marine life), solid waste and air pollution (which can change climates locally and globally).

According to the United Nations Development Programme (UNDP), the richest two per cent of the world's adults own more than half of global household wealth, while the poorest 50 per cent of adults own only one per cent. The rich have benefited the most from global economic growth; poor people have generally benefited much less. Much of the environmental damage that has been caused by humans has been to serve the consumption of wealthy people. They usually have an indirect relationship with the environment, and so rarely see the damage they are causing. They are therefore likely to continue with their high consumption.Many poor people in the South have a direct relationship with the environment. They often rely directly on natural resources to meet their basic needs through agricultural production, fishing and the gathering of resources such as water, firewood, and wild plants for consumption and medicine. Poor people's health suffers most when the environment is degraded, such as through water, air or land pollution. Many poor people are forced to live in areas that are environmentally fragile, such as on steep slopes or flood plains, making them more vulnerable to climatic hazards. Poor people are also particularly vulnerable to the losses that result from environmental damage (such as crop failure due to drought or flooding) and may not have the resources to adapt to a changing environment. Poor people may be forced to exploit the environment, not usually through ignorance but in order for their families to survive. Although they may be aware of the damage they are doing, their immediate need for survival takes priority over long-term environmental sustainability. They usually lack access to information and technology to help them to reduce that damage.

Climate change is an urgent and global issue, but environmental degradation also has an impact locally and globally, including changing rainfall patterns and reducing the ability of the soil to hold water. Understanding these pressures is key to helping people to conserve and, where possible, enhance environmental resources and restore environmental damage.Coastal erosion in HondurasThe removal of vegetation along the shoreline of a thin strip of land in Honduras, for use as firewood and to clear spaces for houses and other purposes, has led to significant soil erosion. Homes, infrastructure and livelihoods are being lost as a result. Water supplies are affected, which is impacting people's health. Although this environmental degradation has long been recognized, it was not until community participatory tools were used that the nature and scale of the threat was clearly defined. Small groups of neighbours have since been replanting mangroves to protect the shore from further erosion. MOPAWI, Tearfund partner in Honduras

Sustainable development

Our dependence on a sustainable environment has been the focus of a number of international gatherings. In 1982 the World Commission on Environment and Development was established to look at the links between economic development and the environment. The report that was produced defined 'sustainable development' as, 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The 1992 Rio Earth Summit, as it became known, was the largest ever gathering of heads of government to discuss environmental issues. It resulted in historic agreements about a number of key principles related to sustainable development that have helped shape policies and practice over the last two decades:

(1) Economic development and environmental protection should be integrated.

(2) There should be more equity within countries and between rich and poor countries.

(3) Scientific and technical knowledge related to sustainable development should be improved.

(4) Governments should protect citizens from environmental problems.

(5) The polluter should pay to restore damage caused to the environment.

(6) Environmental impact studies should be carried out before undertaking projects that are likely to have negative environmental consequences.

(7) Recognise the particular roles of:

i. women who often play a vital role in environmental management and development;

ii. young people, so that the needs of future generations can be met; and

iii. indigenous people, due to their knowledge and traditional practices related to environmental management. Since the Rio Earth Summit, a number of agreements and plans related to sustainable development have been made at international level. For example:

(a) Agenda 21 is a plan of action to take forward the commitment to the Rio principles.

(b) Millennium Development Goal 7, Target 9 is to ensure that principles of sustainable development are integrated into country policies and programmes to reverse the loss of environmental resources.

(c) The United Nations Framework Convention on Climate Change aims to prevent dangerous climate change. The above agreements indicate good progress in many areas on paper and in discussion, including a greater understanding of the importance of sustainable development. However, despite these international agreements, exploitation of the world's resources continues, mostly due to the demands of consumers in the North, increasingly at the expense of people in the South.

Our environmental footprint

Stewardship of God's earth should be considered within all areas of our work and life. We all have an influence on our environment. Often this is a negative influence, using up resources or causing pollution, but we can also take actions to ensure that our way of life has a positive impact on the environment. Most things we do in life involve inter action with the environment, whether directly or indirectly. For example, providing a meal requires energy to grow the food and cook it. Catching a bus or driving a vehicle results in air pollution. When we walk through mud, we leave footprints behind. As we walk through life, we leave behind a mark on the environment, and environmental footprint. Some of us are like elephants, trampling down the vegetation and leaving a trail of damage behind in terms of our consumption, pollution and use of energy. Others are like antelopes, walking delicately and lightly, leaving behind a trail that can hardly be seen. This footprint can cause environmental degradation. It has consequences for other people. Climate change is a key example. Our use of fossil fuels and deforestation is causing climate change which has negative consequences for people all around the world, but it is poor people who are suffering the most. We now look at two key environmental resources – water and forests. We then look at the issue of climate change – its causes, impacts and our responses. This will build a foundation for the following sections.

Human lives are directly linked to the climate. Therefore, there is no gainsaying that human activities are changing the climate. Climate change of course has great impact on the ecosystems. There has been a continuous rise in global temperature in the last 130 years, which has huge consequences on a wide-range of climate related factors. It is evident that carbon dioxide (CO_2) and Methane are being dumped in the atmosphere at an alarming rate as a result of the advent of industrial revolution. There are oil spillages and gas flaring all over the environment. Fossil fuels burning and deforestation which produce greenhouse gases are on the increase. This phenomenon is called greenhouse effect. Greenhouse gases act like blanket around the earth, wrapping energy into the atmosphere. This is the cause of the earth warming. As such our earth's average temperature has risen by 1.4°F over the past century, and is projected to rise to another 2 to 11.5 °F over the next hundred years. (www.epa.gov/climatechange/basics). This rise in temperature of the planet can bring about ice caps melting, sea levels rising and other environmental challenges. The buildup of greenhouse gases can change earth's climate and result in dangerous effects to human health, safety, welfare and to the ecosystems. There are distortions and pollutions in our water supplies, agriculture, weather, seasons, power, transportation system, and so on. However, it is important to state that, some changes in the climate are unavoidable; carbon dioxide can stay in the atmosphere for nearly a century. As such, the earth will continue warming, and the warmer it becomes, the greater the risk for more adverse changes to the climate and the Earth's system. Even though it is difficult to predict or forecast the impact of climate change, yet, what is certain is that the climate we are used to is no longer a reliable guide for what to expect in future. In view of the adverse effects of certain human activities, that cause earth warming and climate change, it is important that we begin to make choices that will reduce greenhouse gas pollution, and the best way out of this is to get ourselves and the younger generations educated through technical and vocational education and training, TVET. The National Policy on education of the Federal Republic of Nigeria FRN, (2004), does not have any provision for the teaching of climate and environmental education. Nigeria is not the only country of the world that has this deficiency in her educational system. Several other countries in Africa have not made provision for this form of education. The western world is not left out. It is in the light of this, that this paper is billed to discuss the causes of climate and environmental changes and the need for environmental-friendly education policy in Nigeria through the following sub-headings;

i. The concepts of climate, environment, climate and environmental changes;
ii. Causes of climate and environmental changes;
iii. The need for education policy on climate and environmental education;
iv. Problems of teaching climate and environmental education;
v. Suggested policy statements on climate and environmental education

The concepts of climate, environment, climate and environmental changes

Climate is the average weather condition of a place over a long period of time, usually about or even over 30 years. Climate is the average weather usually taken over a 30-years period for a particular region and time (http://www.classzone.com/books/earth_science). It is a large-scale, long-term shift in the planet's weather patterns or average weather condition (http://www.metoffice.gov.uk>Home>public>climate). To ascertain the climatic condition of a place, there is always a systematic observation, recording and processing of the climatic elements such as temperature, rainfall, atmosphere, pressure, humidity, wind, sunshine and clouds. Climate differs from weather in that, weather reflects short-term condition of the atmosphere while climate is the average daily weather for an extended period of time (www.noaa.gov>Home>ocean>facts). The climatic elements are normally observed and measured over a period of time by weather instruments. Based on the data collected, maps and charts are prepared. Through these charts and maps, one can easily observe certain changes that may have occurred over a period of time. Environment in the view of Ajayi (1998) is the total surrounding of an organism in a given area including the physical and non-physical surroundings. Kwan, Lam and Ofoefuna (2011) see environments as the conditions of an organism's surroundings. Onuoha (2012) defined an environment as a set of conditions and forces which surround and have direct influence on the organization/organism. The Oxford Advanced Learners Dictionary defines environment as the conditions that affect the behaviour of somebody or something and/or the physical conditions that somebody or something exists in the natural world in which animals and plants live. It therefore implies that environment is made up of all the physical visible and microscopic matters that affect the existence of organisms positively or negatively and an organism does not exist in isolation. It must co-exist with other matters. There are five divisions of the sphere of an environment according to Ajayi (1988). These are:

1. ***The atmosphere:*** made up of the troposphere and stratosphere. The atmosphere consists of 78% nitrogen, 21% oxygen and 0.003% carbon dioxide and water vapour as the most valuable component. This sphere is seen as very important because it aids biotic activities.
2. ***The stratosphere;*** which also is known as the ozone layer absorbs ultra-violet radiation. So, when such radiation is prevented by the ozone layer from reaching the earth's surface in high intensity, many organisms (plants and animals) are relieved.
3. ***The Hydrosphere:*** this is the world of water existing in form of water, lakes and oceans.
4. ***The Biosphere:*** is the part of environment which is known as the active part of the earth where plants and animals inhabit. It is made up of Aquatic and terrestrial bicycles. The aquatic bicycles contain fresh and salt water, while the terrestrial bicycle is zone where certain life forms can exist outside water.
5. ***The lithosphere:*** is the part of environment which contains rocks, sediments and soil minerals. Supporting this view (www.the-guardian.com/environment/2015jan/29/British.belief.) argued that scientists generally define the five components of earth's climate system to include – atmosphere, hydrosphere, cry sphere, lithosphere (restricted to the surface soils, rocks and sediments) and biosphere. Natural changes in the climate system result in internal climate variation e.g. include the typical distribution of species and changes as ocean currents.

Climate and Environmental changes

Climate change refers to a long change in the average weather pattern over a specific region/and a significant period of time. It is also seen as a change in the statistical distribution of weather patterns when that change lasts for an extended period of time (i.e. decades to millions of years). The most general definition of climate change is a change in the statistical properties of the climate system when considered over long period of time (www.en.m.wikipedia.org/w). As such, fluctuations over periods shorter than few decades, such as El Nino do not represent climate change. The term sometimes is used to refer to climate change caused by human activity as

opposed to change in climate that may have resulted as part of Earth's natural processes (www.en.m.wikipedia.org/w). In this sense especially in the context of environmental policy the term climate change has become synonymous with anthropogenic global warming'' (www.en.m.wikipedia.org/w). Some scientific journals are of the opinion that global warming refers to surface temperature increases while climate change includes global warming and everything else that increasing greenhouse gas levels will affect'' climate change is also seen as a change in global or regional climate patterns, in particular, a change apparently from the mid to late 20th century onwards and attributed largely to the increased level of atmospheric carbon dioxide (CO_2) (www.epa.gov/climatechange/basics). Environmental changes have to do with changes caused by the variation in the occurrences of some climatic factors; rainfall, temperature, light wind: biotic factors; predators, parasites, soil micro-organism, pest and diseases: and edaphic factors; soil pH, soil texture, soil structure etc. when environmental changes occur as a result of the actions of man and other natural phenomena, lives and properties are adversely affected.

Causes and effect of climate and environmental changes

In a broad sense, climate and environmental changes is the after mat of so many human activities and some natural occurrences. Some natural causes of climate change are referred to as 'climate forcing' or 'forcing mechanisms'. Changes in the state of this system can occur externally (from extraterrestrial systems) or internally (from ocean, atmosphere and land systems), through any one of the described components. For example, an external change may involve a variation in the Sun's output which would externally vary the amount of solar radiation received by the Earth's atmosphere and surface. Internal variations in the Earth's climate system may be caused by changes in the concentrations of atmospheric gases, mountain building, volcanic activity, and changes in the surface or atmospheric albedo (www.cheron.com). However, some climatologists are of the opinion that only a limited number of factors are primarily responsible for most of the past episodes of climate change on the Earth. These factors include:

(a) Variations in the Earth's orbital characteristics.
(b) Atmospheric carbon dioxide variations.
(c) Volcanic eruptions.
(d) Variation in solar output.
(e) Plate Tectonics Thermohaline Circulation.

The need for sustainability

There is no question regarding the need for sustainability. In "The Concept of Environmental Sustainability," Robert Goodland substantiates a history documenting this need, presenting proponents ranging from Mill and Malthus to Meadows and Brundtland et al., and puts forth a definition of "environmental sustainability as the maintenance of natural capital" and as a concept apart from, but connected to, both social sustainability and economic sustainability. These arguments are not repeated here but rather accepted as valid, supported, and used as a basis from which to proceed to further develop this concept. While the concept of sustainability is increasingly discredited as a useful concept by itself, it appears to be serving some purpose when preceded by a delineating modifier like "ecological" or "agricultural" or "economic." Efforts have been made by members of various professions to give meaning to the term within the context of those respective professions. Callicott and Mumford, for example, develop the meaning of the term "ecological sustainability" as a useful concept for conservation biologists; In "Ecological Sustainability as a Conservation Concept," these authors advance an ecological definition of sustainability that connects human needs and ecosystem services: "meeting human needs without compromising the health of ecosystems." They propose this concept as a guiding principle for areas where human activities take place.

In "Economic Sustainability and the Preservation of Environmental Assets," Foy explains that from an economic standpoint, sustainability requires that current economic activity not disproportionately burden future generations. Economists will allocate environmental assets as

only part of the value of natural and manmade capital, and their preservation becomes a function of an overall financial analysis. In contrast, the ecologist will seek to preserve minimum levels of environmental assets in physical terms. He suggests that since an ecological approach will better characterize the present situation, it should serve to limit conventional economic reasoning to ensure sustainability. Economic sustainability should involve analysis to minimize the social costs of meeting standards for protecting environmental assets but not for determining what those standards should be. In "Social Sustainability" (McKenzie, 2004) identifies several attempts to define social sustainability and concludes it generally to be, "a positive condition within communities, and a process within communities that can achieve that condition." This definition is supplemented with a list of corresponding principles, including:

(a) equity of access to key services
(b) equity between generations
(c) a system of relations valuing disparate cultures
(d) political participation of citizens, particularly at a local level
(e) a sense of community ownership
(f) a system for transmitting awareness of social sustainability from one
(g) mechanisms for a community to fulfill its own needs where possible
(h) political advocacy to meet needs that cannot be met by community action

A sustainable environment is a necessary prerequisite to a sustainable socio-economic system, therefore the actions we take to remove threats to and foster environmental sustainability should contribute to such a system. While ecosystems range "from those that are relatively undisturbed, such as natural forests, to landscapes with mixed patterns of human use, to ecosystems intensively managed and modified by humans, such as agricultural land and urban areas," the "environmental" focus proposed here delineates the portion of that range where there exists significant patterns of human use ("Ecosystems and Human Well-Being"). A general definition of "environmental sustainability" can now be crafted in recognition of these linkages between human well-being and ecosystems and, in particular, "ecosystem services. The development of technical and vocational skills is vital to economic development for two important reasons. First, technical and vocational skills are needed for enterprise productivity and profitability, as well as for national productivity and wealth creation. Without the necessary technical skills, enterprise and national growth can be seriously hobbled. Technological innovation and economic growth fuel the demand for skilled workers. The need for technical and vocational skills is increasing because of a convergence of factor: technological change, changes in work organization, growing economic openness and competitiveness, and capital deepening (increasing capital per worker).The second reason development of technical and vocational skills is of vital importance is because it is essential for individual prosperity. Skills enable the individual to increase productivity and income. This is especially important for those who are seeking out a living in the informal sector of the economy.

Technical Vocational Education and Training (TVET) is globally recognized for its role in preparing people for dynamic engagement in occupations of functional value and effective source of skilled workforce. The United Nations Educational Scientific and Cultural Organization (UNESCO) and the International Labour Organization (ILO) recommendations of 2000 on TVET for the 21st century, as reported in (Oviawe, Uwameiye and Uddin (2017) defined TVET as:

(a) an integral part of general education;
(b) a means of preparing for occupational fields and effective participation in the world of work;
(c) an aspect of lifelong learning and a preparation for responsible citizenship;
(d) an instrument for promoting environmentally sound sustainable development;
(e) a method of facilitating poverty alleviation.

Similarly, UNESCO (2009) defined TVET as all forms and aspects of education that are technical and vocational in nature, provided either in educational institutions or under their authority, by public authorities, the private sector or through other forms of organized education, formal or non-formal, aiming to ensure that all members of the community have access to the pathways of lifelong learning. The above definitions of TVET implies that its goal is to fight ignorance and

literacy, provide knowledge, develop skills and inculcate the attitudes that are required for entry and progressing in any occupation. To Kukoyi (2009), TVET is a planned programme of courses and learning experiences that begin with exploration of career options, support basic academic and life skills, and enable achievement of high academic standards, leadership and preparation for industry-defined work. This implies that TVET prepares learners for career that are based on manual or practical activities, traditionally non-academic and totally related to a specific trade, occupation or vocation. Unlike general education, learning in TVET is centred on 'applied' as opposed to 'academic', practical as opposed to theory, and skills as opposed to knowledge. Accordingly, TVET today face huge demands globally due to high level of unemployment characterized by rapid population growth with no corresponding growth in infrastructures and job opportunities. For TVET to achieve its envisaged objectives, it must be properly strengthened.

Attitude towards implementing TVET policies

TVET programmes need to play a pivotal role in developing a new generation of people who will face the challenges of achieving sustainable socio-economic development throughout the globe (UNESCO, 2001). The major issue facing TVET implementation is the lack or unsatisfactory policy framework. Good policy framework will help promote TVET and its curriculum design and delivery to meet the needs of the labour market. There is need to revise the school's curriculum to reflect multiple intelligent from the industrial sector. To ensure that the issue of policy framework in TVET is addressed, publicity and advocacy for new TVET policy can serve as a means for proper implementation of TVET programmes. Since policy framework is the driving force to the planning, implementation and attainment of any programme or organizational objectives, therefore a good TVET policy framework can help to monitor and control manpower development for the workplace.

Relating TVET to priority areas of the country

It is important to identify priorities of a nation before coming out with innovation areas that would contribute to the rapid development of the nation. TVET institutions should fashion its training in harmony with identified priorities of the country. A study by the African Union on the state of TVET in 18 African nations has shown the priority areas for vocational training in Africa in the following order: agriculture, public health, water resources, energy, environmental management, information and communication technology, construction and maintenance. The general recommendation from the states include the development of appropriate competency-based curriculum in these areas, and compulsory implementation of TVET programmes for students in strategic fields such as entrepreneurship, computer literacy, agriculture and building construction. Training without consideration to priority areas will certainly result in flooding the workplace with unwanted skills thereby raising the level of unemployment and under-employment.

Linking TVET with traditional skills

Traditional skills have served tremendously in providing a source of livelihood. Some of these have been abandoned in quest for foreign skills. Where foreign skills can no long suffice due to lack of raw materials and where there is plenty of raw materials, TVET programmes can inject innovation into local skills for the production of traditional artefacts and related crafts to safeguard them from being extinct and to provide sustainable living.

Funding of TVET

Funding is an absolutely crucial input of any educational system. It provides the essential purchasing power with which education acquires its human and material resources. It is difficult to talk of the relevance and quality of education without considering the issue of funding and indeed, the funding process. TVET has suffered in the hands of general education administrators who in many nations have control over funds especially when such funds are centrally controlled, and where TVET is jointly managed with general education. In the situation where the two are jointly

managed the likely personnel in control, for obvious reasons, is the general educator who hardly understands that TVET is much more capital intensive and more financially demanding than general education. A way out is to separate the management of TVET from that of general education. In Nigeria, the establishment of the National Board for Technical Education (NBTE) and TVET boards at the State level has to an extent addressed the management issues. However, a lot still need to be done by ensuring that only professional TVET managers and policy makers with adequate expertise and insight be placed in control of TVET.

Education is an expensive social venture that requires adequate financial provision from all tiers of government for successful implementation of the educational programme (FRN, 2004). TVET today has shifted towards skill acquisition courses capable of making youths and adult self-reliant hence there is a clear need for the Nigerian Government to invest in it. According to Michael (2002) other countries, such as France, have taken a giant step to making it work. French National Assembly approved the law on social modernization which contains important measures concerning TVET and the right to employment. Okolocha (2012) noted that Nigeria today has joined other world counterparts in revamping and repositioning TVET programme which is geared towards ensuring a national system of education will enable young people see TVET as challenging and worthwhile. Nigeria, knowing the importance of TVET has taken a new direction. According to Osam in Oviawe (2018) one of the main defects of the Nigeria education system in the colonial era was its strong bias towards academic and literacy studies and its underdevelopment and underfunding of technical education.

Financing of education in Nigeria has principally been through government grants which continued till the 1970's before the establishment of the "Industrial Training Fund" (ITF) in October 1971. It is an agency of the government established to be part of the collaboration for the sharing of funding burden between the private and public sectors on recognition of the importance of Vocational Technical Education in Nigeria. This agency provides a link between academic institutions and the world of work through the Students Industrial Work Experience Scheme (SIWES). They are also involved in the management of funds attracted from organizations. The establishment of the ITF initiated wider participation in the financing of vocational and technical education in addition to government direct funding. According to Osam Oviawe (2018), vocational and technical education must be adequately funded to revamp our economy for environmental sustainability. To achieve this, the Federal Government of Nigeria came up with a strategy of using the "Education Trust Fund" (ETF) which was set up by law in 1993 to fund and upgrade the quality of vocational technical education in Nigeria (Olakunri, 2006). Furthermore, the Federal Government mapped out a three-year action plan to revamp technical and vocational education programmes through ETF, five billion naira (N5b) was mapped out as annual allocation for fiscal year action plan for 2005, 2006 and 2007 respectively.

Sources of Finance for Vocational Education

There are two major sources of finance to TVET otherwise referred to as revenue. These sources include: internal and external sources of finance. Finance from either source is used for capital expenditure or recurrent expenditure. The internal sources of school finance include; school fees, income from investments or educational entertainment activities, sales and services among others (Ebong, 2004). While the external sources include government grants, subventions, loans, non-governmental donations, endowment fund and appeal funds. The sourced finance is utilized in the execution of TVET in aspect of capital and recurrent expenditure. For clarity, the sources of finance for vocational education are:

1. ***Budgetary allocation by Government:***This is basically the major source of finance for vocational education. It is the finance that is often used for the running of the programme and all other expenses. FRN (2004) stated that the financing of education is a joint responsibility of the federal, state and local governments and the private sector. This fund is used for the payment of workers' salaries which makes up part of the recurrent expenditure (Borode, 2010).

2. ***Students' School Fees:*** Technically, education is free in Nigeria as to allow every citizen the right to attend. FRN (2004) stated that the government ultimate goal is to make education free at all level. However, tuition fees are paid in some schools, developmental levies, purchase of uniforms and books (Obasi & Asodike, 2007). These funds when generated are used for the running of TVET programme in Nigeria.
3. ***Endowment Fund/Donations:***These are funds provided through donation for the execution of institution projects and provision of facilities for the running of vocational education. Schools hold functions like prize giving day, inter-house sports competitions etc. Appeals can be made by schools to government agencies, non-governmental agencies (NGO's), wealthy individuals and to organizations to donate funds for the execution of some specific projects that assist vocational and technical education to achieve its mission for Nigeria (Offiong et al, 2013). This is backed by the FRN (2004) which states thus: in the quest to finance education, government welcomes and encourages the participation of local communities, individuals and other organization who may donate funds for the running of the educational sector.
4. ***Companies and Non-Governmental Organizations:*** Borode (2010) stated that there are some multi-national companies that partly sponsor vocational education by awarding scholarship to learners. Some other non-governmental organization like banks, UNESCO and UNICEF also support vocational education. FRN (2004) asserted that relevant sectorial bodies such as Nigerian Education bank and the Education Tax Fund are established to respond to the funding needs of education.
5. ***Industrial Training Fund:***This was established in October, 1971 by the federal government with the aim to donate funds and equipment in support of vocational and technical education (Okeke, 2006). This establishment has been a source of finance of vocational education. It equally helpsto train men and women to have skills leading to the production of craftsmen, technicians and other skilled personnel for self-reliance. Other sources of fund to ease the burden on the government are; the Petroleum Trust Fund (PTF), National Science and Technology Fund (NSTF).
6. ***Sales and Services:*** These are funds generated from the sale of school produce. Vocational and Technical Education Department with the effort of the students' practical work produces materials and other products to be used by the public. These things are sold out to individuals, or companies and the fund being put back into the development of the school. For instance, a poultry farm is established at the end of every three months the birds are sold, the money goes back into the school account which will be used at subsequent time for the expansion of the farm.
7. ***Alumni Association and Aids:*** This is an old students association which assists the school through cash donations, provision of equipment, building of infrastructure such as classroom blocks, libraries, hostels etc. This is a major contribution to the development of the school.
8. ***The Host Community:*** The community where the school is located also provides funds to the school directly or indirectly. Fund is provided directly in a situation where wealthy individuals in the community donate school facilities for the running of the school like chairs, books, cash, writing materials among others whereas indirectly the community funds the school through the area of land provided for the sitting of the school which when valued could be more than any other source through which funds come to the school.
9. ***International Aids:*** Funds are gotten for the running of Vocational Technical Education through the help of international organizations such as the UNESCO, UNCEF, Ford Foundation, World Bank and the rest of them. These organizations have been helping out to see that Vocational Technical Education in Nigeria succeed as to cut down the level of unskilled workers being produced in the formal educations as it has been evident that graduates of the universities or higher institutions often do not have saleable skills to fit into the world of work.

10. ***Parents-Teachers Association (PTA):*** This is an association that is made up by students' parents who come together to discuss the affairs and well-being of the school. Their main goal is to promote development in the school by supporting the school through fund raising and could as well seek external financial assistance from wealthy individual in a critical situation where funds are urgently needed. The funds raised by this organization are majorly used for building infrastructure for the school and for providing facilities/equipment.

For Nigerian citizens to benefit maximally from TVET as experienced by many of the developed nations, other sources of funding have to be exploited in addition to the ones stated in this study. Some of these are:

i. Government should improve more and ensure that financing of TVET programmes is adequate enough to meet the staffing, facilities and equipment needs of the sector so as to meet international standard.
ii. Multi-national companies should live up to their responsibilities in terms of their agreement with their host communities. This will generally enhance the performance of the sector.
iii. International aids should be sourced by the Federal Government Nigeria to boost the implementation of action plans for the sector.

Training for skills, job-creation and linking TVET institutions to the workplace

Oviawe (2018) stressed that developing relevant skills and matching training with job for sustainable living is fundamental to effective TVET. This objective can be achieved if TVET know the needs the workplace requires from TVET products or graduates. These needs may include: practical capacity (capacity for skill acquisition); theoretical and technical knowledge (capacity to show knowledge of operating principles and relate to practice); creativity and entrepreneurship, social capacity, and information and communication technology (ICT) skills (Madungwa, 2012). Other skills required by the workplace include communicative skills; critical thinking and problem Solving skills; team work; long learning and information management skills; entrepreneurship skills; ethics, moral and professional; and leadership skills. TVET institutions cannot successfully play this role of providing high quality manpower with advanced skills if it operates in isolation of the operating industries that require skilled workers. TVET institutions must establish collaborative linkages with these industries that require their graduates. Such linkages on a well fashioned partnership terms will guarantee quality skill and smooth transition from school to work. In meeting, the skill needs of the teeming youths and addressing ever-increasing trend of unemployment and underemployment, government globally have been compelled to strengthen the link between institutions and workplace. This in most cases takes the form of closely involving the industry and, developing occupational standards and, work-based verification and continuous assessment of trainees. The world needs a production-oriented TVET which must incorporate functional skill development and knowledge driven programmes with sufficient motivational and reward mechanism. For TVET to produce people with powerful skills and high quality innovative minds to build the world and make it a better place, some fundamental mechanisms such as TVET institution-workplace collaboration should be considered.

Conclusion

This study covers current developments in financing vocational education, sources of finance for vocational education and utilization of revenue in vocational education. The study also noted that Vocational Education should be made more affordable and accessible to Nigerians. Unskilled professionals in the workforce and making funds available to retrain unemployed Nigerian graduates in the labor market werealso focused. Funds should be made available by stake holders to boost the sector. Sources of finance for vocational education programme include budgetary allocation by Government, Student's school fees, endowment fees/donations, Alumni Association and Aids, sales and services by host communities. Finance allocated to vocational education are been utilized for the payment of workers' salaries, purchase of equipment, facilities and the maintenance of existing equipment as well as training of personnel. Recommendations

Recommendations

1. Government should improve more on the financing of vocational education to meet the staffing, facilities and equipment of the sector so as to meet international standard.
2. Multi-national companies should live up to their responsibilities in terms of their agreement with their host communities. This will generally enhance the performance of the sector.
3. International aids should be sourced by tertiary institutions in Nigeria to boost the implementation of action plans for the sector.4.Vocational education should be practical oriented in order to provide goods and services to boost the sector.

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ACQUISITION OF BUSINESS SKILLS ON VOCATIONAL CAREER OF HEARING-IMPAIRED SECONDARY SCHOOL STUDENTS IN OYO TOWN, NIGERIA

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Abstract: *This study has adopted descriptive survey to investigate the effects of acquisition of business skills on the vocational career of the hearing-impaired secondary schools students in Oyo town. The reliability of the instrument was determined at 0.79. Fifty purposively selected students in Oyo town Secondary Schools were used as respondents. The data was analyzed using the inferential statistics of t-test. The findings of the study revealed that calculated-value (9.02) is greater than table-value (1.984) which means that there is significant relationship between acquisition of business skills and vocational career of the hearing-impaired students and calculated-value (18.20) is greater than table-value (1.984) which means that there is significant relationship between teaching method and acquisition of business skills to the hearing-impaired. It was then recommended that government should provide adequate facilities for the acquisition of business skills, government should employ qualified teachers in school for the hearing-impaired children, technical and vocational education (TVE), Teachers should always use practical-oriented teaching methods like: field-trip, project work, simulation and work-based teaching methods often in order to achieve the desired result of impacting the necessary business skills to the hearing-impaired students and government should sponsor the hearing-impaired students and give them hearing aids this will also make them to develop interest in vocational education.*

Keywords: Business Skills, Vocational Career, Hearing-Impaired, Funding

Introduction

Vocational education is the acquisition of specific skills for self-employment, for example cookery, dressmaking, carpentry, masonry as well as working in the industries. This type of education is offered to meet needs of individuals and society as well. The ability of individuals is utilized to the fullest (Tum, 1996). Vocational education is one of the national development strategies in many societies. It creates a great impact on human resource development, productivity and economic growth (Van, 1992).Vocational training has been there throughout history. Every society had its crafts men. In the United States it became popular after 1880. The courses that sprung under vocational education was industrial training, book-keeping, stenography (shorthand) and commercial work. The courses were offered both in private and public institutions. Trade schools in the united states of American (USA) at that time were like copper union, Tuskegee institute and practice institute. In Africa, most of the technical and vocational education (TVE) institutions are facing the challenge of producing employable graduates due to various institutional factors. In Ghana Dasmani (2011) indicates that inadequate supply of instructional materials, large class sizes, inadequate training facilities, weak linkages with local industries for hands-on experience for both instructors and trainees lead to ineffective and inefficient training of students while emphasizing on passing final examination in the technical and vocational education (TVE) institutions. This led to inadequacy in the preparation of students for the job market and brought work-place challenges to the graduates. Udofia, Ekpo, Akpan, and Nsa (2012) revealed that there is significant relationship between teacher quality, teaching methods and instructional facilities and acquisition of business skills by students. Maeko and Makgato (2016) point out that in South Africa, the quality of technical and vocational education (TVE) teachers is poor since they do not have frequent exposure to relevant industries in order to keep abreast with latest technological developments. A teacher of vocational and technical subject must not only teach, but must use methods that will enhance students' acquisition and development of knowledge, skills, interest and self concept formation. Teaching methods used during training are very significant in acquisition of skills. In Nigeria, Audu, Umar and Idris (2014) revealed that work-based learning, field trip, project-based learning, seminar and simulation methods of teaching, facilitates acquisition of both technical skills and business skills by students at the same time.

However, these teaching methods are rarely used by most of the technical and vocational education (TVE) institutions in Africa due to inadequate fund and poorly equipped instructional facilities. In the United State there were several laws that helped to improve the work force in industries and made sure that there was vocational training for the economically challenged youth. The laws were known as Manpower Development Training laws, Vocational and Applied Technology law and Vocational Education law. The Dutch schools also pay attention to the provision of vocation education. The targeted age of the learners at 14 – 16 years, In Italy, vocational education began in the 16th century. The Italian architects sought to make their vocational education professional (knoll, 1993). In Africa there are different systems of vocational education from country to country. Training is provided in both private and public polytechnic, enterprise and apprenticeship training centers. The West Africa apprenticeship departments offer the largest opportunity for technical and vocational education. Hearing impairment refers to all degrees of hearing loss from mild deafness to severe or profound hearing loss. However, hearing difficulty is more strict for it is a disability whose effects are so pervasive that they give rise to the disorganization of the whole personality of the affected including his physical, mental, social and psychological well-being. The greatest effect of hearing impairment is in the area of communication and speech. It depends on a child's ability to hear the speech of those around him and to associate what he hears with meaning. Morlet (2012) defined hearing impairment as a problem that occur when there's a problem with or damage to one or more part of the ear. Hearing impairment as a disability category is similar to the category of deafness, but it is not the same. The official definition of hearing impairment by individual with disabilities education act (IDEA) is impairment in hearing that diversely affects a child's educational performance but is not included under the definition of "deafness". Thus, knowing the definition of deafness is necessary to understand what sorts of disability are considered to hearing impairment. A hearing less below 90 decibels is generally considered deafness, which means that hearing loss at 90 decibels classified as a hearing impairment.

A Child born deaf or one who lost his hearing before he had developed language and speech cannot acquire language and speech naturally. He has to be taught laboriously and somewhat "artificially" to speak and to understand the speech of others. However his greatest need is not just being able to speak, but the ability to understand and use language either through the medium of speech or by some other modes, such as finger spelling, signing and lip reading. Many deaf children learn and attain proficiency in the use of language without being able to vocalize. Many of such children come from home where they were probably rejected or neglected by their parent at the critical period of learning speech. If such young star manages to learn a smattering of speech at school frequently their speech lacks intelligibility and fluency. The world is growing technologically and Nigeria must not be left behind. The Nigerian deaf child must be given that aspect of education, which leads to the acquisition of business skills as well as basic vocational knowledge. In this direction there arose the need to improve our educational system (Ademokoya, 2001). Hearing Impairment can result in dramatic changes in the life of an adult. On the other hand, young children with congenital or early acquired hearing loss presence have significant different problems from those of adults. Ibitoye (2012) opined that deafness means that a person has a limited ability to hear sounds. It is a communication difficulty rather than merely a loss of sound perception. Whatever the severity of the hearing disorder, children and adult need aural rehabilitation/habilitation, Aural rehabilitation according to Bakare (2013) refers to the restoration of communication skills, which implies helping with impaired hearing loss to reach their maximum educational, social and personal situations. Ibitoye (2011) defined Business Education as an aspect of vocational education that focuses on the development of the students with the acquisition of skills needed to satisfy human wants. Hence, considering the abovefact, the national policy on education (FRN, 2013) introduced innovations in secondary education in Nigeria. Instead of the former five years of secondary education, there is now a six years secondary school system broken into two stages: Junior and Senior stages, each lasting three years. National Policy on Education recommends prevocational courses in secondary schools classes. All these are also available to hearing-impaired students.

Statement of problem

In years past, a large number of the hearing-impaired students after their secondary education end up on the street begging because of lack the of vocational training when they were in schools. Most of the hearing-impaired children's parents don't give them much attention which affects the academic performance of the students and later end up on the street begging for alms. Lack of enough equipment for vocational education will hinder the fast understanding of the vocational skills because the hearing-impaired do understand faster through practical demonstration.

Hypotheses

$\mathbf{H_{O1}}$: There is no relationship between Acquisition of business skills and vocational career of the hearing-impaired students.

$\mathbf{H_{O2}}$: There is no relationship between teaching method and acquisition of business skills to the hearing-impaired.

Methodology

Descriptive survey type was used for this research for the responses from selected secondary schools, since the responses were not manipulated. The population of the study comprises of secondary schools, having hearing-impaired unit in Oyo town. It also comprises all their hearing-impaired students. The sample for the study consists of two selected secondary schools and 50 students that were purposively selected from the schools since these type of students were not many. The instrument employed for the study was Business and Special Education Questionnaire (BUSPEQ). It consists of fifteen items duly constructed by the researcher. It has a covering letter and a personal data of the respondents. The questionnaire was duly validated by three experts in the College. After the pilot study, the reliability value was 0.79, using test and re-test method. Inferential statistics of t-test was used for the data analysis at 0.05 level of significance.

Results

Table 1: t-test Analysis on the Relationship Between Acquisition of Business Skills and Vocational Career of The Hearing-Impaired Students

Variable	N	$\overline{X}$	SD	t-cal	Df	t-crit	p-value
X1	30	4.23	4.03				
				9.02	12	1.984	Significant
X2	20	1.17	3.62				

Table 1 shows that the calculated value (t-cal) of 9.02 is greater than the critical/table value of 1.984 given 12 degree freedom. This implies that there is significant relationship between vocational materials and the acquisition of business skills to the hearing-mpaired students.

Table 2: t-test Analysis on the Relationship Between Teachers' Teaching Method and Acquisition of Business Skills by The Hearing-Impaired Students

Variable	N	$\overline{X}$	SD	t-cal	Df	t-crit	p-value
X1	30	2.32	3.21				
				18.20	12	1.984	Significant
X2	20	2.70	1.62				

Table 2 shows that the calculated value (t-cal) of 18.20 is greater than the critical/table value of 1.984 given 12 degree freedom. This implies that there is significant relationship between teaching method and acquisition of business skills to the hearing-impaired.

Findigs and discussion

Research hypothesis one stated that there is no significant relationship between acquisition of business skills and vocational career of the hearing-impaired students. Upon testing the hypothesis with T-test, it was revealed that calculated-value (9.02) is greater than (>) table-value (1.984) at 0.05 level of significance; therefore the null hypotheses (H_o) is rejected this means that there is significant relationship between Acquisition of business skills and vocational career of the hearing-impaired students. This is in line with the research conducted by Karemu and Gongera (2017) affirms that in Kiambu country (TVE) technical and vocational education has gain its relevance and the (TVE) technical and vocational education can equip the youth with employable skills and empower them to be self-reliant.

Research hypothesis two stated that there is no significant relationship between teaching method and acquisition of business skills to the hearing-impaired. Upon testing the hypothesis with T-test, it was revealed that calculated-value (18.20) is greater than (>) table-value (1.984) at 0.05 level of significance; therefore the null hypotheses (H_o) is rejected this means that there is significant relationship between teaching method and acquisition of business skills to the hearing-impaired. This is in line with the research conducted byAudu, Umar and Idris (2014), it revealed that the most effective and efficient teaching methods to be used in order to enable student to acquire skills include demonstration, work based learning (attachment), simulation, fieldtrip, context based learning discussion and problem based learning (project work) he further reveals that these teaching methods should be used together with teacher centered and learner- centered approaches of teaching learning in Kenya, the most teaching method used is lecture method which is majority theory based and teacher-centered.

Conclusion

There is significant relationship between Acquisition of business skills and vocational career of the hearing-impaired students. There is significant relationship between teaching method and acquisition of business skills to the hearing-impaired.

Recommendations

1. Government should provide enough vocational equipment/materials needed for the acquisition of business skills.
2. The government should employ qualified teachers in school for the hearing-impaired children.
3. Technical and vocational education (TVE) Teachers should always use practical-oriented teaching methods like; field-trip, project work, simulation and work-based teaching methods often in order to achieve the desired result of impacting the necessary business skills to the hearing-impaired students.
4. The government should sponsor the hearing-impaired students and give them hearing aids this will also make them to develop interest in vocational education
5. All the teachers of vocational education should create awareness on the benefits and importance of vocational education and give it a more positive approach than has been before. This in turn would attract more students to vocational education centers and retention of learners especially the hearing-impaired students in vocational education centers.
6. Finally, a teacher should allow the hearing-impaired to participate fully in the vocational activities so as not to be isolated.

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DESIGN AND TECHNOLOGY FOR SUSTAINABLE TECHNOLOGICALLY DEVELOPMENT IN NIGERIAN SYSTEM OF EDUCATION

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Abstract: *Amid concerns of 21st century technological development, tackling skill acquisition challenges and unstable educational system, the need to address these issues is becoming an urgent focus for all stakeholders in Nigeria. Therefore, this paper presents a critical review of the need to integrate Design and Technology for sustainable technology development. Specifically, this review looked into background of design and technology, rationale and prospect for the integration of design and technology into curriculum of Nigerian system of education were discussed. Also, constraints of Design and Technology at international and national levels were fully analyzed. The paper discovered that the new subject Design and Technology has a number of distinctive and innovative features which will transform industrialization vision into reality. The paper recommends for the integration of design and technology, training of resource personal as well as provision of workshops and sufficient funding.*

Keywords: *Design, Technology, Development, Sustainable, Integration*

Introduction

Design and technology is one of the subjects taught at secondary schools and tertiary institutions in many countries across the world. For instance, countries that adapted design and technology as teaching subject include England, Iceland, Australia, Singapore, Cyprus, Botswana, Papua New Guinea, among others. In essence Design and Technology were introduced into National Curriculum in England and Wales as a distinct academic subject in 1990. This is because, without design and technology, it will be harder to inspire young people to go into the engineering and technology education professions and develop new technology (Smithers, 2011), especially with the advent of 21st century. Looking at the dimensions of 21st Century skills raised the need for interdisciplinary subject that will strengthen students to match the present demands of industries and/or be self-employed. To this end, Spendlove, (2015), view design as integral aspect of a sustainability economy, design represent empowering learning opportunity in terms of productivity and performativity these arise when considering feature-focused technology education programs that value design thinking. Design and technology education according to the Ministry of Education Singapore (2006), is that aspect of technical and vocational education, a holistic broad-based education that is project based and anchors on design actions and the application of knowledge and process skills. Process in the context of the above description means that students should be able to produce creatively, technology-based products. In other words, design and technology gives young people the skills and abilities to engage positively with the designed and made world and to harness the benefits of technology. They learn how products and systems are designed and manufactured, how to be innovative and to make creative use of a variety of resources including digital technologies, to improve the world around them (Design and Technology Association, 2019). This indicated the relevance and development of Design and Technology towards sustainable technological development.

Background for development of design and technology

Design and technology were introduced into the National Curriculum in England and Wales as a distinct academic subject in 1990 (under the *Technology in the National Curriculum* Statutory Order, DES and We1sh Office, 1990). It is claimed that England and Wales were the first countries in the world to make technology education compulsory for all children between the ages of 5 and 16. This has been described as a pivotal moment in history (Wilson & Harris, 2004). Some scholars viewed that this was a response to government recognition of the importance of technology to the British economy (Layton, 1995). Also, in 1999 a technological subject, under the heading of *Design*

and Craft was introduced and this new subject was based on a rationale of technological literacy, innovation and design (Autio, Soobik, Thorstensson, & Olafsson, 2015). Accordingly, Design and Technology education in Cyprus were introduced in 1992 and replaced a craft-based subject. Students were to be given the opportunity to 'design and make' products using mainly resistant materials and produce systems involving electric/electronic circuits, mechanisms, pneumatics and structures (Mettas, Thorsteinsson, & Norman, 2007). According to Elmer (1999) design and technology not only enhances the thinking and decision-making powers of young people, it also enhances their conscious awareness of those thought processes. They not only learn to think and make decisions, they also know (and can see) that is what they are doing which could be the reasons for the integration of the corse/subject into the curricular of the Nigeria educational institutions at all levels.

Rationale for the integration of design and technology

The rationale for the integration of design and technology into Nigerian system of education is for the sustainable development of technology. According to Tanna and Kumar (2009) the course/subject has a number of distinctive and innovative features such that it commences with building a science-based foundation followed by basic engineering principle as well as the area of design concept. Technology education has a lot of opportunities for the feature development as well as curriculum review from time to time (Milne, 2018). Also, one of the rationales of the Design and Technologies curriculum is that students create quality designed solutions across a range of technologies contexts. Students consider the economic, environmental and social impacts of technological change and how the choice and use of technologies may contribute to a sustainable future. Students also take into account the ethical, legal, aesthetic and functional factors that inform the design processes (Victoria Curriculum, 2019).

Additionally, through Design and Technology, students plan and manage projects from conception to realization. They apply design and systems thinking and design processes to investigate ideas, generate and refine ideas, plan and manage, produce and evaluate designed solutions. They develop a sense of pride, satisfaction and enjoyment from their ability to create innovative designed solutions. From this perspective, it could be argued that design and technology was created by a forward-thinking government seeking to establish a vehicle through which science and mathematical principles and theories could be explored through practical application (Bell, Wooff, McLain, & Morrison-Love, 2017). With all the foregoing, it is clear to mention that, prospects and importance of design and technology remain at stake.

Prospects of design and technology integration

The higher expectation of people with regards to design and technology on self-reliance, entrepreneurships, and skills acquisition is quite relevant for the sustainable technology development in Nigeria. According to Abassah (2011), the generality of the people are becoming aware of the economic value of technology education as the avenue of turning the economy and technology around. Internationally, Design and Technology programs, as delivered by a number of institutes such as Loughborough, Brunel, North Umbria in England have delivered hundreds of Industrial/Product Design and Technology graduates over decades who have made significant contributions to society in general, UK plc and the people around them (Southee, 2015). In addition, Design and technology as an area in the curriculum which always causes pupils to look into the future and produce answers to needs by practical application, design and technology is uniquely placed both to consider the issues of sustainability and to deliver understanding via practical project-work (Goggin, & Lawler, 1994). The review of literature shows evidence of the impact of Design and Technology (D&T) among the countries adapted the subject. Moreover, some educationist perceives the curriculum discipline of design and technology as being job focused, a route with inherent value that align to employment and a clear career trajectory. However, others educationist focuses as academic in nature, as being fundamental to an individual's ability to secure future economic prosperity (Gibb, 2015).

Analysis shows that design and technology is both vocational as well as academic in nature. And this is the type of subject Nigerian youth are needed and useful for sustainable technology development. Also, Sidawi, (2009) asserted that in the Design and Technology classroom there is no separation between doing and knowing and their relationship is no longer based on a ''inferior/superior''. Presently there are many international examination bodies which the developed syllabus and conducting examination on Design and Technology such as Cambridge IGCESs. The Cambridge IGCSE (9–1) Design and Technology syllabus enables learners to identify, consider and solve problems through creative thinking, planning and design, and by working with different media, materials and tools (Cambridge IGSE, 2019).

Constraints of design and technology integration

There were numerous challenges that effect the integration of design and technology into Nigerian system of education and these included inadequacies of resources, insufficient of trained teachers, lack of awareness, and couple with pedagogical instructional challenges. In addition, some of the constraints are lack of funds and policy makers' support. Whilst acknowledging that vocational and technical disciplines are vital to future economic growth however, insufficient qualified teachers of science and technology are problem in implementing science and technology education in Nigeria. According to Sadawi (2009) the Design and Technology classroom provides great opportunities for collaboration among students, this collaboration does not happen automatically. The teachers have to be trained to provide the environment that fosters collaborative learning. Another constraint is wrong usage of instructional methodology such that many teachers avoid implementing hands-on projects, in favor of typical, lecture-based instruction. As Jones (1997) viewed it that lack of a developed and inadequate pedagogical strategy to teach design and technology compared with science or mathematics. Furthermore, this lack of research on pedagogical strategies combined with a complex nature of knowledge with a definition and understanding that is still evolving, has created a challenging situation for design and technology educators. Also, one of the challenges that faced design and technology education in Nigeria is lack of awareness about the proposed new subject and its important in relation to sustainable technology development and industrialization.

Conclusion

It could be concluded from the reviewed papers that there is needs for the integration of design and technology into curriculum of Nigerian system of education at all level of education to provide resource personal. Also, the analysis of papers reviewed shows prospects and constraints as well as challenges faced by some countries already implemented design and technology in their countries. Upon understanding challenges, the ministry of education would address the emerging issues for a smooth integration of design and technology into curriculum of the Nigerian system of education. By introducing this unique subject will hopefully contribute to industrialization, economics diversification and produce feature generation with technological and engineering mindset.

Recommendations

1. Short- and long-term planning should be organized by ministry of education for the provision of adequate and properly trained Design and Technology teacher nationwide.
2. Government should provide an enabling environment, specifically, functional Workshops and laboratories should be made available.
3. Practical material resources necessary for teaching Design and technology should be made available at all levels such as junior and senior secondary schools as well as tertiary institutions.
4. Policy makers would support design and technology by providing adequate fund for the take up as well as introducing law to make it compulsory subject.
5. There is need for all the stakeholder's awareness campaign on the important of Design and Technology as a new subject to be integrated into curriculum of Nigerian system of education.

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COMPERATIVE ANALYSIS OF RUSBULT AND CONVENTIONAL PROBLEM-SOLVING MODELS IN TEACHING TECHNICAL SUBJECTS

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Abstract: *This study was designed to determine the effect of two models of problem solving on Technical College students' academic achievement, interest and retention in building Technology. The study used the quasi-experimental research design, precisely, pre-test and post-test. The population of the study was 210 NCE II (Tech) in building Technology students in Technical Colleges Bauchi State. Three research questions and three hypotheses tested at 0.05 level of significance was used to guide the research. The Instrument used for data collection were Building Technology Cognitive achievement test (BTCAT) and Building Technology Interest Inventory (BTII). The BTCAT was drawn based on a table of specification.The Reda's and Rusbult's model lesson plan, BTCAT and BTII were subject to face and content validation by three experts. The sample Instrument was trial tested on a sample of 20 NCE II Building Technology students of Government Technical College Bauchi. Kuder-Richardson 20 8(K-R20) and Pearson product moment correlation coefficient, were used to establish the coefficienf of consistency and stability of the BTCAT. The value were found to be 0.71 and 0.80respectively. Data collected were analyzed using mean to answer the three research questions and Analysis of Covariance (ANCOVA) statistic was used to test the three hypotheses. The research revealed that Reda's model is more effective in improving students achievement in Building Technology than Rusbult's model. It was also discovered that Reda's and Rusbult's models are effective in stimulating students Interest but that Reda's model improves retention of learnt knowledge than the Rusbult's model in Building Technology. It was recommended, among others, that the Government should organize workshops, seminars and in-service training for Technical Teachers on regular basis.*

Keywords: *Academic Achievement, Interest, Retention, Building Technology, Problem-Solving*

Introduction

Technical Education subjects are the types of subjects aimed at studying the competencies in the trade related areas which include: Building, Electrical Electronics, Wood Work, Welding and Fabrication, Foundry and Forging, Auto – Mechanic Technology. It involves activities using different types of materials for the purpose of construction of different types of projects and designed activities. The Technical College curriculum is designed to meet requirements necessary to prepare students for employment, self – reliant and entrepreneurial ventures. These trade related courses , according to national policy on education (2004) are vocational subjects offered at senior secondary schools and Technical Colleges level for the purpose of enabling the students to acquire further knowledge and develop skills. It exposes students to have intelligent understanding of increasing complexity of Technology. The goal and objectives of technical education are to equip graduate with saleable skills which will make them face the world of work . Salami, (2001) maintain that this system of education is to produce trained Man-power in technology and be equipped knowledge in craft, advance craft, with technical knowledge and Vocational skills that are necessary for the individual who shall be self-reliant in contemporary Nigeria. To achievement of the above objectives, would depend on the mode of instruction and motivation of students in the study of technology education. Training then needs to be conducted for Technical College students so as to achieve these lofty objectives. This is because the graduates are practically barren.

Since most of the graduates are considered unemployed and unskillful due to the training acquired from their various institutions and the training programmes were not addressing the growing need of the industry and society. The graduates of Bauchi state technical colleges are considered not self-employed nor employable as craftsmen and technicians due to lack of saleable skills. Hence there is the need for trying other method of training to acquire work skills. therefore , one of such metthods is Rusbult's Problem Solving Models.. Rusbult developed a 4-Phase model for problem solving as follows:

1. ***Orientation:***Translate the problem's word, picture and free information in to a clear idea, of now (the situation defined by the problem statement) and Goal (what the problem is asking you to do.
2. ***Planning:*** Figure out what to get from where you are now to the Goal.
3. ***Action:*** Start doing the plan, and continue until you have reach the Goal.
4. ***Check:*** Ask yourself, have I answer the question that were ask? Have I reach the Goal.

Rusbult believes that you get "oriented" by using all available information (words, pictures, and free information) to form a clear, complete mental picture of the problem situation. By reading the problem statement carefully, you get accurate comprehension, the meaning of words and sentence structure, so as to gather all the important facts. Most problems are written clearly, so use standard reading techniques to accurately interpret what is written. You may re-read a problem carefully for details, using the "successive refinements" methodsOccasionally, a problem contains useless information (a decoy), so you need to learn to recognize what information to be used and what should be ignored. Study the diagram in the problem or make your own diagram because when the problem information (lengths, angles, forces, velocity and so on) is visually organized on paper, it is easier to understand it. This also helps to decrease your memory load, thus leaving your mind free to do creative thinking. The problem-writer may expect you to assume certain reasonable things about the problem situation (free information), or to use data that is not given in the problem but is available in textbooks, tables or in a special part of the exam. McGraw-Hill (1997) said that problems represent gaps between where one is and where one wishes to be, or between what one knows and what one wishes to know. Problem-solving is thus the process of closing these gaps by finding missing information, re-evaluating what is already known or, in some cases, redefining the problem. McGraw-Hill further stated that a well-structured problem is a typical situation with a known beginning, a known end, and a well-defined set of intermediate states. Solving a well-structured problem consist of finding an infrequently used path connecting the initial state of the problem with its end state. People solve well-structured problems not by exhaustively searching through the set of possibilities, but rather by heuristically identifying good starting places and productive lines of search.

Statement of problem

Nigerian government have been spending a lot of resources aimed at improving the image and performance of Technical Education programmes, Unfortunately Technical College students have been having poor results in the final year NABTEB Examination Imandojemu, (2008). Some researchers have identified defective teaching method as one of the reason Okerie, (1979), (Ajerole & Adenoyin, (2006) and Daluba, (2008). It have been observed by the Federal ministry of education that Technical Teachers only employ the Teacher – Centered method of teaching to implement the Curriculum that's also result in to ineffective use of varieties of instructional methodology as a result effects the Achievement, Interest and Retention of students negatively. The shortcoming of the Teacher – centered method could be responsible for the poor academic achievement of students in public Examination. Therefore, there is the need for the change of method and techniques in teaching Technical subjects so as to enable graduate of technical colleges acquire adequate knowledge and skills for the world of work. The problem of this study therefore is Rusbult's problem solving put into consideration enhance technical students achievement, interest, and Retention in Technical colleges in Bauchi state.

Research questions

1. What is the effect of Rusbult's proble solving models of students achievement in Building construction?
2. What is the effect of Rusbult's problem solving models of students Interest in studying Building technology?

Hypotheses

H_{O1}: There is no significant difference in the achievement of students taught Building technology with conventional method and those taught with Rusbult's model.

H_{O2}: There is no significant difference between the Interest scores of the students taught Building Technology with conventional method and those taught with Rusbult's model.

Methodology

A quasi-experimental research design is to be used for the study. According to Gall, Gall and Borg (2007) quasi-experimental design can be used when it is no possible for the researcher to randomize the subjects and assign them to treatment groups without disrupting the academic programme of the school involved in the study. The design is considered suitable to conduct this study because intact classes will be used and as such the researcher will not randomize the subjects to groups. The model of design is as follows:

Group	Pre-test	Treatment	Post-test
E	Q1	RUPSS	Q2
C	Q1	CPSS	Q2

Where: Q1=Pretest scores of the two groups; Q2 = Posttest scores of the two groups; E = Experimental group; C = Control group; RUPSS = Rusbult's Problem-Solving Strategy; CPSS = Conventional Problem-Solving Strategy

Results

Table 1: Mean and Standard Deviation of Acheivement Scores of Students Taught Building Technology Using RUPSS and CPSS Methods

Method	N	Pretest Gain/Loss		Posttest Gain/Loss	
		Mean	SD	Mean	SD
RUPSS	39	34.85	8.74	64.92	+30.07
CPSS	29	27.62	11.31	36.76	+3.14

Table 1 shows that pretest achievement mean and standard deviation scores for students taught Building Technology using Conventional Problem Solving Strategy 1 are 34.85 and 8.74, while those taught Building technology using Rusbult's model are 27.62 and 11.31. This shows that both groups were not in the same achievement standing prior to experiment treatment. However, posttest achievement mean and standard deviation scores for Conventional Problem Solving Strategy s group are 64.92 and 22.57, whereas the posttest mean and standard deviation scores of Rusbult's group are 30.76 and 6.85. This shows that group taught with' Rusbult's model out performed group taught using Conventional Problem Solving Strategy s model with mean gain

Table 2: Analysis of Covariance (ANCOVA) of Mean Achievement Scores of Students Taught Building Technology Using RUPSS and CPSS Methods

Source	Type 111 Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	23209.818a	2	11604.909	36.605	0.000
Intercept	13582.970	1	13582.970	42.844	0.000
Pretest	66.430	1	66.430	0.210	0.649
Method	22686.902	1	22686.902	71.560	0.000

Source	Type 111 Sum of Squares	df	Mean Square	F	Sig.
Error	20607.167	65	317.033		
Total	207183.00	68			
Corrected Total	43816.985	67			
R Squared = 0.530 (Adjusted R Squared = 0.515)					

Table 2 indicate that F-ratio (71.56) with associate probability (sig(2-tailed)(p = 0.000) under method is less significant level (0.05) the postulated hypothesis. Hence, the researcher failed to uphold the null hypothesis, which mean that the alternative hypothesis was upheld. Therefore, there is a significant difference between the mean achievement scores of students taught Building Technology with Conventional Problem Solving Strategy and those taught with Rusbult's model in favour of Rusbult's model with high mean gain score of 30.07.

Table 3: Mean and Standard Deviation of Mean Interest Scores of Students Taught Building Technology Using RUPSS and CPSS Methods

Method	N	Pretest Gain/Loss		Posttest Gain/Loss	
		Mean	SD	Mean	SD
RUPSS	39	2.84	3.01	0.42	+0.17
CPSS	29	2.93	3.03	0.37	+0.10

Table 3 shows the pre-Interest mean and standard deviation scores of the students taught Building technology using Rusbult's model are 2.84 and 0.32, while those taught building Technology using Conventional Problem Solving Strategy Rusbult's model are 2.93 and 0.29. This shows that both groups were almost in the same interest score prior to experimental treatment. However, Posttest Interest mean and standard deviation scores for Rusbult's group are 3.01 and 0.42, whereas the posttest mean and standard deviation scores for Conventional Problem Solving Strategy Rusbult group are 3.03 and 0.37. This shows that group taught with Rusbult's model has been gain score of 0.17, whereas Conventional Problem Solving Strategy Rusbult model group has gain score of 0.10.

Table 4: Analysis of Covariance (ANCOVA) of Mean Interest Scores of Students Taught Building Technology Using RUPSS and CPSS Methods

Source	Type 111 Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.346a	2	0.173	1.070	0.349
Intercept	8.738	1	8.738	54.056	0.000
Pre-Interest	0.226	1	0.226	1.396	0.242
Method	0.036	1	0.036	0.223	0.638
Error	10.507	65	0.162		
Total	612.547	68			
Corrected Total	10.853	67			
R Squared = 0.32 (Adjusted R Squared = 0.002)					

Table 4 indicates that F-ratio (0.223) with associate probability (sig(-tailed)(p = 0.638) under method is greater than significant level (0.05) postulated. Hence, the alternative hypothesis was upheld. Therefore, there is no significant difference between the mean, interest scores of students taught Building Technology with Rusbult's model and those with Conventional Problem Solving Strategy.

Findings

1. Rusbult's model's instructional model was found to be superior over Conventional Problem Solving Strategy in terms of improving students' academic achievement since students taught using Rusbult's model achieved higher than the group taught using Rusblt's model, with the mean gain score of 30.07.
2. Both Rusbult's model and Conventional Problem Solving Strategy improve students interest in Building Technology. Hence, both models are good instructional models for promoting students interest to learn.
3. Rusbult's model's instructional model was found to be superior over Conventional Problem Solving Strategy in terms of promoting students Retention in building Technology.

Conclusion

This study was set out to determine the effect of Rusbult's model and Conventional Problem Solving Strategy on Technical College student's academic achievement, Interest and Retention in Building Technology in Bauchi State. The study revealed that Rusbult's model is more effective in improving student's achievement and Retention but that both Rusbult's model and Conventional Problem Solving Strategy arouse and sustain students Interest in Building Technology. These results therefore showed that Rusbult's model's and Conventional Problem Solving Strategy are viable alternative to the teacher centered method of teaching Building Technology. Instructional methods such as Rusbult's model s and Conventional Problem Solving Strategy give Technical Teachers opportunity to engage students in real world of classroom exercises. It give students the opportunity to develop valuable thinking skills and acquire an understanding about the Technology world. Thus , If Rusbult's model and Conventional Problem Solving Strategy are adopted to teach Trade related subjects in Technical Colleges, students will undoubtedly' be equipped with knowledge and skills in all the trades as well as perform and cope more effectively with requisite skills needed for work in the Industry, for self-reliance and present world of work.

Recommendation

1. The study recommends the teaching and learning of all Trade related subjects in Technical Colleges via Rusbult's model and Conventional Problem Solving Strategy.
2. National Board for Technical Education (NBTE) should consider review of curriculum for all the Trades with the view to incorporating Rusbult's model and Conventional Problem Solving Strategy.
3. Workshops, Seminars and in-service programme to be organized to Technical Teachers to improve their knowledge and skills on the use of Rusbult's model and Conventional Problem Solving Strategy for improving the student's performance in Technology.

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AN EVALUATION OF FACTORS THAT ENHANCE TEACHERS' COMPETENCIES IN TEACHING INTRODUCTORY TECHNOLOGY IN SOME SELECTED SECONDARY SCHOOLS IN POTISKUM LOCAL GOVENMENT, YOBE STATE

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Abstract: *This paper examines "An Evaluation of Factors That Enhance Teachers' Competence in Teaching Introductory Technology" Evaluation can be viewed as a process of collecting and processing data relating to an educational programme, on the basis of which decision can be made about the programme. The researcher used descriptive survey design, questionnaire was used as an instrument in obtaining data and the data were analyzed base on the responses of the findings and conclusion was drawn. The paper made some useful recommendations among which are: Seminars and workshops should be organized periodically for all introductory technology teachers to enhance their productivity; Motivation and incentive should be provided to teachers as it will help reduce the mobility of technology teacher to other jobs or sectors and Introductory technology teacher should adopt modern mean of teaching their course.*

Keywords*: Evaluation Enhance, Teachers' Competencies, Introductory Technology And Secondary Schools*

Introduction

Evaluation in education is an assessment of student's performance taking into cognizance both qualitative and quantitative aspects of students performance or amount of knowledge or skill possessed by students. Nworgu (2003) viewed evaluation as process by which a variety of instruments can be used to assess the goals and objectives associated with systematic management of learning experiences. It also reveals areas where students are weak and exposes incompetency of the teachers. Evaluation can be used to determine the extent to which the student has acquired the technical knowledge and skills taught. It can also be used to determine strength or weakness of a student or programme. According to Okoro (1993) evaluation can be viewed as a process of collecting and processing data relating to an educational programme, on the basis of which decision can be made about the programme. Similarly, Olaitan (2003) maintains that evaluation involves making judgment based on information; a decision can be made on performance in relation to competency.

Teachers' competency in the teaching of introductory technology depends on several factors; these factors include among others the provision of well-equipped workshops for effective workshop practice and availability of training materials. These are necessary to help the students acquired the much needed skills, knowledge, attitude and values. In search for teacher competency it has been the goals of educational research for quite some decades in the developed world and a developing nation, like Nigeria needs to produce teachers that are competent in the teaching of introductory technology in junior secondary schools. Introductory Technology is defined an essential practical subject, that introduces one to pre-vocational subject in which students are introduced into world of technology and appreciation of technology towards interest arousal and choice of a vocation at the end of junior secondary school and professionalism later in life (FRN, 2014).

Introductory technology is a pragmatic approach to learning technology; it basically involves learning by doing. In practical nature therefore, it means the development of skills which are increasingly necessary in all countries. Introductory technology is a fully integrated junior secondary course designed to stimulate the students understanding of simple technological concepts and their practical applications in everyday. Introductory technology which is the only core subject among the pre-vocational subjects of the junior secondary school in Nigeria, involves the academic practical knowledge from the study to provide a comfortable environment for man (FRN, 2014). This study of introductory technology helps to reduce ignorance about technology.

Introductory technology is the rudiment of technology at the junior secondary school level to expose Nigeria youths early enough to technology education. It is prevocational subject and need to be taught by experienced, dedicated and competent technical teachers. There is no way we can talked of introductory technology without making reference to technical education. Technical education: Manfred and Jennifer (2004) advocated that technical education comprises all more or less organized or structured activities that aimed at providing people with the knowledge, skills and competencies necessary to perform a job or a set of jobs whether or not they lead to a formal qualification. In similar views Olaitan, Nkwachukwu, Igbo, Onyemaechi, and Ekong, (1999) posits that technical education is education for work, which can be made available only for those who need it and are interested in it and hope to sale the skills acquired through occupation and make a living. In more specific terms Idriss & Garba (2007) looked at technical education as a form of vocational education that produces technicians and craftsmen, which is usually learnt in the formal school system.

The Federal Republic of Nigeria (2014) classified introductory technology as an essentially practical subject. The introductory technology is one of the pre-vocational subjects as defined in the NPE to include: Business studies, introductory technology, local crafts and home economics. These subjects constitute the skill forming programmes of the curriculum. Introductory technology comprise woodwork, metal work, electrical and electronic, Auto-mobile/mechanics, and technical drawings to be taught as composite subjects. There are so many problems that militating against teaching and learning of introductory technology in the secondary schools. According to Adekunle (2003) opined that the standard of most schools laboratories are below expectation. One of the most obvious implications of introductory of a curriculum that is skill based in the need for the provision of infrastructures such as workshop accommodation, equipment and other in structural facilities. The extents to which facilities are provided will determine an appropriate degree, the attainable available to provide them. This implies the need for provision of relevant and adequate training facilities, personnel and infrastructure to achieve the objectives of introductory technology subject in the educational system. There is need for country to provide competent and qualified teachers that can lay good foundation to our engineers that we can improve technologically. Fagbemi (2001) insufficient funding is another factor that affects the learning and teaching of introductory technology education which amount those of funds provided not enough to cater for the effective teaching and learning of introductory technology education in the school. Fagbemi (2001) noted that inadequate funding is a major constraint which can limit level of participation of students on teaching in practical work.

Pre-vocational course like introductory technology also requires finance from time for purchases of raw materials, equipment and tools. This accruing to him is usually one of the major problems which call for attention of the government in order to enhance the introductory technology skill which is in turn will boost our economy. Furthermore, Aramu (2001) point out the problems that hamper the progress of technical vocational education in Nigeria as lack of physical facilities like minimum laboratory facilities such technical drawing and pre-vocational education technical subject. Abdullahi (2005) notes that hindrance can come from shortage of building accommodations, shortage of tools and equipment, inadequate funding or improper use of funds, inadequate guidance and counseling service and shortage of teaching staff. Looting is also a great problem that militates progress in teaching introductory technology. The federal government provided much introductory technology equipment to school and NCE colleges, but it is very astonishing to know that the teachers of these students are not competent in handling this equipment.

The incompetency of teachers in the teaching and learning of introductory technology is alarming nowadays as had been indicated by the students' performance in Junior Secondary School Certificate Examination (JSCE). It has been observed that students' performance in technological subjects in examinations (e.g. WASSCE and NECO Examinations) has, over the years been generally poor (Ezeh, 2000; and Eze 2002). Some reasons have been deduce for the observed poor performance, prominent among which is scarcity of qualified introductory technology teachers,

incompetence on the part of the few available technological teachers, students lack of interest in technology, e.t.c. (Ezeh, 2000; Eze, 2002). For instance, students cannot select correct options and cannot answer the essay question correctly. The most serious weakness is that students cannot draw simple objects like isometric block neither can they produced it, in first or third angle projection.

- Can the students' problem in introductory technology be as a result of lack of competent and teaching methods?
- Ineffective teaching aids?
- Poor classroom management and insufficient school facilities, lack motivation and encouragement to the teachers?

Hence, the study sought to evaluate teachers' competencies in teaching introductory technology.

Purpose of the study

The purpose of the study is to evaluate the factors that enhance teachers' competencies in teaching introductory technology in some selected secondary schools in Potiskum L.G, Yobe state. Specifically, the study sought to determine to:

1. Identify factors that enhance teachers' competency in the teaching of introductory technology in junior secondary schools.
2. Find out the extent to which school facilities aid teachers competency in the teaching of introductory technology.
3. Find out the extent at which teachers' competence enhances student's performance.
4. Find out the extent at which classroom management and discipline enhance teachers' competency.

Research questions

1. What are the factors that enhance teachers' competency in the teaching of introductory technology?
2. What are the extents to which school facilities aid teachers' competency in the teaching of introductory technology?
3. What are the extents at which teachers competence enhance students' performance?
4. What are the extents at which classroom management and discipline enhance teachers' competency?

Methodology

This study used descriptive survey research design. According to Best and Kahn (2003) survey design is used in a situation where the study employs questionnaire to determine opinions, preference, attitude and perception of people about an issue. The design is considered appropriate for this study since it will seek the opinion of administrators and introductory technology teachers in secondary school in Potiskum local government area of Yobe state. This study was carried out in Potiskum local government area of Yobe state comprises of Government Science and Technical College Potiskum, Fika Government Secondary School Potiskum, Federal Government Girls' Secondary School Potiskum, ECWA Academy Potiskum, Sahel Academy Potiskum, International Private School Potiskum, Kara Government Junior Secondary Potiskum and St' Peter College Potiskum. The population of the study comprised of 63 administrators and 162 introductory technology teachers in all the eight junior secondary schools in Zone B. The sample of the study used comprise of ten (10) administrators and ten (10) introductory technology teachers from each schools within the area of study. The instrument for data collection for this study was questionnaire. Four-point likert scale question was used. The questionnaire will be administered to the respondents by the researcher. The direct administration will enable the researcher to have

direct interaction with the respondents; it will facilitate the quick completion and return of the questionnaire. An interval of three days was allowed for the respondents to complete the questionnaire after which the researcher will go round to retrieve the completed questionnaire. Data collected for this study was analyzed using mean and real limits of upper and lower class limits of statistical tools. The information collected was grouped under headings for easy collation and analysis. Tables were drawn to represent number of responses on specific information. Means will be used to calculate the magnitude of information and to determine its level in acceptance or rejection.

Results

Table 1: Evaluation of Factors that Enhance Teachers' Competency in the Teaching of Introductory Technology, Mean Responses of Administrators, and Teachers

S/N	Items	Administrators $\overline{X}_1$	Remark	Teachers $\overline{X}_2$	Remark
1.	Teacher's qualification affects the competency in teaching of introductory technology.	2.88	Agreed	3.10	Agreed
2.	Motivation of introductory technology teachers enhances their competency in teaching.	2.88	Agreed	3.03	Agreed
3.	Knowledge of subject matter determine teachers competency.	3.03	Agreed	3.25	Agreed
4.	There are adequate of introductory Technology teachers in your school.	2.03	Disagreed	2.43	Disagreed
5.	Good remuneration improves teacher's competency in teaching introductory technology.	2.70	Agreed	2.83	Agreed
6.	Incentives always boost teachers' morale and competency.	2.50	Agreed	2.83	Agreed
7.	Inappropriate time management Affects teacher's competency.	2.45	Disagreed	3.10	Agreed
8.	One of the skills that determine of Teacher's competency is good communication skill.	3.10	Agreed	3.18	Agreed
9.	Students' participation in lessons determines teacher competency.	2.70	Agreed	3.23	Agreed
10.	Effective teaching method enhances teacher's competencies.	3.20	Agreed	3.00	Agreed

Table 1 shows that factors that enhance teachers' competency in the teaching of introductory technology as indicated by item 1, 2, 3, 5, 6, 8, 9 and 10 agreed, while item 4 disagreed and except item 7 the administrators disagreed while the teachers agreed that the above stated items are factors that enhance teachers competency in the teaching of introductory.

Table 2: Evaluation of Extent to Which School Facilities Aid Teachers' Competency in the Teaching Of Introductory Technology

S/N	Items	Administrators $\overline{X}_1$	Remark	Teachers $\overline{X}_2$	Remark
1.	There are adequate teaching aids in your workshops.	2.0	Disagreed	2.18	Disagree
2.	Functional teaching facilities helps teachers competency in the teaching of introductory technology.	3.13	Agreed	3.35	Agreed
3.	Poor facilities affects teacher's competency.	2.93	Agreed	3.10	Agreed
4.	Teachers are more committed to work when facilities are made available.	2.93	Agreed	3.40	Agreed
5.	The availability of school facilities enhances teachers' competency.	3.00	Agreed	3.25	Agreed
6.	Introductory technology teachers handle machines competently.	2.08	Disagreed	2.45	Disagreed
7.	Teachers know how to use drawing instrument effectively.	2.40	Disagreed	2.45	Disagreed
8.	Lack of proper management of facilities enhances teacher's competency.	2.20	Disagreed	2.50	Disagreed
9.	Equipped workshop improves teacher's competency.	2.80	Agreed	3.10	Agreed
10.	Provision of enough teaching facilities enhance teachers' competency.	3.33	Agreed	3.08	Agreed

Table 2 mean response of administrators and teachers agree that school facilities aid teachers' competency in teaching introductory technology as indicated items 2, 3, 4, 5, 9 and 10 while items 1, 6, 7, and 8 disagreed that school facilities do not aid teachers' competency in teaching of introductory technology.

Table 3: Evaluation of the Extent to Which Teachers' Competence Enhances Students' Performance

S/N	Items	Administrators $\overline{X}_1$	Remark	Teachers $\overline{X}_2$	Remark
1.	Teacher's competence in demonstration enhances students' understanding.	2.95	Agreed	3.40	Agreed
2.	Teacher's competency improves student's performance.	2.83	Agreed	3.30	Agreed
3.	Lack of teacher competence contributes to poor performance of students.	2.53	Agreed	3.20	Agreed
4.	The teachers' ability to select appropriate material for instruction depends on the teacher's competence.	2.53	Agreed	3.00	Agreed
5.	The teacher competency enables the teacher to understand the exact time to use a particular material for a particular exercise.	2.60	Agreed	3.13	Agreed
6.	Teacher competency does not affect students' performance.	1.93	Agreed	2.40	Disagreed
7.	Arranging of tools for practical influence students performance.	2.68	Agreed	2.95	Agreed
8.	Observing safety rules during demonstration affects students performance.	1.68	Disagree	2.93	Agreed
9.	A competent teacher carries out practical lessons regularly.	2.65	Agreed	2.93	Agreed
10.	The appropriate use of demonstration during practical lesson is linked to teacher competency.	2.70	Agreed	3.35	Agreed

Table 3 shows that teachers' competence enhance students' performance as indicated by the mean responses of teachers and Administrators in item 1, 2, 3, 4, 5, 7, 9, and 10 while, item 6 disagreed and item 8 administrators disagreed and teachers' agreed that teachers' competence enhance students' performance.

Table 4: Evaluation of the Extent to which Classroom Management and Discipline Enhance Teachers' Competency

S/N	Items	Administrators $\overline{X}_1$	Remark	Teachers $\overline{X}_2$	Remark
1.	Classroom management is ability of the teacher to capture students' attention.	3.03	Agreed	3.28	Agreed
2.	Discipline usually makes students more attentive to the teacher.	2.48	Disagreed	3.05	Agreed
3.	Classroom management helps to reduce distraction by students.	2.43	Disagreed	2.75	Agreed
4.	Learning is greatly influenced by classroom management.	2.63	Agreed	3.10	Agreed
5.	Class control enhances teacher's efficiency.	2.98	Agreed	3.40	Agreed
6.	Discipline always makes teachers more committed in teaching students.	2.80	Agreed	2.90	Agreed
7.	Proper dressing with protective devices is part of workshop activities.	2.88	Agreed	2.89	Agreed
8.	Good relationship with students' encourages students' participation.	3.03	Agreed	3.15	Agreed
9.	A competent teacher discipline students when he/she misbehaves.	2.80	Agreed	3.15	Agreed
10.	Evaluating practical encourages students' improvement.	2.88	Agreed	3.00	Agreed

Table four shows that classroom management and discipline enhance teacher's competency teachers' as indicated by the mean responses of teachers and Administrators in item 1, 4, 5, 6, 7, 8, 9, and 10 while, item 2 and 3 disagree administrators disagreed and teachers' agreed that teachers' classroom management and discipline enhance teacher's competency.

Findings of the study

1. Knowledge of subject matter, good enumeration, incentive improves teachers' competency in the teaching and learning of introductory technology.
2. Functional teaching facilities, equipped workshop enhances teachers' competency in teaching of introductory technology while inadequate teaching aids in workshops affect teaching and learning of introductory technology.

3. Demonstration methods of teaching enhance students' understanding and academic performance in teaching and learning of introductory technology.
4. Class control and evaluating practical lesson encourage students.

Discussion of findings

In the findings support was found for all the four research questions in this study. The tables show that teachers' competency is always boost by encouraging them and lack of such encouragement make teachers ineffective. School facilities, the research question was found supported as the findings revealed that, facilities has greater effect on competency of teachers, Okoro (1993) observed that the inadequacies in the contemporary Nigeria secondary schools and stressed that the educational understandings have exceeded the financial resources. This is evident in schools with uncompleted, unmaintained and dilapidated buildings ill-equipped libraries, laboratories and workshops where they exist and lack of text books in schools. For effective teaching and learning of introductory technology to take place the social and physical environment should be such that encourage learning.

Competency and commitment enhance teachers effectiveness was accepted as the finding revealed that competency and commitment enhance Teachers effectiveness in demonstration of skills, knowledge attitude and values. According to Olaitan (1999) the acquisition of practical and applied skills as well as the basic scientific in a conducive learning situation, such learning situation can be created through effective's production and utilization of instructional materials. It indicated that no adequate training can take place without qualified and competent teachers to handle the programme.

Support also found for classroom management and discipline as a factor that enhances teachers competency. The findings reveal that classroom management and discipline influence learning and teachers effectiveness. However, learning is greatly influenced by classroom emotional climate and teachers ability to manage instructions. Competent teacher spends more time with his students, provides individual attention ask lower order questions than the ineffectiveness teacher. The successful classroom manager creates order and high engagement rate by establishing appropriate activities.

Conclusion

This study shows that for an introductory technology teacher to be competent in his work, the teacher should be properly trained both in theoretical and practical aspect of the subject matter. The teacher must also be innovative, imaginable, creative and resourceful to identify and use teaching methods effectively and improvise when the need arises. However, to improve and enhance teachers' competency, teachers should be motivated with proper incentives that will boost their moral and effectiveness.

Recommendations

1. Seminars and workshops should be organized periodically for all introductory technology teachers to enhance their productivity.
2. Motivation and incentive should be provided to teachers as it will help reduce the mobility of technology teacher to other jobs or sectors.
3. There is need for government to promote in service training for teachers on introductory technology.
4. Introductory technology teacher should adopt modern mean of teaching their course.

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IMPACT OF POLITICS ON THE ADMINISTRATION OF FEDERAL GOVERNMENT UNITY COLLEGES IN NIGER STATE

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Abstract:- *This study was carried out to examine the impact of politics on the administration of Federal Government Unity Colleges in Niger State. The study adopted a descriptive survey design, four research questions were raised to guide the study and four null hypotheses were tested at 0.05 level of significant. The population for the study was 360 respondents made up of 310 teachers and 50 parents (P.T.A Executives). 205 samples comprised of 155 teachers randomly selected from the teachers' total population and 50 parents (PTA Executives) that are the population of teachers were used as the sample size for this study. Questionnaire was used for data collection. Mean and Standard deviation was used to answer the research questions, and t-test statistics were used to test the hypotheses. The result showed that politics has some negative impacts on education therefore, leading to poor teachers' professional development, poor personnel administration, poor funding, and lack of basic infrastructures and equipment. The paper recommended that the appointment of administrators should be based on merit and not being politicized, government should sponsor any Programme that will improve teachers' professional output and provision of basic infrastructure and equipment should be distributed to schools according to their needs.*

Keywords: - *Politics, Administration, Teachers' Professional Development, Equipment*

Intoduction

Nigeria is a country whose political terrain may be described as unsteady- so many political parties to contest the administrative offices at the three arms of government. Each with its own ideology/political agenda which is pivotal to the administrative styles of any leader in power, Obabori (2007) revealed that political instability is a major feature in the political history of Nigeria and opined that this has brought about changes in educational policies and practices in the country over the years. The political leader in power often replaces the existing educational policies with new ones in line with the agenda of his political agenda, forcing the educational policies planner to discontinue the ongoing policies to implement new ones as spelt out by the government in power (Orji & Job, 2013). This confirms the assertion that politics and education are inextricably linked together and cannot be easily separated (Obabori, 2007 & Osuji 2013), the objectives of education, the control, production, process variables, financial and accreditation system are tied to politics (Osuji, 2013). For this reason, Okeke (2007) concluded that politics plays a vital role in control and governance of secondary schools and in the decision making process. He further looked at politics in education as a process of control, decision making, implementation, management, governance and a method by which resources are allocated to different schools to achieve their aims.

The Federal Government Unity Colleges in Niger State were created politically after the civil war in 1970 with the aim to foster unity among all tribes in the country. A look at the trend of admission into the five unity schools in Niger State showed that this practice has since changed due to the impact of partisan politics on the selection process, giving highest percentage to indigenes of towns hosting a unity school by reducing the cut-off marks for the indigenes (Admission lists 2014 - 2019). In the beginning it was not so because the quota system was religiously followed in placing students in unity schools across the nation, making all the major tribes to be well represented in them. One major cause of this is the highly politicized educational systems in which certain portfolios such as principals, vice chancellor, commissioner and minister are reserved for some political appointees which they are not qualify for (Orji & Job, 2013).

Statement of the problem

The Federal Government Unity Colleges in Niger State are under the supervision of the Basic and Secondary education department of the federal ministry of education. It is a popular belief among the federal unity schools community members and the researcher who is a member for the past ten years , that some unity schools are well favoured than others in the aspect of funding, allocation of resources such as learning material, equipment and infrastructures etc, promotion and posting of officers in the director cadre just mention a few. This, they attached to the interest of the government in some officers and in those schools. Though, this claim have no empirical back up yet, but some unity schools have had internal crisis due to unpaid arrears by the principals, and the National Union have also embarked on industrial strike action in the past on the ground that poor administration at the Ministry level has negatively affected the staff welfare and the running of the Unity schools across the nation. In order to verify the above, this paper focused on the impact of politics on the administration of Federal Government Unity Colleges in Niger State since all the unity schools have the similar features.

Research questions

1. What is the mean score of the extent of teachers and parents perceived impact of politics on the administration of Federal Government Unity Colleges in Niger State?
2. What is the mean score of the extent of teachers and parents perceived impact of politics on the teachers' professional development in Federal Government Unity Colleges in Niger State?
3. What is the mean perception score of respondents by gender on the impact of politics on the administration of Federal Government Unity Colleges in Niger State?
4. What is the mean score of the extent of respondents perceived impact of politics on the funding of Federal Government Unity Colleges in Niger State?

Hypotheses

H_{O1}: There is no significant difference in the mean perception by gender on the impact of Politics on the administration of Federal Government Unity Colleges in Niger State.

H_{O2}: There is no significant difference in the mean perception of Teachers and Parents on the impact of Politics on the administration of Federal Government Unity Colleges in Niger State.

Methodology

The study adopted a descriptive survey design. The total population for this study comprised of 360 respondents made up of 310 teachers and 50 parents (P.T.A Executives). 205 samples comprised of 155 teachers randomly selected from the teachers total population and 50 parents (PTA Executives) were used for this study. A 4-likert scale Questionnaire was used for data collection. Section 'A' contains respondents' demographic information while section 'B' sought information from respondents on the impact of politics on the administration of Federal Government Unity Colleges in Niger State.

Drafted copy of the questionnaire was given to expert in the department of Science Education, Federal University of Technology, Minna for face and content validation before producing the final draft. The reliability coefficient of 0.85 was obtained using spearman ranking .The questionnaire was administered to 205 respondents and 205 questionnaires were returned making 100% rate. The questionnaire scales are Strongly Agree (SA), Agree (A), and Strongly Disagree (SD), Disagree (D) with corresponding values of 4, 3, 2 and 1. The negatively worded questions were positively reworded after which the responses were compressed to Agree (A) and Disagree (D). These were analyzed using mean, standard deviation and t-test with SPSS Statistical package of version 23.

Results

Table 1: Mean and Standard Deviation of the Impact of Politics on the Administration of Federal Government Unity Colleges in Niger State

Question Items	N	Mean	Standard Deviation
Govt biasness in appointing Pricipals encourages autocratic leadership	205	3.63	.839
Change in govt policies interrupt the running of FGUC	205	3.46	1.036
Schools with govt presence enjoy heavey in-flow of resources than others	205	3.37	1.111
Some Politicians do interfere with the running of the FGUC	205	3.59	.895
Inexperiences Principals find it difficult to mamage internal crisis	205	3.33	1.144

As shown in Table 1, all the items have means of 3.63, 3.46, 3.37, 3.59 and 3.33 respectively which indicated that the respondents agreed with all the items. The implication is that Politics has significant impact on the administration of Federal Government Unity Colleges.

Table 2: Mean and Standard Deviation of the Impact of Politics on the Teachers' Professional Development in Federal Government Unity Colleges in Niger State

Question Items	N	Mean	Standard Deviation
Favouritism is employed when teachers are to attend teachers professional development programmes	205	3.36	1.140
Principals with godfathers often deny teachers their D.T.A.	205	3.60	0.790
Incompetence of some teachers is traceable to inconsistence organisation of trainning programmmes for teachers	205	3.70	0.825
Most Professional development programmes are ineffective due to government biasness on the selection of resouce persons	205	3.55	0.920
Funds meant for teachers' trainning and re-trainning are often mismanaged leading to skeletal trainning programmes	205	3.35	1.238

Table 2 above shows that all the items have means of 3.33, 3.60, 3.70, 3.55 and 3.35 respectively which indicated that the respondents agreed with all the items. The implication is that Politics has significant impact on Teachers' professional development in Federal Government Unity Colleges.

Table 3: Mean and Standard Deviation of the Impact of Politics on the Funding of Federal Government Unity Colleges in Niger State

Question Items	N	Mean	Standard Deviation
There is favouritism in the disbursement of funds by govt to schools	205	3.56	0.842
Funds meant for teachers' allowances and arrears are often mismanaged by offficials in political offices and this is one of the cause of srike action	205	3.40	1.013
Poor maintenance of School facilities may be linked to untimely disbursement of fund to them	205	3.41	1.014
There is no mechanism to checkmate fund's misappropriation among principals	205	3.55	1.016
Bursars who have affliation with govt in power often mismanage funds allocated to schools	205	3.42	1.048

Also Table 3 shows that all the items have means of 3.56, 3.40, 3.41, 3.55 and 3.42 respectively which means that the respondents agreed with all the items. This implies is that politics has significant impact on how Federal Government Unity Colleges are being funded.

Table 4a: Sample by Gender Mean, Standard Deviation and Standard Error Mean

Gender	N	Mean	Standard Deviation	Standard Error Mean
Female	113	1.18	0.383	0.036
Male	92	1.33	0.471	0.049

The table simply shows the sample by gender, means, standard deviations and standard error mean for each variable.

Table 4b: t-test for Equality of Mean Response of Male and Female Respondents

Gender	Levene's Test for Equality		t-test for Equality of Means						
	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Standard Error Difference	95% Confidence Interval	
								Lower	Upper
Equal variances assumed	24.265	0.000	-2.498	203	0.013	-.149	0.060	-0.267	-0.031
Equal variances not assumed			-2.446	174.330	0.015	-.149	0.061	-0.269	-0.029

The above table presents the t-test result of male and female respondents mean perception as t_{cal} **(203) = 000, p= 0.013.** Since, **p < 0.05**, then it means that there is significant difference between Male and Female respondents on the impact of politics on the administration of Federal Government Unity colleges in Nigeria

Table 5a: Sample by Status, Means, Standard Deviations and Standard Error Mean for each Variable

Status	N	Mean	Standard Deviation	Standard Error Mean
Teachers	155	1.40	0.491	0.039
Parents	50	1.60	0.495	0.070

The table simply shows the sample by Status, means, standard deviations and standard error mean for each variable.

Table 5b: . t-test for Equality of Mean Response of Teachers and Parents

Status	Levene's Test for Equality		t-test for Equality of Means						
	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval	
								Lower	Upper
Equal variances assumed	0.000	1.000	-2.498	203	0.013	-0.200	0.080	-0.358	-0.042
Equal variances not assumed			-2.489	82.485	0.015	-0.200	0.080	-0.360	-0.040

The above table presents the t-test result of Teachers and Parents respondents mean perception as t_{cal} **(203) = 1.000, p= 0.013.** Since, **p < 0.05**, then it means that there is significant difference between Male and Female respondents on the impact of politics on the administration of Federal Government Unity colleges in Nigeria

Findings and discussion

The results have substantiated the claim of the community members of Federal Government Unity Colleges that some schools are closer to the government and that such school enjoy more in-flow of funds, good infrastructures and so on than other schools. This agrees with the findings of Osuji (2013), who investigated the influence of politics on the management of secondary schools in the south- east region of the country. Using a sample of 1441 respondents, Osuji found out that the disbursement of funds and development of infrastructures are highly influence by politics.

Furthermore, the administration of these schools is at the mercy of the government of the day and the administrators were appointed by the Government of the day. These administrators are transfer to the "juicy" Federal Government Unity Colleges and upon arrival, mismanage the school's resources and give less attention to teachers' professional development training programmes.

Conclusion

Based on the findings of this study, Politics and education cannot be easily separated. It has the capacity to either mar or make the educational system. In order to attain and maintain excellent academic standard, politics must be played with caution.

Recommendations

1. Government should be mindful of the impact of politics on the administration of federal unity Schools in Nigeria, therefore endeavor to be fair in playing politics.
2. The disbursement of funds should be done equally without favouritism.

3. Attention should be given to programs that aim at teachers' professional development.
4. The posting of Principals to schools should be done without favouritism.
5. Competence of officers must be a vital criterion for promotion.

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PROJECT-BASED LEARNING IMPACT ON ELECTRICAL TECHNOLOGY STUDENTS' PERFORMANCE IN COLLEGES OF EDUCATION IN NORTH-EAST, NIGERIA

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Abstract: *This quasi-experimental study was carried out to ascertain the impact of project-based learning approach on the academic performance of students in Electrical Wiring System at Colleges of Education (Technical) in North-East, Nigeria. Four research questions and their corresponding null hypotheses guided the study. Existing class setting of sixty one (61) N.C.E III electrical technology students of 2016/2017 academic session was involved for experimentation. Student in the experimental group were taught using Project-Based Learning (PBL) approach, while those in control group continue to receive instruction using conventional method. Electrical Wiring System Performance Test (EWSPT) was used for data collection. The test reliability coefficient stood at 0.9. Data were analyzed using mean, standard deviation and t-test statistical tools. The findings revealed that the performance of students taught Electrical Wiring System (EWS) using Project-Based Learning was significantly higher than the performance of students taught EWS using conventional method. Based on the findings, the study concluded that PBL has significant effect on students' performance in Electrical Wiring System compared to the conventional approach. It was therefore recommended that lecturers of Electrical Wiring System should include the use of PBL in teaching Electrical Wiring System to students in NCE III.*

Keywords: *Problem-Solving, Project-Based Learning, Electrical Wiring System, Performance*

Introduction

The primary purpose of teaching at any level of education is to bring a fundamental change in the learner. The process of knowledge transmission requires that teachers should apply appropriate teaching methods that best suit specific objectives of teaching the subject (Tebabal & Kahssay, 2011). In the conventional method of teaching, many teaching practitioners applied teacher-centered methods to impart knowledge to learners. Questions about the effectiveness of teaching methods on student learning have consistently raised considerable interest in the field of educational research (Hightower, 2011). Kazeem (2006) opined that Technical Education is that aspect of education which utilizes scientific knowledge in the acquisition of practical and applied skills for solving technical problems. In cognizance with this philosophy, the Federal Government of Nigeria (2013) clearly stipulated in its national policy on education that one of the primary objectives of technical education is to prepare persons for gainful employment in a recognized occupation. It can be observed that technical education deals with application of scientific knowledge in solving human problems. Technical education comprises of numerous specialization at the N.C.E level, such as building technology education, automobile technology, wood work technology, metal work technology, electrical electronics technology education.

Electrical electronics technology education at the NCE (technical) is primarily designed to teach the students saleable skills for the benefits of mankind, which electrical machine and power is one of them. Electrical machines and power is one of the trade subject areas in electrical electronics technology education taught in colleges of education. This subject area is designed to expose the students with skills in many areas to become self-reliant economically. Electrical Wiring System is a large area under electrical machines and power, which is offered at Nigeria Certificate in Education III (NCCE, 2012). It is expected that when student are exposed to skills in the various areas of electrical electronics technology education will enable them to set up their own business and become self-employed and be able to employ others after completing their program. Teaching of electrical wiring system involved exposing the students to electrical installation in a domestic and industrial building. This requires the students to fix various types of electrical apparatus in a position ready for use together with necessary conductors, cables, fuses, control gear and distribution board in order to lighting, power and prevent the building. Where necessary to prevent

danger, every installation shall be protected by means of current devices include fuses, circuit breakers. These protective devices must be automatically operated. With regard to electrical conductors, all conductors must be properly insulated and further protected. It must be placed and safeguarded so as to prevent danger, every electrical joint and connection shall be on proper construction as regard to conductance, insulation and mechanical protection. Therefore, connections wiring shall be visually inspected, the insulation resistance between conductors and between each conductor and earth shall be measured, and also the earth loop impedance.

Based on the goals of vocational and technical education as stated in the National policy of education (2013), the teaching of trade related subject should be designed toward acquisition of more practical so that the students can be functional for job after graduation. It is expected that proper implementation of these goals will bring about the desired technological and economic development. The objectives of vocational and technical education is applicable to electrical wiring system, in that it gives training and impart needed skills to students in that option to enable them secure employment in recognized organizations or become self-reliant economically. Electrical wiring system also equip an individual with functional and saleable skills, knowledge and attitude, or value that would enable them operate in rendering service in electrical related institutions or work. Electrical wiring system deals with electrical appliances, wiring, electrical equipment, control and use of electricity. Moreover, research on teaching and learning constantly endeavor to examine the extent to which different teaching methods enhance growth in student learning, while in the view of Okoro (2013), poor academic performance by the majority students is fundamentally linked to application of ineffective teaching methods by teachers to impact knowledge to learners. In collaborating this assertion, Ayeni (2011) maintains that for the teaching method to be effective, teachers need to be conversant with various teaching strategies that take recognition of the magnitude of complexity of the concepts to be covered. Project-based learning is one of the instructional method centered on the learner. Instead of using a rigid lesson plan that directs a learner down a specific path of learning outcomes or objectives, project-based learning allows in-depth investigation of a topic worth learning more about (Harris & Katz, 2001).

Whereas the conventional passive view of learning involves situations where material is delivered to students using a lecture method of teaching, but a more modern view of learning is constructivism, where students build their own version of reality rather than simply absorbing versions presented by their teachers (Carpenter, 2006). Project-based learning is a learning strategy, which is centred on the learners and provides opportunity for students to develop skills in group interactions and teamwork (Sharan, 2010). Project-based learning is a student centered pedagogy that involves a dynamic classroom approach in which students acquire a deeper knowledge through active exploration of real world challenges and problems. In project based learning students learn about a subject by working for an extended period of time to investigate and respond to a complex question, challenge, or problem. Thomas (2011) describes project-based learning as a style of active learning and inquiry based learning which integrates knowing and doing. In project based learning, students learn knowledge and elements of the core-curriculum and also apply what they know to solve authentic problem and produce results that matter. Within the framework of project based learning, students pursue solutions to nontrivial problems by asking and refining questions, debating ideas, making predictions, designing plans and or experiments, collecting and analyzing data, drawing conclusions, communicating their ideas and findings to others, asking new questions and creating artifacts. Another important motivation for project-based learning is the emphasis it places on teamwork. Teamwork in project-based learning can be understood through the concept of distributed cognition (Sharan, 2010). This has important implications for designing a learning environment which trains students to work as professionals in a multidisciplinary team, whereas the team work as a multidisciplinary team enhanced the students' performance academically. The student academic performance is directly linked with social and economic development of the country. The students' performance plays an important role in producing the best quality graduates who will become great leader and manpower for the country thus responsible for the country's economic and social development (Ali, 2009). It has been

reported that learning and understanding of school subjects have been frustrated by the inapproriate methods and instructional materials used (Mtsem, 2011). Ogunniyi (2009) adduced poor performance in public examination to teaching techniques used by teachers. Mtsem (2011) reported that teaching method affects the responses of students and determines whether they are interested, motivated and involved in teaching and learning process. Ogunniyi (2009) asserted that one of the most persistent and compelling problems besetting performance is quality of teaching. Corroborating this assertion, Kolawole and Popoola (2009) reported that many school subjects are not being taught as they are ought to be in Nigeria institutions of learning because of inappropriate teaching methods. Going by these citations, it can be deduced that what constitutes good teaching and learning of school subjects is the use of appropriate methods of teaching.

Electrical wiring system being a wider area in Electrical power and machine in colleges of education is designed to adequately equip its recipients with requisite skills to enable them become self-reliant if taught appropriately. This was supported by Obi (2010), who asserted that these skills are teachable and are thereby improved upon when the individual is in practice after undergoing well supervised training. If the teaching and learning of electrical wiring system is efficiently executed through quality teaching and supervision, it would undoubtedly equip students with skills and knowledge that enhance students' performance and contribute to economic development while reducing poverty in the society. Akpomi (2009) pointed out that electrical wiring system taught in schools using lecture method with less supervision of students by their teachers does not encourage acquisition of skills, attitudes or academic performance in students. In relation to view of Kolawole and Popoola (2009) that many school subjects are not being taught as they are ought to be in Nigeria institutions of learning because of inappropriate teaching methods. The real challenge lies on teachers of electrical wiring system to use appropriate learning strategies that would ensure quality skills acquisition which will in turn enhance the students' performance academically. Numerous studies have been conducted on project-based learning approach in teaching and learning process in other academic disciplines, such as Agboola and Oloyede (2007) on the effect of PBL on secondary school students' achievements in separation of mixtures in chemistry, Okoro (2013) on the effect of project-based learning on junior secondary school students' academic achievement, interest and retention in Home Economics in Nsukka Education Zone of Enugu State and Wekesa and Ongunya (2016) on the effect of PBL on Biology students' performance in the concept of classification of organisms among secondary school in Kenya, but there are limited empirical studies on the effectiveness of Project-Based Learning in Technical and Vocational Education, specifically on Electrical power and machine. It is on this view that this research covered this existing literature gap by finding out the effect of project-based learning approach on the performance of students in electrical wiring system in colleges of education (Technical) in North – East Nigeria.

Purpose of the study

The main purpose of this study is to determine the effect of project-based learning approach on the academic performance of students in electrical wiring system at Nigeria Certificate in Education (Technical) level in Colleges of Education. Specifically, the objective of this study intends to:

1. Identify the difference in the pre-test mean scores of students in Electrical Wiring System) in PBL and conventional group.
2. Determine the difference in the pre-test and post test mean scores of students taught Electrical Wiring System (EWS) using Project Based Learning (PBL) approach.
3. Identify the difference in the post-test mean scores of students taught Electrical Wiring System using Project-based Learning (PBL) approach and those taught using conventional method.
4. Determine the difference in the mean gain of students taught Electrical Wiring System (EWS) in PBL and conventional group.

Research questions

1. What is the difference between the pre-test mean scores of students in Electrical Wiring System (EWS) in PBL and conventional group?
2. What is the difference between the pre-test and post-test mean scores of students taught Electrical Wiring System (EWS) using PBL approach?
3. What is the difference between the post-test mean scores of students taught Electrical Wiring System (EWS) using PBL and those taught using conventional method?
4. What is the difference in the mean gain of students taught Electrical Wiring System (EWS) in PBL and conventional group?

Hypotheses

H_{O1}: There is no significant difference between the pre-test mean scores of students in Electrical Wiring System (EWS) in PBL and conventional group.

H_{O2}: There is no significant difference between the pre-test and post-test mean scores of students taught Electrical Wiring System (EWS) using PBL approach.

H_{O3}: There is no significant difference between the post-test mean scores of students taught Electrical Wiring System (EWS) using PBL and those taught using conventional method.

H_{04}: There is no significant difference between the mean gain of students in Electrical Wiring System (EWS) in PBL and conventional group?

Methodology

The research adopted pretest and posttest non equivalent quasi experimental design, this resuled as normal class setting interruption was not possible. The design is diagrammatically presented thus;

Groups	Pre-test	Treatment	Post-test
G1	Y11	X	Y12
G2	Y21		Y22

Fig. 1: Pre-test Post-test Quasi Experimental Design

Where:
G1- Experimental Group
G2- Control Group
Y11- Pre-test of the Experimental Group
Y21- Pre-test of the Control Group
X- Treatment
Y12- Post-test of the Experimental Group
Y22- Pre-test of the Experimental Group

The study was conducted in North–Eastern geopolitical zone of Nigeria, which comprises of Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe states. A total 61 N.C.E. III students offering electrical wiring system course from two collecges of education (technical) in the study area served as target population for the research (see table 1). Since quasi experimentation was conducted, no sampling was done, total polulation was entirely used for the research.

Table 1: **Population of the study**

S/N	Name of Institutions	NCE III Electrical Students
1.	F.C.E.(T) Potiskum, Yobe State	30
2.	F.C.E.(T) Gombe, Gombe State	31
	Total	**61**

Using table of specification, 30 items performance test tagged "Electrical Wiring System Performance Test" (EWSPT) was developed and used for data collection. The test was developed from elecgrical technology curriculum of NCE III under a courses titled "Electrical Power and Machines", a course taught in N.C.E. III. A five points rating scale was also developed and used for assessing the performance of the students taking the test. The rating scale is interpreted as: Highly Accurate (5), Very Accurate (4), Moderately Accurate (3), Less Accurate (2) and Not Accurate 1). Both the EWSPT and rating scale were validated by experts in Electrical Electronic Technology Education and Measurement and Evaluation from the Faculty of Technology Education, Abubakar Tafawa Balewa University, Bauchi. The calculated reliability coefficient of the instrument also stood at 0.91. Prior to the commencement of the treatment, the research assistants were trained on the administration of the research instruments, after which they were asked to administer the pretest to the students. The pretest helped to test the students' knowledge on electrical wiring system before the commencement of the experiment, in order to have a firsthand knowledge on the students' entry behaviours. The researcher marked the script and scored the students based on their performance in the pretest. The lecturer in the experimental group was asked to adhere strictly to the lesson plan prepared for the purpose of the study. The students in the experimental group were taught using the PBL for three weeks, whereby each unit of the topic was treated weekly under the duration of three (3) hours. While the students in the control group were taught using conventional method of teaching for the same period of time. The teachings of both the experimental and the control group were done by the research assistants. After the treatment, both the experimental and control group were post-tested immediately using the EWSPT. The aim of the posttest was to find out if there was a change in the performance scores of the students in the two groups. The data collected from the EWSPTs were analyzed using mean and standard deviation in order to answer the research questions. This is because mean and standard deviations have the greatest reliability than other measures of central tendencies and the mean can be used to interpret performance (Uzuagulu, 2011). While the hypotheses were tested using t-test at 0.05 level of significance.

Results

Table 2: **Pre-test Mean Scores and Standard Deviation of Students Taught EWS using PBL and Conventional Method**

	Group	N	Mean	S.D
Pre-Test	Conventional Group	30	2.30	0.48
	PBL Group	31	2.29	0.49

Where: N – Number of Students and S.D – Standard Deviation

Table two shows the pre-test mean scores of students in the PBL and conventional group. The conventional group had pre-test mean score of 2.30 and standard deviation of 0.48, while the PBL group had pre-test mean score of 2.29 and standard deviation of 0.49. This result shows that the students in the PBL and conventional groups were within the same level of performance before the treatment.

Table 3: **Pre-test and Post-test Mean Scores and Standard Deviation Of Students Taught EWS in PBL Group**

Variables	Groups	N	Mean	S.D
Pre-test	PBL Group	31	2.29	0.49
Post-test	PBL Group	31	4.71	0.25

Where: N – Number of Students and S.D – Standard Deviation

Table three indicates the pre-test and post-test mean scores of students in the PBL group in Electrical Wiring System (EWS). The students had pre-test mean score of 2.29 and standard deviation of 0.49, while their post-test mean score is 4.71 and standard deviation 0.25. The result from table three shows that the Post-test mean score of students was quiet above the pre-test mean score of students in the PBL group when tested in electrical wiring system. Thus the significance of the difference in the academic performance in the two tests, that is in the pre-test and post-test in electrical Wiring system (EWS) can be established after t-test.

Table 4: **Post-test Mean Scores and Standard Deviation of Students Taught EWS Using PBL Approach and those Taught Using Conventional Method**

	Group	N	Mean	S.D
Post-Test	Conventional Group	30	3.90	0.71
	PBL Group	31	4.71	0.25

Where: N – Number of Students and S.D – Standard Deviation

Table four shows the post-test mean scores of students in the PBL and conventional group in Electrical Wiring System (EWS). The conventional group had post-test mean score of 3.90 and standard deviation of 0.71, while the PBL group had post-test mean score of 4.71 and standard deviation of 0.25. The result from table four shows that the mean score of students in the PBL group was above the mean score of students in the conventional group.

Table 5: The Difference in the Learning Gain of Students Taught Electrical Wiring System (EWS) Using PBL Approach and those Taught Using Conventional Method

Group	N	Mean Gain
Conventional Group	30	1.62
PBL Group	31	2.43

Table five shows the learning mean scores of students in the PBL and conventional group in Electrical Wiring System (EWS). The conventional group had a mean gain score of 1.62 and the PBL group had a mean gain score of 2.43. The result from table five shows that the mean gain score of students in the PBL group was quiet above the mean gain score of students in the conventional group when tested in electrical wiring system. Thus the significance of the difference in the mean gain in the two scores that is in Electrical Wiring System (EWS) can be established after t-test.

Table 6: **Test of Difference Between the Pre-Test Mean Scores of Students in EWS in PBL Approach and Conventional Method**

Group	N	Mean	S.D	Df	P	Decision
Conventional	30	2.30	0.48			
				59	**0.89**	**H_{01} Accepted**
PBL	31	2.29	0.49			

Table six shows the independent samples test that was conducted to compare the pre-test mean scores of conventional group and PBL group in EWS. The result from the table shows that there was no significance difference between the mean scores in conventional group (mean= 2.30 and S.D= 0.48) and PBL group (mean= 2.29 and S.D= 0.49) and P= 0.89. The P value is greater than the confidence level, that is P>0.05. The null hypothesis which states that there is no significance difference between the pre-test mean scores of students in Electrical Wiring System (EWS) in PBL and conventional group was accepted.

Table 7: **Test of Difference Between the Pre-Test and Post-Test Mean Scores of Students Taught EWS Using PBL Approach**

Variables	N	Mean	S.D	Df	P	Decision
Pre-Test Scores	31	2.29	0.49			
				30	**0.00**	**H_{02} Rejected**
Post-Test Scores	31	4.71	0.25			

Table seven shows the paired samples test that was conducted to compare the pre-test and post-test mean scores of PBL group in EWS. The result from the table implies that there was a significance difference between the mean scores of students in the pre-test (mean= 2.29 and S.D= 0.49) and post-test (mean= 4.71 and S.D= 0.25) in EWS. The P value, 0.00 is less than the confidence level, that is P<0.05. The null hypothesis which states that there is no significance difference between the pre-test and post-test mean scores of students taught (EWS) using PBL approach was rejected.

Table 8: Test of Difference between the Post-Test Mean Scores of Students Taught EWS in Conventional and PBL Group

Group	N	Mean	S.D	Df	P	Decision
Conventional	30	3.90	0.71			
				59	**0.00**	**H_{03} Rejected**
Experimental	31	4.71	0.25			

Table eight shows the independent samples test that was conducted to compare the post-test mean scores of students taught EWS using PBL approach and those taught using conventional method. The result from the table implies that there was a significance difference between the mean scores in conventional group (mean= 3.90 and S.D= 0.71) and PBL group (mean= 4.71 and S.D= 0.25). The P value, 0.00 is less than the confidence level, that is P<0.05. The null hypothesis which states that there is no significance difference between the post-test mean scores of students taught (EWS) using the PBL approach and those taught using conventional method was rejected.

Table 9: **Test of Difference between the Mean Gain Scores of Students Taught EWS Using PBL Approach and those Taught Using Conventional Method**

Group	N	Mean Gain	Df	P	Decision
Conventional	30	1.62			
			59	**0.00**	**H_{04} Rejected**
PBL	31	2.43			

Table nine shows the independent samples test that was conducted to compare the mean gain scores of students taught EWS using PBL approach and those taught using conventional method. The result from the table implies that there was a significance difference between the mean gain of students in conventional group (mean gain= 1.62) and PBL group (mean gain = 2.43). The P value, 0.00 is less than the confidence level, that is P<0.05. The null hypothesis which states that there is no significance difference between the mean gain of students taught (EWS) using PBL approach and those taught using conventional method was rejected.

Findings of the study

1. There was no significant difference between the pre-test mean scores of students in Electrical Wiring System (EWS) in PBL group and those in conventional group. This implies that both the PBL and conventional group were at the same entry behaviour before the treatment was applied.

2. The post-test mean scores of students taught Electrical Wiring System (EWS) using PBL approach was significantly higher than the pre-test mean scores of students in Electrical Wiring System (EWS). The difference experienced in the students' performance in the two scores can be attributed to the treatment offered to the PBL group.
3. Significant difference existed between the post-test mean scores of students taught Electrical Wiring System (EWS) using PBL approach and those taught using conventional method. This implies that post-test mean score of students taught EWS using PBL was significantly higher than the mean score of students taught EWS using the conventional method of teaching.
4. Significant difference existed between the mean gain of students taught Electrical Wiring System (EWS) using the PBL approach and those taught using conventional method. This indicates that the mean gain of students taught EWS using PBL approach was significantly higher than the mean gain of students taught EWS using the conventional method of teaching.

Discussion of findings

The finding reveals that there was no significant difference in the pre-test mean scores of students in EWS in the PBL and Conventional group. This shows that both groups have equal entry behavior before the treatment was applied. The findings of this study are in line with the findings of Saima, Muhammad and Muhammad (2015) who found no difference between the achievement of students in the experimental and control group in the pre-test. The findings also shows that there was a significant difference in the pre-test and post-test mean scores of students taught EWS using PBL approach. That is the post-test mean score of students taught EWS using PBL was significantly higher than the pre-test mean score of students after the treatment. This invariably implies that the difference was as a result of the treatment (PBL approach) being applied. The findings is in line with Saima, Muhammad and Muhammad (2015) who found out that there was a significance difference between the pre-test and post test scores of students in the experimental group (PBL group). The findings concluded that the difference in the pre-test and the post-test scores can be attributed to the treatment offered.

The findings also reveal that there was a significant difference in the post-test mean scores of students taught EWS in PBL and Conventional group. That is the post-test mean score of students taught EWS using PBL was significantly higher than the mean score of students taught EWS using the conventional method of teaching. This invariably implies that the students in the PBL group performed better than the students in the conventional group after the treatment was applied. The findings concurs with the findings of Wekesa and Ongunya (2016); Agboola and Oloyede (2007); Noe and Neo (2009) and Okoro (2013). The study revealed that project-based learning technique enabled students to improve in academic achievement as well as developing positive attitude towards classification of organisms. The findings of the researchers revealed that project-based learning enhanced students' achievement more than conventional method of teaching. The findings also reveals that there was a significance difference in the mean gain of students taught EWS using PBL approach and those taught using conventional method. This implies that PBL was very effective when compared with conventional method of teaching. The findings also concurs with the findings of Okoro (2013) and Saima, Muhammad and Muhammad (2015), who found out PBL was very effective in teaching technical related concepts when compared with conventional method of teaching.

Conclusion

The findings reveal that the PBL approach has an effect on the academic performance of students taught EWS. The PBL approach serves as an alternative to the conventional method of teaching Electrical Wiring System. PBL approach enables active participation of students in the process of learning and as such gives room to students to apply their ideas in acquiring new skills and developing their existing talents in solving real life problems. PBL also allow cooperative learning among students, therefore inculcating high rate of confidence in the students to learn and apply what they have learnt in their own pace.

Recommendations

1. The lecturers of Electrical Wiring System should adopt PBL in teaching electrical wiring system concept at N.C.E. level.
2. Necessary tools and equipment that are needed in teaching electrical related courses should be made available in other to give room for using PBL approach appropriately.
3. Required physical facilities and materials that are needed in teaching electrical related courses should be put in place for effective implementation and continuity of PBL approach.
4. Lecturers in Colleges of Education should adopt PBL approach in teaching electrical related courses that are practically oriented.

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EFFECT OF THINK-ALOUD PAIR PROBLEM SOLVING ON STUDENTS' ACHIEVEMENT AND INTEREST IN BASIC TECHNOLOGY

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Abstract: *This study evaluated the effects of think-aloud peer problem solving (TPPS) on students' achievement and interest basic technology. To carry out the study effectively, four research questions and six hypotheses were formulated and tested. A quasi experimental design, specifically the non-randomized control group pretest posttest design involving two groups – the control group and experimental group was used in this study. 6125 (JS3) students who offered Basic Technology in 2018/2019 academic year in Minna Educational zone formed the population of this study. The sample for the study consisted of 241 Junior Secondary three (JSS3) students of two co-educational secondary schools doing Basic Technology. The two-co-educational secondary schools were randomly drawn using balloting from four co-educational schools offering Basic Technology in Minna educational zone. Two intact classes were used for the study. In each of the sampled schools, all the JS3 students in the intact class randomly selected belonged to one group – either the experimental (TPPS) or control (TAT) group and thus received the same treatment. Two instruments, the Basic Technology Achievement Test (BTAT) and the Basic Technology Interest Inventory (BTII), were developed and validated. An internal reliability consistency of BTAT was found to be 0.75 using Kuder Richardson formula 20(K – R20) and that of BTII was 0.85 using Cronbach Alpha. The BTAT and BTII were administered as pretest to the two groups. Treatment lasted for one month of 12 lesson periods for each group. After the treatment session, the same instruments were rearranged and re-administered as posttest to the same subjects. The data obtained were analyzed using Means and Standard Deviation for research questions; while analysis of covariance (ANCOVA) was used in testing the hypotheses at 0.05 level of significance. The result of the analyses indicated that the effect of TPPS on students' achievement and interest in Basic Technology was significant. Gender was not a significant factor on students' academic achievement and interest in Basic Technology. Thus, it is recommended that teachers should adopt the use of TPPS in assessing students since it seemed to be more effective in improving students' achievement and interest in Basic Technology.*

Keywords: *Think-Aloud, Pair, Problem Solving, Achievement, Interest*

Introduction

Thinking aloud pair problem solving, which was first developed by Arthur Whimbey, aims to better understand thinking among the students *(*Whimbey & Lochhead, 2009*)* and to develop students' cognitive processes associated with problem solving. Thinking aloud pair problem solving is mainly based on thinking aloud and listening (Jeon *et al.*, 2015). As the name suggests, this involves students working in pairs. One student (the problem solver) is required to read the problem aloud and think aloud during the problem solving process, which includes verbalizing everything they are thinking and doing. Another student (the listener) attends to the problem solver's thinking and reminds him/ her to keep saying aloud what he or she is thinking or doing, while also asking for clarifications and pointing out errors being made. It is important to highlight that listeners are not allowed to attempt to solve the problems or give correct answers. Instead of merely imitating worked examples, this instructional method focuses on helping the students learn by being aware of their thinking process in tackling mathematics problems. Students are not always able to express their mathematical understanding in detail. Often, answers from the students were given in the form of one word or sometimes, keywords. Thinking aloud during problem solving may reveal much more about the students' personally constructed understanding compared to assessing them from their written works (Jeon *et al.*, 2015). However this may also be restricted to how well the students are able to express their thinking process verbally.

Jeon *et al*. (2015) observed in their investigation on the effectiveness of TAPPS in improving problem solving performance of high school chemistry students that students in both the individual and TAPPS groups performed better in problem solving compared to the control group. They found that students in the individual and TAPPS groups performed better in recalling the related law and mathematics execution. The students in TAPPS group also performed better than the others on conceptual knowledge. Jeon *et al.* (2015) also stated that the verbal interactions between the solvers and listeners could help the students be "more cognizant of both their own thinking and the thinking of other students". However, they discovered that listeners seemed to gain more benefits from TAPPS than the problem solvers. They found that listeners' 'pointing out' behaviour showed the greatest correlation with their own problem solving performance; listeners' 'agreeing' behaviour to the solvers' statements was also positively correlated to the listeners' problem solving performance. In this study, we investigated the effects of conducting Think-aloud Pair Problem Solving (hereafter, referred to as TAPPS) in a mathematics classroom on students' mathematics achievement in Brunei Darussalam. We also explored whether thinking aloud has any significant effects on students' problem solving performance. Different teaching and learning approaches in Basic Technology have been investigated and were found useful but students' poor achievement in Basic Technology still persisted. For instance, Onwubiko (2011) applied the Student Centered Teaching Approach while Akudolu (2013) and Anekwe (2016) applied the Computer Assisted Instruction and Constructivist Based Instructional Model respectively. The findings of their studies proved to have significant effects on students' achievement in Basic Technology. Despite their findings, students have not improved in their Basic Technology achievement. Offorma (2010) observed that class one Junior Secondary School (JSSI) students are very enthusiastic about Basic Technology and the enthusiasm lingers on and starts to dwindle from Junior Secondary class three (JS3). Akudolu (2013) made a similar observation that the exodus of students from Basic Technology class occurs mostly in the Junior Secondary School (JSS) after the students have learnt basic technology for at most three years.

Interest has been defined by Anderson *et al.* (2008) as "the capacity to evoke an emotional response". It is this emotional response that sustains the quests for learning. Olikeze (2009) defined interest as "a persisting tendency to pay attention and enjoy some activities; or content is of interest if it's pleasing and engages one's attention". Anderson *et al* (2008) added that "interest increases attention which, in turn increases learning." However to test the statement, they conducted a series of experiments and found out that even when the factor of attention was removed, that interest was enough to promote learning. They also found out that as regards to language learning, interest has a profound positive effect on the learning of sentences and the students' reading time. Akudolu (2013) explained that "educationists all over the world emphasize the need to consider the learners' interest in the learning process". According to Akudolu (2013), Tyler was one of early curriculum specialists who popularized the place of the learners' interest in the curriculum planning, development and implementation. A learner needs to have interest in the target language for the learning to be effective. To what extent would students' interest be sustained when taught Basic Technology using think-aloud pair problem solving (TPPS)? This gap in knowledge underscores the need to investigate the influence of think-aloud pair problem solving and Teacher Assessment Techniques on students' interest in Basic Technology. Gender issues have arisen in studies carried out on many subjects in school curriculum. Findings from research carried out by Harding (2012) indicated that school curriculum and learning activities carry with it large dose of gender bias. Anekwe (2016) mentioned that the science and mathematics curricula are most frequently cited. He explained that such content area of force, gravity, pendulum, thermodynamics are closer to experiences boys would have or may have in the course of their development. Gender differences exist in career choice. It is observed that boys choose careers that can take them to top management or prestigious positions such as law, engineering, medicine, while girls go for careers in caring and service sector. The issue of concern is the embedded belief that some careers are exclusive to either sex, a trend which limits individual's options and robs the society of possible benefits. Hence, learners react differently to instructions and instructional materials due to gender.

Statement of the problem

Students' poor achievement in Basic Technology over the years in both internal and external examinations in the Junior and Senior Secondary Schools has attracted a lot of concern. Based on the observed poor achievement, a number of methods of teaching designed to stimulate students' interest and learning of Basic Technology had been suggested and tried out by researchers in Nigeria. Despite these useful strategies, students' have not yet improved in their academic achievement. Since the teachers have made use of different instructional methods without the students improving in the academic achievement, perhaps an assessment technique like think-aloud pair problem solving could be of help. Think-aloud pair problem solving encourages students' active participation in their own learning and motivates students learning. Students' participation includes contributing during discussions, initiating ideas, clarifying points among students, students paying individual attention to their fellow students, asking and answering questions. All these will be done under the supervision and direction of the teacher. The role of the classroom teacher in Nigerian Secondary Schools does not give students the opportunity of being involved in their own learning. The 'chalk and talk' practice prevalent in Nigerian Secondary Schools has made the role of the student a passive one. The student is regarded as the recipient of learning while the teacher is the giver. Onukaogu and Arua (2010) saw the student in this regard, as one who "sits and swallows what the teacher has to give in terms of narration, exposition, instruction, classification, definition, etc". When the teacher needs to assess the success or the failure of the learning experience through class exercises, mid-term test or examination, the material is regurgitated on demand. Some studies have been conducted in the area of gender – related differences in the academic achievement and interest of students in the different learning method. It was discovered that in some cases (Anekwe, 2016; Akudolu, 013), there is no gender difference in students academic achievement and interest while in some, gender difference abound. The contradictory results/reports in academic achievement and interest due to gender has led to the need to find out the influence of TPPS on students' achievement and interest, by gender, in Basic Technology.

Research Questions

The following four research questions were posed to guide the research.

1. To what extent would any of the two assessment techniques, Think-aloud Pair problem solving (TPPS) and Teacher Assessment Technique (TAT) enable students to have higher academic achievement as indicated by their mean scores in Basic Technology Achievement Test (BTAT)?
2. Which group, male or female students has higher academic achievement as indicated by their mean scores in BTAT?
3. Which group of students, those assessed with TPPS or those assessed with TAT showed greater interest in Basic Technology as indicated by their mean scores in Basic Technology Interest Inventory (BTII)?
4. For male and female students, which group showed greater interest in Basic Technology as indicated by their mean scores in the BTII?

Hypotheses

Based on the research questions, the following null hypotheses are put forward in this study to be tested at $p<0.05$ level of significance.

Ho_1: There is no significant difference in the BTAT scores of students exposed to think-aloud pair problem solving and those exposed Teacher Assessment Techniques.

Ho_2: There is no significant difference in the mean BTAT scores of male and female students exposed to think-aloud pair problem solving and those exposed to Teacher Assessment Techniques.

Ho_3: There is no significant difference in mean interest scores of students exposed to think-aloud pair problem solving and those exposed to Teacher Assessment Techniques as determined by the use of BTII.

Ho_4: There is no significant difference in the mean interest scores of male and female students exposed to think-aloud pair problem solving and those exposed to Teacher Assessment Techniques as determined by the use of BTII.
Ho_5: There is no interaction effect of gender and assessment techniques on the achievement of students in Basic Technology as measured by their mean achievement scores in BTAT.
Ho_6: There is no significant interaction due to exposure to assessment techniques and gender as measured by their mean interest scores in the BTII.

METHODOLOGY

The design is a quasi-experimental design. Specifically the design used is the non-randomized control-group pretest-post-test-design involving two groups - the experimental group and the control group. This study was conducted in Minna educational zone. The target population comprised of all the Junior Secondary School class three (JSS 3) students doing Basic Technology in all the state owned co-educational secondary schools in Minna educational zone. Two out of the four co-educational schools doing Basic Technology in the area of the study were randomly sampled using balloting. Using co-educational schools will enable the researcher obtain a true record of gender interaction. Two instruments were used for data collection in this study, which are; Basic Technology Achievement Test (BTAT) for JSS 3 and Basic Technology Interest Inventory (BTII) for JSS 3. The instrument was validated by two experts in Industrial and Technology Education Department, Federal University of Technology, Minna.

The reliability of internal consistency of BTAT was determined using the Kuder Richardson Formula 20(K-R20) technique. The procedure helped to establish the internal consistency of the BTAT items. The researcher administered the BTAT to 65 JSS 3 Basic Technology students of Government Secondary School, Bida. These students' scores were used to compute the coefficient of internal consistency of BTAT. Establishing this form of reliability for the BTAT was considered necessary since items were aggregated into a composite score for each individual. This practice presupposed that the items are homogenous. The reliability index of r = 0.75 was obtained for the BTAT and 0.85 for BTII.

The two instruments for collection in this study (BTAT and BTII) were administered to the students before the experimental treatment. Students' scores in this first administration served as the pretest of the study. After this, the treatment and control condition commenced. The teaching period of the research lasted for one month of twelve lesson periods.

The research questions were answered using mean and standard deviation. The hypotheses were tested at 0.05 level of significance Analysis of Covariance (ANCOVA).

RESULTS

Research Question 1:

To what extent would any of the two assessment techniques, Think-aloud Pair problem solving (TPPS) and Teacher Assessment Technique (TAT) enable students to have higher academic achievement as indicated by their mean scores in Basic Technology Achievement Test (BTAT)?

Table 1: Means and Standard deviation of Pre-test and Post-test scores of students in BTAT by treatment and gender

Treatment		Gender Pretest Male	Pretest Female	Overall Mean	Gender Posttest Male	Posttest Female	Overall Mean
	Mean	41.69	45.83	43.76	59.67	63.48	61.58
Experimental	SD	14.98	14.07	14.52	12.07	12.50	12.28
(TPPS)	N	58	65	123	58	65	123

	Mean	43.33	46.97	45.15	46.61	49.73	48.17
Control	SD	13.96	13.32	13.64	12.79	8.90	10.85
(TAT)	N	43	75	118	43	75	118

The overall mean post-test score of the students taught using Think-alound Pair Problem Solving (TPPS) was 61.58 with standard deviation (SD) of 12.28. The group taught using Teacher Assessment Technique (TAT) had an overall mean post-test score of 48.17 with SD of 10.85. The difference between the experimental group and control group was 13.41. This suggested that students assessed with PAT have higher academic achievement than students assessed using TAT.

Research Question 2:

Which group, male or female students has higher academic achievement as indicated by their mean scores in BTAT?

With regards to influence of gender in Table 1, the male students taught with TPPS had a mean posttest score of 59.67 with a standard deviation of 12.07 while the female students had a mean posttest score of 63.48 with a standard deviation of 12.50. Also the male students in the control group (TAT) had a mean posttest score of 46.61 with a standard deviation of 12.79 while their female counterparts had a mean posttest score of 49.73 with standard deviation of 8.90. The differences in the mean scores 2.81 for TPPS and 3.12 for TAT were in favour of the females and this appears to indicate that female students scored higher than the males in BTAT.

Research Question 3:

Which group of students, those assessed with TPPS or those assessed with TAT showed greater interest in Basic Technology as indicated by their mean scores in Basic Technology Interest Inventory (BTII)?

Table 2: Mean and Standard Deviation (SD) of Pre and Post-test scores of students in BTII by treatment and gender

Treatment		**Gender Pretest**			**Gender Posttest**		
		Pretest Male	**Pretest Female**	**Overall Mean**	**Posttest Male**	**Posttest Female**	**Overall Mean**
	Mean	45.36	48.92	47.14	56.28	73.06	64.67
Experimental	SD	12.60	11.76	12.18	11.11	16.71	13.91
(TPPS)	N	58	65	123	58	65	123
	Mean	46.23	49.35	47.79	49.19	50.53	49.86
Control TAT	SD	13.40	11.71	12.55	11.87	10.26	11.06
	N	43	75	118	43	75	118

Table 2 showed that the students assessed using TPPS recorded higher overall mean interest score of 64.67 with a standard deviation (SD) of 13.91 while students taught using TAT had a less overall mean interest score of 49.86 and a SD of 11.07. It seemed that the experimental group (TPPS) showed more interest in Basic Technology than the control group (TAT) as indicated in their overall mean interest score in BTII.

Research Question 4:

For male or female students, which group showed greater interest in Basic Technology as indicated by their overall mean scores of BTII?

The post intrest mean score of the female students in the experimental (TPPS) group was 73.06 with a SD of 16.71 while that of male students was 56.28 with a SD of 11.11. On the other hand, the post intrest mean score of female students in the control group (TAT) was 50.53 with a SD of 10.26 while that of the males was mean intrest score 49.19 and a SD of 11.87.

In order to make decision on students' academic achievement based on the use of PAT and TAT in teaching secondary school Basic Technology, hypothesis 1 was tested.

Hypothesis 1:

Ho_1: There is no significant difference in the BTAT scores of students exposed to think-aloud pair problem solving and those exposed Teacher Assessment Techniques.

Table 3: Analysis of Covariance (ANCOVA) of students' overall Post Achievement mean scores in BTAT (Assessment Technique and Gender)

Source of variation	Sum of squares	Df	Mean square	F calculated	Sig. of F	F table
Corrected model	28633.34	4	7158.34	125.71	.00	
Intercept	16343.68	1	16343.68	287.02	.00	
Pretest	17603.35	1	17603.35	309.14	.00	
Sex	65.80	1	65.80	1.16	.28	3.96
Treatment	11720.53	1	11720.53	205.83	.00	3.96
Sex x treatment	2.01	1	2.01	.04	. 85	3.96
Error	13438.59	236	56.74			
Total	778375.00	241				
Corrected Total	42071.93	240				

The F calculated for assessment techniques in BTAT was 205.83 at the 0.05 level of significance and 236 degree of freedom (df) while the F critical value was 3.96. Since F calculated (205.83) was greater than f critical (3.96), the decision was to reject the null hypothesis. This implies that there is a significant ($P<0.05$) difference between the two assessment techniques (TPPS and TAT) as measured by the students' mean BTAT scores using Analysis of Covariance (ANCOVA). This appears equally to suggest that the early observed difference between the means of the two groups was not attributed to chance error but due to the treatment.

Hypothesis 2:

Ho_2: There is no significant difference in the mean BTAT scores of male and female students exposed to think-aloud pair problem solving and those exposed to Teacher Assessment Techniques.

Table 3 revealed that gender is not a significant factor on students' academic achievement in BTAT. The F calculated for gender was 1.16 against a table value of 3.96 for 1df for numerator and 236 df for denominator at the 0.05 level of significance. Therefore, the null hypothesis of no significant difference on the effect of gender in the mean achievement of male and female students was upheld. This meant that though female students appeared to achieve more than their male counterparts, the achievement was not statistically different.

Hypothesis 3:

Ho_3: There is no significant difference in mean interest scores of students exposed to think-aloud pair problem solving and those exposed to Teacher Assessment Techniques as determined by the use of BTII.

Table 4: Analysis of Covariance (ANCOVA) of students' overall Post-Interest mean scores in BTII (Assessment Techniques and Gender)

Source of variation	Sum of squares	df	Mean square	F calculated	Sig. of F	F table

Corrected model	35421.46	4	8855.36	5.44	.00	
Intercept	12070.25	1	12070.25	7.41	.01	
Pretest	12996.91	1	12996.91	7.98	.01	
Sex	2820.71	1	2820.71	1.73	.19	3.96
Treatment	13343.06	1	13343.06	8.19	.01	3.96
Sex x treatment	3323.81	1	3323.81	2.04	.15	3.96
Error	384387.61	236	1628.76			
Total	1223588.00	241				
Corrected Total	419809.06	240				

The F calculated for assessment technique was 8.19 against the critical value of 3.96 at the 0.05 level of significance, 1 df for numerator and 236 df for denominator. Since the calculated value exceeded the critical value, the null hypothesis of no significant difference in the mean interest scores is rejected. It is therefore inferred that the effect of think-aloud pair problem solving on students' interest in Basic Technology is significant.

Hypothesis 4:

Ho_4: There is no significant difference in the mean interest scores of male and female students exposed to think-aloud pair problem solving and those exposed to Teacher Assessment Techniques as determined by the use of BTII.

Table 4 revealed that gender was not a significant factor in students' overall interest in Basic Technology. The F ratio calculated was 1.73 against a table value of 3.96 at the 0.05 level of significance, 1 df for numerator and 236 df for denominator. Therefore the null hypothesis of no significant difference on the effect of gender in the mean interest score of male and female students was not rejected. This meant that the female students' interest was not statistically different from the male students' interest.

Hypothesis 5:

Ho_5: There is no interaction effect of gender and assessment techniques on the achievement of students in Basic Technology as measured by their mean achievement scores in BTAT.

The Analysis of Covariance (ANCOVA) of the students' overall achievement scores presented in Table 3 showed that the interaction effect due to assessment technique and gender (sex x treatment) was not significant. The calculated F-ratio of 0.04 was less than the table value of 3.96 for 1 df for numerator and 236 df for denominator at the 0.05 level of significance. Therefore the null hypothesis of no significant interaction effect of gender and assessment technique was upheld.

Hypothesis 6:

Ho_6: There is no significant interaction due to exposure to assessment techniques and gender as measured by their mean interest scores in the BTII.

As could be seen from table 4, the interaction due to assessment technique and gender was not significant. The calculated F-ratio was 2.04 against a critical value of 3.96 at the 0.05 level of significance, 1 df for numerator and 236 df for denominator. This then meant that the effect of assessment technique was consistent across the levels of gender. Therefore the null hypothesis was not rejected.

DISCUSSION OF RESULTS

The study has revealed that students taught using TPPS achieved significantly better than students taught using TAT. The higher achievement of students taught using TPPS could be attributed to the fact that the students were involved in their own learning starting from setting of criteria to assessment of their fellow students' work. This could excite them and boost their enthusiasm to learn Basic Technology. Oboh (2008) noted that peer assessment encourages creativity on the part of the students, promotes students' independence and limits teacher's interference on students' output. The students' achievement in peer assessment could be explained on the basis of expectations from fellow students, coupled with the fact that a student's achievement will be made known to other students.

The above finding appears to be consistent with that of Anekwe (2016) and Akudolu (2013). They observed that students' achievement in Basic Technology were statistically significant using the Constructive Based Instructional Model (CBIM) and Computer Assisted Learning (CAL) respectively. The works of Agbaegbu (2011), Ifeakor (2012) and Anaekwe (2016), were also consistent with the above finding. They studied on the effects of peer assessment techniques on students' cognitive achievement in their different subject areas and found out that the students' cognitive achievement using TPPS was statistically significant. However, the finding of this study with respect to cognitive achievement in Basic Technology contradicts those of Onwubiko (2011) in which they reported that the teaching approaches he studied using Basic Technology, were not statistically significant to the conventional teaching method. Peer assessment exposes students to the skills of critical reflection and analysis and increases students' confidence in their ability to perform according to special criteria, as well as their awareness of the quality of their work.

The result of the research question revealed that female students had a higher mean score on achievement than their male counterparts but how significant is the difference in the achievement of males and females. Evidence from the analysis in table 3 confirmed that the difference was insignificant. Though the female students appeared to achieve more than their male counterparts, the difference in achievement was not statistically significant. Hence gender was not a significant factor in this study. This finding could be as a result of learners' much involvement in the learning. It could also have resulted from the fact that TPPS was new to all the students. So all the students, irrespective of gender were excited with TPPS. Subsequently each student performed as best as he could. Anekwe (2016) and Akudolu (2013) had similar findings. They found out that gender had no effect on the achievement of students in Basic Technology learning instructions like the Contextual Teaching Method (CTM) and CBIM. Nevertheless, some contradictory findings were reported in gender related differences in achievement. Akudolu (2013) in his study, found out that girls achieved better in mixed-ability pairing than in like-ability paring.

The study has revealed that students taught using Think-aloud Pair Problem Solving (TPPS) showed significant interest in Basic Technology than those taught using Teacher Assessment Technique (TAT). The finding of this study in respect to students' interest with regards to assessment techniques agrees with that of Agbaegbu (2011), who observed that the mean interest score of students in the peer assessment group was greater than the mean interest score of students in the teacher assessment group. Also in agreement with the findings of this study in respect to students' interest in Basic Technology is the finding of Anekwe (2016) on the Effects of Constructivist –Based Instructional Model (CBIM) on students' Interest and Achievement in Basic Technology. He observed that students taught with CBIM (experimental) showed greater interest in Basic Technology than those taught with TCM (control). This means that modes of assessment and instruction have significant effect on the interest rating of students. Akudolu (2013) observed on the contrary in his finding, that mode of instruction had no significant effect on the interest rating of the student.

The study revealed that gender was not a significant factor in students overall interest in Basic Technology. Though the female students tended to show more interest than their male counterparts, their better interest ratings were not statistically different. This finding is in consonance with that of Anekwe (2016) in which he reported that students' interest in Basic Technology was significantly independent of sex. However, it appeared to contradict the findings of Anaekwe (2016) and Ifeakor (2012) who reported statistically significant effect of gender on students' development of interest in chemistry and Biology respectively. They noted that female students showed greater interest than male students.

Some studies on gender influence on students' interest in arts subjects were of the opinion that girls were inclined to arts than boys. Boys, as it was reported by Ifeakor (2012) and Akudolu (2013), are more exposed to scientific activities very early in life than girls. Moreover, they are encouraged to enter for science related professions like engineering and technology while girls go for Biology, Home Economics, Basic Technology and other allied subjects. In this study, though female students manifested greater interest than their male counterparts, it was very minimal and therefore negligible because it was not statistically significant. It was therefore upheld that gender

was not a significant factor in students' interest in Basic Technology. This would imply that the use of TPPS might reduce or eliminate gender related differences in students' interest towards Basic Technology.

The interaction effect of treatment and gender on students' overall cognitive achievement in Basic Technology was not significant (Table 3). This is in agreement with the findings of Anaekwe (2016) and Agbaegbu (2011) in which they reported that the combined effect of assessment technique and gender on overall cognitive achievement in chemistry and geography respectively were not significant. However, this disagrees with Ifeakor (2012) who found a significant interaction effect between gender and assessment technique on students' achievement in chemistry.

On the combined effect of Think-aloud Pair Problem Solving and gender on students' interest in Basic Technology, there was no significant effect. This conformed with Agbaegbu (2011) who found the combined effects on TPPS and gender on students' interest towards Geography not significant. This meant that the efficacy of TPPS on students' interest was consistent across sex levels.

From the findings of this study, it could be deduced that with an innovative assessment technique like TPPS in which male and female students have shown equal interest, they could equally attend to high standard in Basic Technology achievement.

Conclusion

The study had shown that TPPS has significant effect on students' cognitive achievement and interest in Basic Technology. The TPPS enabled students to learn more Basic Technology grammar than their counterparts who were taught using the TAT. The TPPS appeared to be more efficacious than TAT in engendering the aforementioned criterion measure.

The influence of gender on cognitive achievement in Basic Technology was not significant though the female students tended to exhibit superior achievement over their male counterparts. The study indicated no significant gender influence on interest in Basic Technology but the female students tended to show more interest towards the subjects.

The combined effects of TPPS and gender on students' cognitive achievement and interest were not significant. Both male and female students demonstrated equal level of achievement and interest in the TPPS.

Recommendations

1. Since TPPS has been found to enhance the quality of achievement and interest in Basic Technology, Basic Technology teachers should be encouraged to employ it more in the teaching and assessment of the subject. By so doing, the students' achievement and interest in the subject could be increased.
2. Innovations like TPPS demand well-trained personnel and make training and retraining of staff imperative. Heads of teacher training tertiary institutions should include TPPS as one of the methods of evaluation and should impart the usage to the student teachers.
3. There should be no discrimination or gender factor in any teaching and learning situation. Both the male and female learners should be made to see themselves as co-learners and discrimination against sex must be sincerely avoided.
4. The Ministry of Education in Nigeria should organize seminars, workshops and conferences for Basic Technology teachers on how to use TPPS in teaching and evaluating students of Basic Technology. The same ministry of education should consider adopting TPPS for the purposes of promoting gender equality in Basic Technology classroom.

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SUB-THEME 3

TVET CURRICULUM FOR CLIMATE CHANGE INFORMATION NEEDS

INTEGRATING CLIMATE CHANGE INFORMATION NEEDS INTO TECHNICAL VOCATIONAL EDUCATION AND TRAINING CURRICULUM

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Abstract: *Technical Vocational Education and Training (TVET) is recognized as veritable tool for helping people to acquire technical knowledge and vocational skills necessary for economic development. TVET programmes at different levels of education are guided by a curriculum. The curriculum comprises of sets of activities planned and unplanned which the learner is exposed to under the guidance of a school to effect a change in individual's behavior. For a curriculum to remain relevant, it must be revised to embrace the changing needs of the learner and the society. Climate change is one of the problems facing humanity. It is the responsibility of curriculum planners and developers in TVET to source for information on climate change for inclusion in the TVET curriculum. This paper examined TVET curriculum for climate change. The paper recommended among other that TVET curriculum be consistently evaluated to pave way for its revision.*

Keywords: *Integration, Information Needs, Climate Change, Curriculum Process, TVET.*

Introduction

The Nigerian educational system in the past was centered on general education. General education teaches the citizens to understand and possess the survival mechanism within the society. It relates that aspect of school curriculum fashioned to inculcate to learners the competencies needed for everyday living. According to Umoh-Mac (2003) the products of general education are seekers of white-Collar jobs. Nigeria's education system which was characterized by academic curricula deficiency in vocational and technical skill development programme is today rich in academic and vocational programmes to enhance economic growth. Vocational subjects have been introduced in the secondary schools and teacher education curricula. Technical Vocational Education and Training (TVET) is different from general education. TVET prepares individuals in skills, knowledge, attitudes, abilities and competencies for specific occupations of social value. However, general education and TVET are integrated to complement each other. Nevkar (2012) defined TVET as skill-based programme designed for specific vocation. TVET upgrades unskilled individual to semi-skilled and semi-skilled to skilled. Skilled individuals are known to be intelligent consumers of modern technologies, creative and innovative. Skilled people are usually job creators rather than job seekers (Umoh –Mac, 2003). In preparing individual, TVET provides general and technical background that increases the individual understanding of the principles and theories of a field of work and practical background that enhances the development of skills and attitudes necessary for work. In Nigerian school system, pre-vocational subjects are taught to students at the basic education level to allow students explore a vast array of occupations before making a career. TVET comprises the following educational programmes. Agricultural evaluation, home economics Education, Health Occupation Education, Distributive Education, Business Education, Trade / industrial Education and technical education (Ozioma, 2011). TVET is among the vital tools a nation can use to address environmental issues and set it on the path of growth and development since TVET is designed to develop skills, abilities, understanding, attitudes and work habit, products of TVET tend to be creators of jobs. This helps the graduates to become self-reliance. Wodi and Dokubo (2015) state that there is need to revise the TVET curriculum to reflect needed society changes. According to Agus (2017) TVET institutions only emphasize on skills. The training institutions have to go beyond equipping graduates to acquire skills because climate change information is essential. Hence the need for TVET curriculum to embrace climate change information.

TVET curriculum for climate change

Education in general and TVET in particular, operate on a curriculum. The term curriculum seemed to convey many things to many scholars. To some, curriculum denoted a specific course, while to others it has meant the entire education environment. But as teachers who implement the curriculum at the classroom level, curriculum is a programme of curriculum and extra-curricular activities designed in a way that both students and curriculum implementers will attain educational objectives. According to Oyetunde (2002) the term curriculum is defined as all the learning which is planned and guided by schools, it consists of objectives, subject matters, materials, teaching materials and evaluation procedures. It must be recognized that curriculum encompasses more than a simple definition. Curriculum is an important element in the educational process; its scope is extremely broad, it touches virtually every aspect of human endavour that has to do with teaching and learning. Curriculum is not meant to be static because knowledge itself f is not static. It grows and changes therefore; there is always room for curriculum development. Curriculum development is the continuous identification, selection and arrangement of learning opportunities and the creation of curriculum materials with the appropriate teaching strategy which fits challenging conditions. There are current issues whose body of knowledge needs to be included in the TVET curriculum one of which is climate change. Climate change is one of the complex set of challenges confronting humanity. The intergovernmental panel on climate change (IPCC, 2007) reported that climate change will manifest in the following ways: rise in temperature, drought, desertification, flooding and rising sea level. Because of the impact of climate change, Moyinoluwa (2013) called for its inclusion in the school system.

Integration of climate change in TVET curriculum

TVET programme at all levels of education give room for students to acquire both general education and vocational skills. Integration of climate change in TVET curriculum will ensure effective and deep understanding of climate change. Heiss Hodge, Goodman, et al (2013) submitted that the complexities of climate change require it to be addressed using a holistic approach that draws upon a range of disciplines and areas of expertise including climate science, technology, policy law, ethic, sociology and culture, with the aid of effective and inclusive knowledge sharing approach. To promote climate change in TVET curriculum, it is crucial to strengthen teachers' and educators' capacities to deliver accurate information, integrate local content and promote critical thinking. This includes increasing their understanding of climate and sustainability issues as well as helping them develop necessary skills. Furthermore, materials such as teachers' resource guides, lesson models manuals and training modules. Books, cartoons and videos can be made available to teachers to help them inspire and empower students.

Climate change

It is no longer news that Climate change is happening. We now experience temperature rise, the patterns of rainfall are shifting, and sea level is continuously rising. These changes if not checked will continue. Though, the impacts and vulnerabilities of these changes differ across geographical locations, gender and socio-economic status, hazards such as floods and droughts will become more frequent and intense. Climate change is a variation in the natural status of climate. According to Iwuchukwu and Udoye (2014) climate change is said to be one of the serious threats that hampers sustainable development and its adverse effects can manifest on human health, food security and physical infrastructure. Considering the adverse effects of climate change, there is need to guard against it. To guard against and mitigate effects of climate change, a lot need to be done. Apart from enacting laws and creating awareness on the need to preserve natural resources and inhabitance; there is also the need to inculcate into the young one's environmental awareness on collective responsibility of safeguarding the climate for immediate and future consumption. Afun (2009) noted that without a quality environment, there can be no organized society or quality individual. An organized society is best described as a society that has laid down rules and regulations and whole citizens embrace education.

Information gathering is necessary for climate change curriculum development in TVET. According to Sani, Boadi, Oladokun and Kalusopa (2014) information generation is a process of creating, developing and communicating ideas which are abstract, concrete or visual. Curriculum developers in TVET need information from different disciplines. For instance, scientific information which is generated from universities and research institutes. Scientific information is targeted at providing information on climate, weather, drought and water stress periods, water sources, quality and availability. To ensure that TVET programme remains relevant to the changing needs of the learners and the society, the curriculum for TVET has to be subjected to constant development. Curriculum development means change, revision or modification of existing curriculum. This involves the process of evaluating the objectives for appropriateness and adjusting the content, materials, industrial / evaluation strategies and learning experiences to meet changing needs and times (Oyetunde, 2002). The task of curriculum revision is a serious exercise which requires information on the problems, needs, values, development policies and patterns of change that exist in a society. Information needed for TVET curriculum planning and development to mitigate adverse effect of climate change can also be accessed from:

1. ***Parents:*** Parents have a vision of what they want their children to become. For instance, if they want their children to become climate experts, they push for the study of climatology. Parents will also give necessary and vital information on how changes in climate affect them.
2. ***The society:*** Members of a society consider education as a means through which their culture is transmitted and transformed, such a society look up to the school and the curriculum as a means for enabling the rising generation to gain needed right and power to build a better society (Olaitan and Ali 1997). For instance, the persistence climate change in Nigerian society has affected crop yield that require new knowledge for tackling them. Information can be gathered from members of a society in form of abilities, skills, insight and knowledge that will enable each generation to function effectively in the society and assist the society in meeting t he needs of climate change. In the curriculum, needs are expressed in t he context of educational philosophy or objectives.
3. ***Students:*** Students undergoing formal education are expected to learn some appropriate ways of behaviour. This expectation cannot happen unless an individual acquires certain knowledge, skills, techniques and attitude which are stated to form curriculum goals. There are four types of goals in education. Cognitive, affective, synthesis and applicative. According to Olaitan and Ali (1997) educational goals form the basis for the provision of the content or learning experiences in the school curriculum.

Through assessment and evaluation, information can be gotten from students on how best concepts and theories taught to them relating to climate change can practically be applied. TVET curriculum information on climate change can also be found from newspapers, neighbours and friends, professional curriculum planners, developers and implementers, television, radio, environmental extension agents and personal observation (Okoro, 2012).

Conclusion

TVET has been recognized over the world as a tool for empowering people for sustainable livelihood and social economic development. TVET as an integral part of general education and instrument for promoting environmentally sound suitable development, need reliable and dependable information from different sources for its curriculum development. This is especially important for the inclusion into the existing TVET curriculum problems confronting the society. For instance, climate change with its attendant consequences of flooding, temperature rises, droughts and excessive sunshine are very important information to be included in TVET curriculum. The relevance of climate change information TVET curriculum cannot be over emphasized. This will help learners develop sensitivity to their surrounding and the natural environment. Climate change information in TVET curriculum will go beyond the mere importing of information but provide a working and approaches to address those issues.

Recommendations

1. The society, parents, students and research institutions should always be contacted when sourcing for information on issues of climate change in Nigeria for curriculum development.
2. There should be strong partnership between experts in TVET, Federal Environmental Protection Agency, Federal Ministry of Education and other stakeholders' in environmental education in carrying out climate change literacy programmes for formal and non-formal education.
3. TVET curriculum for climate change should consistently be evaluated to pave way for its revision.

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MITIGATES OF CLIMATE CHANGE ON TECHNOLOGY EDUCATION AND VOCATIONAL TRAINING IN NORTH EASTERN NIGERIA

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Abstract: *This paper examines the impact of climate changes as a challenges on [Technology Vocational Education and Training (TVET)] skills development and delivery. These Highlights some of its causes and to mitigate emission of greenhouse gases mean as symptoms of global warming; includes more than just a changes in weather but it involves seasonal variation on changes over long period. This justifies why human induced changes affect TVET Institutions. TVET moves towards skill acquisition for gainful employment and has undergone a fine tuning in order to make it a credible alternative to general education. Recommendation were made to reduce climate change impact. On way forwards; incorporation of climate change issue into curriculum of TVET to optimize human resource for Green skills and Green Jobs improvement. The Training and Re-Training in establishing weather stations in every institutions for data acquisition on regular monitoring of the climate were also recommended as innovative teaching approaches that would be learners-centered inquiry- based teaching, about climate change.*

Keywords: *Greenhouse, Mitigation, Environment, TVET, Climate Change*

Introduction

Change is an alteration of something or situation from the original standpoint, but Season set to changes from rainy to dry and from dry to rainy or temperature wise from cold to hot. Changes equally affects climate". The Nigeria nation leaves under various climatic conditions, because of the country's Topography. North-Eastern population, mostly experience very harsh climatic conditions that limit agricultural activities, while Southern area are more of oil producing area as in crude oil exploration, which resulting in increases the rate of climate change by emission of heat and soot from industries. Climate according to American Heritage Dictionary as the general or average weather conditions of a certain region, including temperature, rainfall, and wind. On Earth's climate is most affected by latitude, the tilt of the Earth's axis, the movements of the Earth's wind belts, the difference in temperatures and land, sea, and topography.

Human activities; especially relating to action and depletion of Ozone Layer, is also an important factors on climate change. Climate change "affect more than just a change in weather, it refers to seasonal changes over long period, and these patterns play a fundamental role in shaping natural ecosystem, and human economics and cultures that depend on the human activities. Ezeji (2011) asserted that climate change has some consequential effects on Technology and Vocational Education and Training (TVET). TVET according to Ezeji (2011) cited as in United Nations Education Scientific and Cultural Organizations (UNESCO) and the International Labour Organization (ILO) are those aspects of educational process involving in addition to general education, the study of technologies and related science, and acquisitions of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life.

UNESCO and ILO in Ezeji (2011) further classified Technology and Vocational Education and Training as:

1. An Integral part of general Education;
2. A means of preparing for occupation fields and for effective preparation in the world of work.
3. An aspect of lifelong learning and a preparation for responsible citizenship;
4. An instrument for promoting environmentally sound and sustainable development and;
5. A method of facilitating poverty alleviation.

Generally TVET moves towards skill acquisition for gainful employment But in recent development, the United Nations Summit in September 2015 adopted the post-2015 development agenda on Sustainable Development Goals (SDG) for the next 15 years with SDG4 focusing on the education 2030 agenda. This includes TVET skills for employment, decent jobs and entrepreneurship for youth and adults as an important sub-target. This will entail a transformation of the TVET sector both in reaching SDG4 and the wider goals of sustainable economies and society (Sofroniou, 2015). The Virtual Conference considers global frameworks and agreements of the UN Summit 2015 in New York at the UN climate Conference of Parties (COP21) in Paris as they challenge TVET to expand quality skills provision and to ensure skills relevance not only for the world of work, but also to support lifelong learning, inclusion of low-carbon transitions of economies and societies (Sofroniou, 2015).

Quest: "*How can we Mitigate Climate Change on TVET*?" to expand quality skills provision and to ensure skills relevance for the world of work, and to support lifelong learning, inclusion and low-carbon transitions of economies and societies. This is the thrust of this paper.

Causes of climate change

Climate change refers to a statistically significant variation in either mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). It's involve a shift of climatic condition to a new equilibrium position with values of climatic elements changing significantly (Adebayo, 2011). According to Adebayo that Inter-governmental Panel on Climate Change (IPCC) define climate change as any change in climate over time, whether due to natural variability or as a result of human activity. This implies that there are both natural and human factors causing climate change.

1. ***The Natural Factors:***
   (a) *Terrestrial causes such as the alteration in orientation of the earth,*
   (b) *Extra-terrestrial causes such as the solar activities, etc*
2. ***The Human Causes:***
   (a) *Emission of Green-House Gases and Aerosols, changes in land use and the depletion of Ozone Layer through various human activities such as industrialization, urbanization, and agriculture; land use clearance amongst others.*

The outcome of these human induced changes is global worming which is the most visible symptom of global climate change which consequently affect TVET. In Simplified perspective; Global Warming also refers to increase in the average temperature of the atmosphere; such as Oceans, and Land masses of the earth etc. The chief causes of global warming is the concentration of greenhouse gases in temperature. The greenhouse gases include carbon dioxide, Chlorofluro Carbon (CFC), Methane, Nitrous Oxide etc. The contribution of these gases according to Adebayo (2011) are as follows:

- Carbon Dioxide-55%
- Clorofluro Carbon (CFC)-24%
- Methane-15%
- Nitrous Oxide-6%

All these gases in the atmosphere act as a blanket which prevents the escape of the long wave radiation into space. Consequently, the proportion of the long wave radiation bouncing back to the earth surface is increasing and hence the earth is becoming warmer.

How human contribute to climate change

It is believed that developed countries through their industrial activities contributed more than 95% to greenhouse emission which is the chief cause of global warming. However, decisions taking about natural resources (use of natural resources) in developing countries also contribute to climate change. We in Nigeria also contribute to climate change through the following ways or practices:

1. Use of Fossil Fuel (Petroleum Product)
2. Deforestation (through fuel wood harvesting, lumbering) which increase carbon dioxide in the atmosphere
3. Land degradation due to soil erosion, over cultivation, overgrazing, bush burning, burning of motor car tires etc
4. Agricultural activities such as use of fertilizer and pesticides which release nitrous oxides into the atmosphere.
5. Rearing ruminant cattle which emit methane gas into the atmosphere
6. Combustion of wood and charcoal use for domestic cooking also release a lot of carbon dioxide into the air as the end product

Impact of climate change on TVET and education

Human being as an existing living creature is one of the social factor that are contributing to the force of energy and to climate change occurrence. These are due to the activities involve in society that increases the level of concentration of greenhouse in the atmosphere. This is an activities of industrialization that arises due to TVET knowledge and skill such technology and scientific application on Cement production, construction industries like road construction, mining industry etc. Adebayo, (2011) Adebayo further stated that directly or indirectly, climate change exerts tremendous impact on education. Climate change threatens to destroy infrastructure, tools and equipment in schools and increase the cost of maintenance as well as disrupting academic activities. Climate change also increases the displacement and migration of families thus disrupting and limiting education opportunities. Climate change worsens health primarily through: Increased vulnerability to poor health due to reduced food security and water security; water-borne diseases associated with reduced water quality due to floods and drought.

Impact of climate change on TVET environment

Nigeria Climate Change, as discussed at the UN Climate Conference of Parties (COP15) has itemized some targets for vision 2020 as an indicative of its desire to achieve two broad objectives over the medium to long term as follows:

1. Optimize her human and natural resource potentials to achieve rapid and sustained economic growth.
2. Translate economic growth into social development that guarantee a dignified and meaningful existence for all her citizen.

The UNESCO (2014) Roadmap for Implementing of the Global Action Programme on Education for Sustainable Development places special emphasis on groups that are particularly vulnerable to the impacts of climate change and development which is unsustainable. These groups include both individuals such as girls and women facing persistent exclusion and inequality, as well as countries that are be hardest hit by climate change such as the Small Island Developing States. The continent of Africa experiencing rising sea levels and climate extremes such as droughts and desertification impact on the livelihoods and wellbeing of their citizens are also affected.

COP21 currently includes Pledges from 154 countries' National Climate Change Plans yielding expected global temperature at 2.5°C to 3°C above preindustrial levels by the year 2100. (Sofroniou, 2015). These Pledges are to be reviewed after 5 years. This may be considered good news because of the commitments being made to limiting emissions to 4Gtonnes CO2 (by 2030). However, the expected global temperature corresponding to these Pledges is above 2 °C ceiling thought necessary to avoid the most serious consequences of global warming so further economic and societal adaptation required to reach such level. All these mentioned targets can be achieved by incorporating climate change into curriculum of TVET to optimize human resource and improvement of their skills acquisition.

That is to say that GREEN SKILLS (knowledge, abilities, values and attitudes) needed to live in, develop and support a sustainable and resource-efficient society and GREEN JOBS (Jobs that contribute to preserving or restoring environmental quality, while also meeting longstanding demands and goals of the labour movement, such as adequate wages, safe working conditions and workers' rights (CEDEFOP, 2012). Climate change compounds Nigeria's human development challenges in fundamental ways. The country's agriculture is independent on climatic patterns, the rapid southern expansion of Sahara Desert has compounded access to water, increase incidences of drought, desertification and exacerbate the degradation of agricultural land and yields. Nigeria and Climate Change: COP15, over past decade, involves Nigeria Hydropower stations that witnessed a steady decline in the availability of water exacerbating existing power crises in the country which is another impact of climate change on TVET. TVET Challenges in relation to the impact of climate change in its environmental changes lies on the functions of the product of technological knowledge like air conditioning system, heating element (heaters) and other electrical appliances that emits and dissipate heat adiabatically or isothermally. Binta (2008), stated that generally, nations of the world including Nigeria accept the fact that the growth of the nation depends on what is generally guided by its advancement in science and technology.

Mitigating the impact of climate change on TVET

The word Mitigate means in explicit perspective; is to reduce, lessen or decrease. i.e to say to downplay, diminish, ease, lighten, In implicit Antonyms; aggrandize, aggravate, exacerbate, incite, increase, intensify, irritate, worsen etc. However, going with synonyms; the case maybe vice versa. But mitigation is to relief or alleviation. To achieve mitigation on climate change impact there is needs involving; "students, teachers/lecturers, school administrators and parents which can all play key roles in reducing greenhouse gas emissions and thereby reducing climate change impacts" through researches. According to Adebayo, (2011), Students can explore the interest and visit sites that provide games that helps students, their parents and their teachers learnt about both the science of climate change and what actions they can take to reduce greenhouse gas emissions. High school students can investigate the link between everyday actions at their school, greenhouse gas emissions and climate change. There are limitation on current and future emissions from man-made sources of greenhouse gases by enhancing the potential sinks of greenhouse gases. These are adaptation or accommodating the impacts of climate change. Accommodating is adjustment made whether positive, negative or anticipatory in response to anticipated or actual consequence of climate change. However, at all academic level students play essential role in mitigating/reducing greenhouse gas emissions by getting involved in such mitigation activities like; tree planting, waste management., organic agriculture to burst teaching /learning activities.

Conclusion

The climate change is one of the global burning issue that has greatest effect on environment. Its impact is felt in all educational facets of life including TVET. Mitigating climate change is required urgent attention to optimize human resource and improvement of their GREEN SKILLS (knowledge, abilities, values and attitudes) needed to live in, develop and support a sustainable and resource-efficient society that would enhanced GREEN JOBS; (Jobs that contribute to preserving or restoring environmental quality. While on meeting longstanding demands and goals of the labour movement, such as adequate wages, safe working conditions and workers' rights are required. One major task for educator/administrator is the incorporation of climate change issue into curriculum of TVET to optimize human resource and improvement of their skills acquisition.

Recommendations

1. Training and re-training in establishing weather stations in every institutions for data acquisition for regular monitoring of the climate should be given more consideration.
2. TVET should apply innovative teaching approaches that are learners- centered as such as; inquiry- based teaching, about climate change.

3. Inculcate to the TVET trainees about climate change and ecosystems.
4. Engage students in estimating emissions etc

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INTEGRATION OF GREEN SKILLS INTO ELECTRICAL INSTALLATION AND MAINTENANCE WORK CURRICULUM OF TECHNICAL COLLEGES FOR SUSTAINABLE ENVIRONMENTAL PROTECTION

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Abstract: *The study was guided by two purposes and two research questions. Descriptive survey research design was used. The population of 47 respondents which are teachers of EIMWT from seven Government Science and Technical Colleges in Gombe state was used. Due to the manageable size of the population, the entire population was used, no sample and sampling techniques for the study. Structured questionnaire titled QIGSCEIMWTTC was used for data collection. The instrument was validated by three experts and has reliability of 0.98. Data collected was analyzed using SPSS where mean and standard deviation was used to answer research questions. Finding of the study revealed that the general green skills content were all found relevant and accepted by teachers for inclusion in EIMWT Curriculum of Technical Colleges. It was recommended among others Ministry of education should organized workshops and seminars for teachers on teaching green skills.*

Keywords: *Green Skills, Curriculum Implementation, Sustainability, Environmental Protection*

Introduction

The term environment symbolizes entire external, physical and biotic factors influencing the life and behavior of all living things. Hence it is paramount the environment in which land, water, human beings, plants and animals are components to be protected from deterioration to maintain balance (Albu, 2013). The united kingdom environmental protection act (1990) stated that environment encompasses water, air and land and the inter-relationship that exist among and between water, air, land and human beings, other living creatures, plants, micro-organism and property. The utilization of these environment components by human beings in producing and developing human capital resources, and meeting the demand of the society through technology in various sector has produce many damages to the environment (Albu, 2013).

In 21st century, the technology advancement has led to great problem such as production of chlorofluorocarbons, emission of carbon monoxide, green house effects, global warming, solid waste generation and deforestation etc. In recent year can concern have been shifted by developing countries towards oriented environment and preserving natural resources, protecting life and ecological diversity. (Mokhtar, Mokhtar, Mokhtar and Mokhtar, 2018). The world had endured vast environmental changes which were belief to be as a result of human activities. The quality of environment is drastically decreasing due to reduced quality of air, water soil, increased ocean pollution, wildlife extinction, loss of biodiversity and violent increased and sudden changes in the features of the earth (Abbas and Singh, 2014). Pavlova (2016) stated that sustainable environment protection require diverse range of skills, such as recycling energy sources, waste management, conservation of natural resources as well as environmental maintaining.

The term 'green skills' is relatively a new term which appear with the advent of green technologies (Sern, Zaine & Foong, 2017). Green skills are needed to deal with environmental pollution and climate change. Green skills as define by Kamis, Alwi, Ismail, Zakaria and Yunus (2017) refers to the abilities, values and attitudes needed by humans to support the sustainable and effective utilization of resources in workplace. Green skills are also skills of sustainability, also known as technical skills, values or attitudes required in work to develop or support the sustainability of the social activities, economy and revenue in business, industry and community (Organization For Economic Cooperation and Development, [OECD] 2014). Ramlee (2015) stated that green skills

is an emerging concept with aim of achieving sustainable development by minimizing environmental degradation and ecological scarcities, carbon emissions and pollution as well as enhancing energy and resource efficiency and preventing loss of biodiversity. Green skill emphasizes on environmental element in lives and how individuals that will be produced can optimized preserved development through economy, community and country (Ramlee, & SitiShuhada, 2014). From the above green skills is concept that furnishes students/trainee with knowledge, skills and attitudes required for societal development and ensure sustainable environmental protection. Nevertheless, green skills are composed of three domains of learning: cognitive domain (knowledge), psychomotor domains (skills abilities) and affective domain (attitude/value) required by students/trainees to accelerate development in social, economy and environment from the cognitive aspect. Green skills provide conceptual knowledge concerning environmental protection. From psychomotor perspective, green skills refer to the ability to minimize energy consumption, or reduce greenhouse gases etc. Green skills in the affective domain dimension deals with motivating individuals to preserve natural resources (Sern, Zaine and Foong, 2017). It is in light of the above that green skills need to be adopted in to the skills students acquires in order to increase awareness of dangers of environmental damage and also reduce/inculcate self-quality practice in various trades.

Technical Colleges are institutions responsible for provide technical and vocational training which prepare learners to specialize in different occupation (Abdulkadir and Ma'aji, 2014). In Nigeria technical colleges gives full time and part-time training in technology, applied science and commerce, commercial aid vocational agriculture, professional studies in engineering and other technologies (Abdukadir, 2011). The Federal Republic of Nigeria (2004) mandated technical colleges' education responsible to train craftsmen, artisans and other sub-professionally skilled workers. The policy further stated graduates of technical/colleges shall have three options: either be employed at the end of the entire trade course or after finishing one or more modules of employable skills, become entrepreneurs and be able to employ others, and pursue advance educational training in craft/technical program or in tertiary institutions such as colleges of education, polytechnics and universities.

Among the trade offered by technical colleges include electrical installation and maintenance work trade (EIMWT) in which students are expected achieve the following objectives on graduation: perform various experiment using resistor, capacitors and inductors, undertake both domestic and industrial installation, install electrical machine, prepare and join electrical cables, install/connect batteries for changing and dismantle, recoil and recouple electrical machines (National Board for Technical Education, 2003). However, from the foregoing, it was established beyond any daunt that 21st century is characterized by environmental degradation due to human activities and advancement in technology. Technical college of education could be avenue for overcoming environment for future generations. Students need to be knowledge of negative effects on the environment brought by the inconsiderate acts of humans. Values of environmental protection should be taught together with other technical skills in the trade; so that technical colleges can produce graduates that are not only skilled but also concerned of sustainable environmental protection (Kamis *et at.,* 2016). Hence, it is necessary to include consistent green skills components in to the curriculum of EIMWT of Technical Colleges to increase awareness towards the importance conserving the environment. This is to produce the workforce that can boast economic growth in future and has values regarding environmental protection.

Statement of the problem

Human activities result in numerous environmental problems and climate change. The burning of different forms of fuel produces emission of carbon monoxide and other harmful gases causing greenhouse effect, depletion of ozone layer due to the use of aerosol. The issue of unbalance air content caused by deforestation as well as increase in temperature due to our development of building construction and agricultural activities. From economic point of view, the developing countries are experiencing economic loos due to drought and flood disaster the climate change

negatively effects of the developing countries. The major challenge of today in to preserve the environment and prevent climate change. According to Kamis et'al (2017) climate change is worrying and its resultant problems need urgent solution. The environmental protection is an important role in all areas of life including technical and vocational education. Therefore all parties starting form educational institution need to contribute in sustainable environmental protection, hence the current study.

Research questions

1. What are the general green skills content to be included in to EIMWT curriculum of Technical Colleges in Gombe Sate?
2. What are the general performance objectives to be included in to EIMWT Curriculum of Technical Colleges in Gombe Sate?

Methodology

The study adopted a descriptive survey research design. The area of the study is Gombe state which is geographically located in latitude $90^0\ 30^1$ and $12^0\ 20^1$ North and longitude $8^0\ 45^1$ and $11^0\ 45^1$ East in the North-East geo-political zone of Nigeria consisting of eleven local government areas. The population of the study was 47 respondents which are teachers of EIMWT from six Government Science and Technical Colleges in Gombe state. Due to the manageable size of the population, there was no sample and sampling techniques for the study. Therefore, the entire population was used for the study. The instrument used for data collection was structured questionnaire titled a questionnaire for integrating green skills in to curriculum of EIMWT in technical colleges (QIGSCEIMWTTC). The responses on the questionnaire was structured on 5-point scale: of Highly Relevant (HR),Relevant (R), Moderately Relevant(MR),Slightly Relevant (SR), Not Relevant(NR). The questionnaire was validated by three experts from Electrical Technology Education Department of Modibbo Adama University of Technology Yola. The reliability co-efficient of 0.93 was obtained for the instrument using Cronbach alpha reliability method. Data for the study was collected with help of two research assistants. Mean and standard deviation was used to answer the research questions. All items with mean score of 3.0 and above will be consider relevant while items with mean less than 3.0 will be consider irrelevant.

Results

Table 1: Mean Responses of EIMWT Teachers on the General Green Skills Contents to be Included in EIMWT Curriculum of Technical Colleges (N = 47)

S/N	Item Statement	$\bar{X}$	SD	Remark
1.	Skills in taking up responsibility to protect environment such as managing energy and water resources and solid waste disposal.	4.21	0.69	Relevant
2.	Social skills such as assuming responsible role to prevent discrimination in the work place.	4.06	0.70	Relevant
3.	Skills in taking up responsibilities in the areas of economy such as financial accountability, innovation and entrepreneurship.	3.91	0.58	Relevant
4.	Skills at local level include those in the field of health, personal life, community and the environment.	3.79	0.51	Relevant

Where: N = Number of Teachers; $\bar{X}$ = Mean; SD= Standard Deviation

Table 1 shows that all the four items on general contents in green skills were found relevant for inclusion in EIMWT curriculum of Technical colleges in Gombe State. The result shows that all the items have a mean value ranging from 3.79 to 4.21 which is within the limit of relevancy.

Table 2: Mean Responses of EIMWT Teachers on General Performance Objectives of Green Skills to be Included in EIMWT Curriculum of Technical Colleges

S/N	Item Statement	$\bar{X}$	SD	Remark
5.	Discuss renewable energy implementation.	4.51	0.51	Relevant
6.	Enumerate steps to increase energy efficiency.	4.36	0.61	Relevant
7.	Reduction of CO2 emission.	4.34	0.64	Relevant
8.	Promote protection of biodiversity	4.19	0.68	Relevant
9.	Identify methods of cleaning up local natural resources.	4.04	0.59	Relevant
10.	Discuss method of purifying local water resources.	3.81	0.39	Relevant
11.	Enumerate steps of planting tree.	3.98	0.61	Relevant
12.	Discuss how to start a compost heap or how to use compost bin.	4.06	0.57	Relevant
13.	Describe how to avoid unnecessary wasteful packaging.	4.40	0.49	Relevant
14.	Identify method of waste disposal after separating them in to biodegradable and non-biodegradable waste material.	4.21	0.62	Relevant
15.	State method of disposing left over chemicals and used oils.	4.21	0.66	Relevant
16.	Discuss the importance of using alternative sources of energy.	4.38	0.53	Relevant
17.	Identify judicious fertilizer application methods.	4.62	0.49	Relevant
18.	List steps in composing organic solid waste for use as manure.	4.21	0.50	Relevant
19.	Describe the importance of replacement of trees removed.	4.34	0.64	Relevant
20.	Describe the purpose of crop rotation.	4.19	0.68	Relevant
21.	Describe intellectual management.	4.04	0.59	Relevant
22.	Identify international value chain management process.	3.81	0.39	Relevant
23.	Discuss green management and environmental solutions.	3.98	0.61	Relevant
24.	Enumerate financial management process.	4.06	0.57	Relevant
25.	Describe self-management process.	4.21	0.62	Relevant
26.	Identify the importance of team work.	4.21	0.66	Relevant
27.	Identify the need to address inequalities and social ills.	4.31	0.63	Relevant
28.	Identify the need for Enhancing capacities of local communities, transfer of expertise to community member.	4.62	0.49	Relevant

Where: N = Number of Teachers; $\bar{X}$ = Mean; SD= Standard Deviation

Table 2 revealed that all the twenty-four (24) items on general performance objectives on green skills contents, are found relevant for inclusion in EIMWT curriculum of Technical Colleges in Gombe State. The result shows that the entire items have mean value of greater than 3.0 which is within the limit of relevancy.

Findings of the study

1. The general green skills content to be included in EIMWT curriculum was sub divided into four (4) units which were all found relevant and accepted by teachers to cover the required content for inclusion in EIMWT Curriculum of Technical Colleges in Gombe State. While item 1 and 2 has the highest mean of 4.21 and 4.06 respectively, this revealed that these items are the most relevant.
2. The green skill has twenty-four identified contents items that covered general performance objectives for inclusion in EIMWT Curriculum of Technical Colleges in Gombe State.

Discussion of findings

The finding with respect to research question one revealed that the suitable general green skills content to be included in EIMWT curriculum was sub divided into four (4) units which were all found relevant and accepted by teachers to cover the required content for inclusion into EIMWT Curriculum of Technical Colleges in Gombe State. While item 1 and 2 has the highest mean of 4.21 and 4.06 respectively, this revealed that these items are the most relevant. This finding is in agreement with the finding of Kamis et'al (2017) which shows that teachers are of the opinion that green skills need to be integrated in to the curriculum as early as possible that is at primary and secondary level. The finding also agrees with Hayward (2012) which stated that students in secondary schools can be taught to understand environmental issues; this is because they are the next generation of the environment and therefore need to be introduced to the skills related to environmental protection. This finding is in line with the finding of Mokhtar et'al (2019) whose study shows that lecturers identified eleven green skills attributes for inclusion in to curriculum through thematic analysis. Based on this finding, the identified green skill contents are really crucial for inclusion in to the curriculum of technical colleges.

The findings on research question two which is on general performance objectives identified in the developed green skills module. The findings show that twenty-four items were identified as contents that covered general performance objectives for inclusion in EIMWT Curriculum of Technical Colleges in Gombe State were found relevant based on employable competencies that are identified. Enamali (2010) describe general performances objective as those particular behavior to be exhibited by a learner under specified conditions. This finding agreed with Brown (2013) who discovered that the development of green skill competences are needed for future green jobs and identified the following items: energy saving, water system sustainability, green development, recycling and low-carbon skills. He further emphasized that these skills need to embedded when training students in schools or educating the general public through media. The finding of Coljin (2014) supported this finding; he stated that when green skills are taught during early stage of education (primary and secondary school levels), students will continuously apply these skills until they enter in to the world of work.

Conclusion

Based on the findings of the study, there is need to include green skill aspects in to the curriculum of educational institution so as to create awareness among the young generation regarding the importance of environmental protection and preservation. Green skils can be developed through curriculum development, education, training, teaching and learning and also giving green skills to the technical education teachers.

Recommendations

1. Curriculum planners like National Education Research Development Council (NERDC), National Board for Technical Education (NBTE) and other examination bodies should adopt and include the green skill contents in EIMWT curriculum of technical colleges in Nigeria. This will enrich the curriculum for better skill acquisition among the younger generation.
2. Ministry of education should organised workshops and seminars for teachers on teaching green skills and the value attached to environmental protection.

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AN EVALUATION OF THE CLIMATE CHANGE INFORMATION NEEDS AMONG THE STUDENTS OF NIGERIAN COLLEGES OF EDUCATION: AN IMPLICATION ON TVET CURRICULUM FOR SUSTAINABLE ENVIRONMENTAL PROTECTION IN NIGERIA

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Abstract: *Climate change information needs for sustainable environmental protection is a theme that is currently receiving considerable attention from researchers. This is due to accumulating evidence that point to an increasing impact of climate change on man's livelihood. This paper sought to assess the extent to which Technical and Vocational Education Training students in Nigeria's Colleges of Education are exposed via their curriculum to the climate change phenomenon. Conclusion reached was based on a sample of 100 TVET students from the five departments of the TVET School, eleven climate change parameters and a 2.50 mean benchmark for responses to questionnaire items. The result showed that with the exception of Department of Agriculture, no other departmental curriculum provides adequate climate change information for its learners. Therefore the research recommended an immediate review of TVET curriculum of COE to meet this need.*

Keywords: *Climate Change, Information, TVET, Curriculum Relevance.*

Introduction

Generally, Technical Vocational Education and Training (TVET) is an educational training that focuses on providing practical knowledge and skills for employment and self-reliance (International Centre for Technical and Vocational Education Training - UNEVOC, 2006). The goal of TVET in Nigeria is to help government boost the availability of skills, vocations, knowledge and modern tools to meet the immediate and future manpower requirements of the nation (UNEVOC, 2019). While this is laudable, because it concerns the future, there is a need to ensure that the pursuit of these goals are carried out with significant sustainability considerations. This is because the implementation of TVET initiatives normally involve activities that have substantial impact on or are impacted by the climate (Le-Treut et al, 2007; National Commission for Colleges of Education – NCCE, 2012; Acciona, n.d.). These activities include among others, crop and livestock management, arts and crafts production, fabrication and welding, leather works, air conditioning and refrigeration, among others (UNEVOC, 2019). Though these activities impact the climate, they nevertheless cannot be stopped but would invariably be on the increase as the country hopes to catch up with advancements in science and technology. For this reason, the need for locally relevant climate change information to facilitate quick adaptation of TVET processes for sustainable environmental protection has become urgent.

Climate change is an evolving topic which has gained considerable attention of scholars from different fields of study. The phenomenon has become an important issue today because it is closely related to several activities of man irrespective of whether such individuals are aware of the consequences or not (Le-Treut et al, 2007). By definition, Climate change refers to an observed variation in global or regional climate occasioned by man's activities and other natural occurrences over a 30 year period (Ifeanyi-Obi, Etuk and Jike-wai, 2012; McMichael, et. al., 2004). Climate however is described as an aggregation of several weather factors that affect the earth's physical balance and its capacity to support life (Oxford Advanced Learners Dictionary, 2015), and changes in climatic conditions occur primarily due to global warming. Global warming is the rising temperature of the earth as a result of an increase in the level of greenhouse gasses in the atmosphere (Londom, 2019). According to United Nations Development Fund (UNDP, 2019), the severe effects of climate change are substantially experienced in every country in the world. It is more critical to Nigeria because of the country's high dependence on agriculture which is sustained by naturally occurring rainfall (Ifeanyi-Obi, Etuk & Jike-wai, 2012). The country is therefore compelled to give the issue of climate change the attention it deserves especially because of the fact that the deposits of its major export earner (crude oil) is not infinite.

The importance of the issue of climate change notwithstanding, there still exist a level of ignorance and/or misconception about the phenomenon in certain climes (Acciona, n.d.). This paper primarily thus aims at examining the relationship between TVET and climate change to assess the climate change information needs of TVET students in colleges of Education with particular reference to Nigeria. This is done with a view to providing a basis for determining what actions are required in preparing learners for climate change adaptations for sustainable environmental protection. One of the key issues in dealing with the climate change subject is that of creating awareness about the problem by providing relevant information. Some studies have shown that while certain persons may still be ignorant, most people have at least some clue about climate change either from personal experiences/observation or from intervention programs carried out by various agencies. In developing countries particularly, there still exist a need for information about certain aspects of the problem as well as how to more effectively reach out to those who are not well informed about the situation (Okoro, Agwu & Anugwa, 20XX). Furthermore, Odjugo (2010) suggested that there is greater availability of information on climate change at the global level than at local levels which consequence is that less informed communities may bear a greater burden of climate change. This is in spite of the potential of local communities to contribute meaningfully to climate change adaptation measures (Hackenbruch, Kunz-Plapp, Muller and Schipper, 2017).

For this reason, it has become needful to not just inform the populace about climate change, but also identify what information is relevant to the entire public or to a segment of the public in order to be involved in climate change management. Khezri, Bennett and Zevenbergen (2018) have reported that in order to ensure greater involvement in climate change activities, Community Based Adaptation Programs (CAPs) have been encouraged in some high impact areas. They however suggested that these programs have not satisfactorily met the information needs of locals because the perspectives of such CAPs are more international than they are local. As such, they suggested setting up of information systems that will provide more locally relevant information to facilitate appropriate responses. This implies that though Climate Change is a global phenomenon, there are variations in terms of information needed at different times and by different categories of people based either on their profession, location or even level of education. It also means that the target audience may determine the objective of such information which may be restricted to awareness creation or aim at driving action. In the opinion of Hackenbruch, Kunz-Plapp, Muller and Schipper (2017), climate change action primarily involve finding ways of adapting to climate change, and effective and appropriate adaptations would necessarily involve relevant stakeholders whose major role will be to provide input relating to the impact of climate change on their locality. They also opined that in order to achieve this, scientific information tailored towards the needs of those communities must be provided. According to Milken Institute School of Public Health (MISPH, 2017) though there is need for professionals, students and the general public to have access to a reliable information on climate change, media reports frequently contain conflicting information about what is happening to the planet, the roles schools, individuals and communities play and what can be done to influence future outcomes. Thus, apart from the importance of providing the right information for climate change adaptation purposes, Okoro, Agwu and Anugwa (2016) suggest that lack of information invariably exposes individuals to the effects of false information which can also be severe. Accordingly, MISPH (2017) reported that many students are faced with limited information on climate change and how to determine which sources cover climate change in a meaningful, contextual and evidence based manner.

Statement of the problem

In a general sense, sustainability has to do with accomplishing present targets without adversely impacting future wellbeing (Evans, 2019). TVET students of COE in particular are not just being prepared for the present, but are future policy makers and also moulders of the generation after them. To ignore this segment of the population in any sustainability discussion therefore will defeat the sustainability objective of that discourse. Whereas the issue of climate change is not just already critical (UNDP, 2019) but also demands urgent action, research and other climate change efforts do not appear to give attention to the enlightenment and preparation of learners especially

in TVET fields to make their contributions in combatting the challenge. This is in spite of the fact that this category of the population hold the key to sustaining the fight because they are young and are being prepared to pass knowledge (as teacher trainees) to the next generation. Giving attention to this category of learners particularly considering their bias towards technology and vocational training is definitely a requirement for sustainability in the development of veritable tools for climate change management. TVET programmes including Business Education, Fine and Applied Arts, Home Economics, and Technical Education have topics impacting on climate or are impacted by the climate (NCCE, 2012). Some of them include waste/sewage disposal in Home Economics, woodwork, metalwork and automobile engineering in Technical Education, land as a production factor and industrialization (including extractive, construction and manufacturing industries) in Business Education, throwing, firing and glazing of utensils and preservation of arts work in Fine and Applied Arts departments among several others. For this reason, it is very important to deliberately include all TVET trainees in the efforts towards sustainable environmental protection if the efforts would be sustainable indeed.

Research questions

1. To what extent does the curriculum meets the climate change information needs of trainees?
2. To what extent are TVET students aware of the dynamics of climate change?

Methodology

This paper used cluster sampling technique to select students from the five departments of the TVET School. These are Agricultural Education, Business Education, Fine and Applied Arts, Home Economics and Technical Education Departments. The selection was further bounded by level of academic achievement based on a CGPA of 2.50 and above though 3 respondents fell outside this boundary. Also, only NCE 3 students currently in their final semester in the college were sampled to ensure that responses are derived from a sample that has gone through the entire curriculum of TVET in COE. A sample size of 100 was used even though some respondents did not provide responses to some items leading to varying totals. The research used primary data obtained through questionnaires which were subjected to expert scrutiny while descriptive statistics (mean) benchmarked at 2.50 was used to answer the research questions. A total of 11 climate change parameters were itemised as topics taught in COE to which each respondent was expected to either agree or disagree.

Results

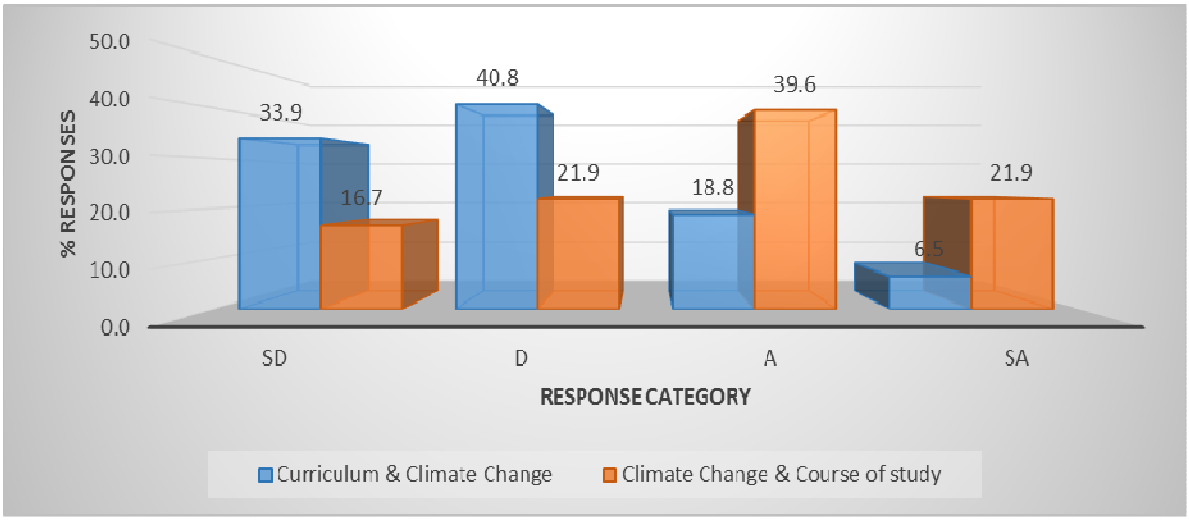


Fig. 1: Frequency Distribution of Responses to the Questionnaire Items Used in the Research

The distribution in Fig. 1 presents the mean responses of students to two set of questions. The first set (Curriculum and Climate change) sought to find out whether respondents have been exposed to climate change related themes in the course of their studies in COE. The second set of questions (Climate change and Course of study) on the other hand sought the opinion of the same respondents about the relationship between their chosen course of study and the climate change phenomenon. From the responses represented above, majority of respondents (approximately 75%) indicated that they have not been exposed to climate-change related courses/topics in in the course of their respective programs in COE both at departmental and general studies level. However, most (approximately 61%) of the respondents are of the opinion that there is a relationship between their respective areas of studies and Climate change.

Table 1: Analysis of the Mean Responses Of TVET Students by Department on Whether or Not Departmental and/or General Courses' Curriculum Cover Climate Related Topics

S/N	Department	Departmental Mean	Remarks
1.	Agricultural Education	2.50	Agreed
2.	Business Education	2.00	Disagreed
3.	Fine and Applied Arts	2.10	Disagreed
4.	Home Economics	1.70	Disagreed
5.	Technical Education	1.80	Disagreed
		1.99	Disagreed

The result of the above descriptive analysis used in answering research question one shows that only AGE department met the 2.50 benchmark. This means that while Department of Agriculture is in agreement, all other departments disagreed. Furthermore, since the grand mean stood at 1.99 which is below the benchmark, it is concluded that at the TVET School level, there is a general disagreement with the first research question.

Table 2: Analysis of the Mean Responses of TVET Students by Department on Whether or Not There is a Relationship Between Climate Change and Their Chosen Course of Study

S/N	Department	Departmental Mean	Remarks
1.	Agricultural Education	3.20	Agreed
2.	Business Education	3.40	Agreed
3.	Fine and Applied Arts	2.10	Disagreed
4.	Home Economics	1.70	Disagreed
5.	Technical Education	2.50	Agreed
		2.60	Agreed

From the result of the analysis above, there is a general agreement with the second research question based on the grand mean of 2.6 which surpassed the benchmark mean. However, a closer look at individual departments show that whereas Agricultural science, Business Education and Technical Education departments met the mean benchmark signifying an agreement with the second research question, Fine and Applied Arts as well as Home Economics fell short of the benchmark denoting a disagreement with the second research question.

Findings and discussion

The result from Table 1 shows that in terms of curriculum coverage, only the Department of Agricultural Education is able to meet the climate change information needs of learners. This agrees with the researchers' review of the curriculum guide where topics like climatology, desert encroachment, humidity, cloud cover, desertification, etc. were found to be part of the Agricultural Education curriculum (NCCE, 2012). This notwithstanding, a 2.50 mean indicates a very low level of agreement which suggests that either the actual teaching of those topics are ineffective or the capacity of learners to understand the issues involved is limited. The questionnaire analysis

actually revealed that whereas there is an agreement with the coverage of most climate change parameters as itemised in the questionnaire, there is also high level of disagreement on the coverage of other parameters. There is a need therefore to determine the importance of all climate change parameters and ensure that the most relevant ones are emphasised in the curriculum to satisfactorily meet the climate change information needs of all students for sustainable environmental protection in Nigeria.

While the first table indicated a general disagreement with research question one, the second table revealed that most students are quite conversant with the connection between climate change and their courses of study. It is noteworthy that Business Education Department which is often considered less concerned with climate change issues returned that highest mean to indicate a very high perception of learners as to the fact that their course of study is not exempted from the consequences of climate change. Having itemised the climate change parameters in the questionnaire, the second section of the questionnaire first pointed out that all the outlined parameters concern the phenomenon of climate change. After that, respondents were required to indicate their opinion on whether they agree or not that climate change has any significant impact on their chosen courses or profession. This was a way of providing information on climate change based on learners' general idea about the different parameters. The resulting responses therefore is an indication that with the right information, students are capable of recognizing the importance of climate change which is the first step towards their active involvement in climate change discourse which ultimately leads to effective cooperation with other stakeholders in working out modalities for climate change adaptation programs.

The result of the data analysis also suggest that there may be a serious level of ignorance about climate change and its effects in the Fine and Applied Arts as well as Home Economics sections of TVET for which urgent steps need to be taken to ensure adequate information is provided first to instructors and then for learners. This is because as indicated earlier, even if not clearly stated, several activities of these particular departments just as the others others have significant impact on the climate. Furthermore, since analysed results show that only agricultural education curriculum is able to meet the information needs of learners, it can be concluded that there is a bias regarding where and when to emphasise climate change issues in curriculum development. Considering the level of impact of climate change on agricultural activities, this bias can be understood. However, in the light of sustainable environmental protection this consideration must be discarded. This is because for sustainable climate change adaptations, all individuals irrespective of profession or location must be involved and actions should not just be responsive but also preventive. While those areas like agriculture which are highly impacted by climate change are struggling with how to respond to the challenge, less impacted fields should be encouraged to champion the campaign for preventive measures to minimise the impact of climate change at their professional or community levels as the case may be.

Conclusion

The outcome of this research indicate that the TVET curriculum of COE has largely failed to satisfactorily meet the climate change information needs of learners. There is also an indication that current climate change information and strategies at curriculum development levels are mostly geared towards responsive rather than preventive measures. All these are issues that need to be re-examined especially in view of sustainability concerns which looks at both present and future implications of climate change strategies. Such reviews should include learners whose early exposure to climate change matters equips them to be vanguards of environmental protection at their present level and experienced policy makers or moulders in the future.

Recommendations

1. There is a need to review the current curriculum of TVET to make it more relevant in adequately responding to the climate change phenomenon. This is so that TVET students are

not just prepared for employment or self-reliance but are made to become advocates of climate change and sustainable environmental protection during and after their studies.

2. Since curriculum reviews require time, it is recommended that climate change workshops and seminars be organised periodically for instructors and learners alike to keep them abreast with recent developments as well as the adaptation required from time to time.
3. There should also be a balance of emphasis on strategies for climate change adaptation that focus on high impact areas/fields/regions and those of low impact areas/fields/regions. This is to ensure that all stakeholders are equally involved in a bid to sustain climate change management efforts for a sustainable environmental protection in Nigeria.
4. Finally, it is recommended that further studies should be undertaken to identify the most relevant information or climate change parameters for students in TVET as a whole and for the different TVET sections or departments. This may be further stratified based on whether the TVET program is a formal or an informal training since there are various programs in TVET some of which do not require any formal education. The whole essence is to encourage participation and also to obtain (local) inputs from different levels of the society.

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NEED FOR AWARENESS OF GLOBAL WARMING, CLIMATE CHANGE AND EFFORTS TOWARDS CURBING THE CONCERN: IMPLICATION FOR CURRICULUM DESIGN IN SCIENCE, ENGINEERING AND TECHNOLOGY

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Abstract: *The paper discussed the meaning, causes and effects of global warming, greenhouse effect and climate change. Reasons for global concern, threats posed and effects of these environmental problems were outlined. Prominent among the human activities to be controlled is burning of fossil fuels for transportation, electricity generation, industrial use and other forms of innovations that were introduced since the period of the first industrial revolution in Britain. Effects such as drought, hurricane, sea level rise, melting of sea ice, habitats and wildlife disruption, challenging health conditions and other hazards were detailed out in the paper. Some efforts being made by International bodies and nations in environmental matters were outlined. Nigeria, being a member nation of the global community is at risk of being effected by global warming and climate change problems. Efforts of agencies such as National Environmental Standards and Regulations Enforcement Agency (NESREA), Nigerian Meteorological Agency (NiMet), Department of Climate Change Nigeria, Federal Ministry of Environment and other governmental and non-governmental bodies in tackling the problems of environmental change were highlighted. Finally, the paper concludes by identifying the implications of these changes on curriculum design in science, technology and engineering programmes.*

Keywords: *Global Warming, Climate Change, Greenhouse Effect, Awareness, Curriculum Design*

Introduction

Problems of global warming, greenhouse effect and climate change are lately becoming a source of concern to individual scholars, scientists/ environmentalists, non-governmental organizations and governments of nations. The grave and possible threats posed to living things on earth by these factors of environmental degradation may have triggered off the present discourse on the subjects-matter. The danger is already starring mankind in the face as the whole space-time spectrum is affected. Evidence of steady global rise in temperature and other environmental abnormalities abounds. The debates are mainly centred on raising awareness and also finding solutions to the environmental menace for a sustainable future. Nunez (2019) posited that nowadays attention is shifting from the agents of global warming to means of curbing the problem. Although mean temperatures have fluctuated among regions of the world between seasons and times of the day, months and year, scientist and environmentalists have demonstrated from analysis and reports an upward trend in average temperature of the globe. Nigeria is regarded a country emitting large proportion of greenhouse gases in Africa, mainly through gas flaring activities. The country is faces with other hazards such as sparse rainfall in the North, uncontrolled logging, oil exploration and spillage, deforestation, flooding, bush burning resulting in acid rain, urbanization, increasing risk of heat-related diseases and rising cost of extreme weather damage (Ogunniran, 2018).

Meaning of global warming, greenhouse effect and climate change

Global warming is the trend at which the average global surface temperature on earth has increased. Macmillan (2016) acclaimed that over the past 50 years, the average global temperature has witnessed the fastest rate of increment in recorded history. According to Nunez (2019), global warming is the rapid rise of greenhouse gas emissions from human activity resulting in dramatic and relatively recent rise in global average temperatures. Other experts and scientists generally see the global-warming emissions trend as accelerating in an unprecedented rate from North to South poles and need curbing urgently. The existence of lives here on earth is being threatened for extinction if the average global temperature increases by up to $10^{O}F$ over the next century. Global warming also known as thermal pollution is regarded as an increase in the average temperature worldwide and believed to be caused by the greenhouse effect.

To be able to understand global warming adequately, the concept of greenhouse effect need to be understood. Experimental evidence exists showing that carbon dioxide in the atmosphere acts to direct heat back toward the Earth. As radiations from the solar system and sunlight escape into space, the heat released is trapped by air pollutants causing the planet to become hotter. It is noteworthy that these pollutants can last from years to centuries in the atmosphere. A greenhouse is synonymous to a glass house where plants grow. Glass lets light in and keeps heat from escaping. The trapped heat in turn keep the plants warm even when it is cold outside. In the same vein, the earth's atmospheric gases (carbon dioxide and other gases – called greenhouse gases) in the air trap heat energy from the sun. Without these gases, too much heat would go back into space, and living things can be endangered for survival. However, as more greenhouse gases get into the air, they also trap more heat, thereby leading to global warming. Human activity, as posited by Flam (2019) has contributed tremendously to the atmospheric load of carbon dioxide by more than 40% since the time of commencement of industrial revolution.

Excess of the greenhouse gases in the atmosphere can result in ozone layer depletion. Ozone layer is the region of the stratosphere with the highest concentration of ozone molecules which by absorbing high-energy solar ultraviolet (UV) radiation protects organisms on earth, also called ozonosphere (HarperCollins, 2010). The ozone layer is the part of the atmosphere, about 15 miles or 24km above the earth's surface and about 20 – 48 km above the sea level (Encyclopaedia Britannica, 2012). Ozone layer protects people by absorbing harmful rays from the sun, but allowing the non-harmful UV – radiations to pass. If these harmful UV rays reach earth's surface without being absorbed somehow, the resultant effects on humans are skin cancer, eye disease and other health hazards. Some gases in reaction which are powerfully-anthropogenic in nature and chemically stable in the atmosphere may become harmful when they drift into the upper stratosphere thereby depleting the ozone layer after emission.

Climate change encompasses rising average temperatures and other extreme weather conditions which tend to shift wildlife populations and habitats, also causing sea levels to rise (National Geographic Society, 2015). Global warming and climate change are not synonymous. Climate change is used by Scientists to describe the complex shift that affects the planet's weather and climate systems. These climatic changes are emerging as humans continue to add heat-trapping greenhouse gases to the atmosphere. Some impact of climate change, as documented by scientists and reported by the National Geographic Society include the following: melting of sea ice worldwide, faster rate of rising of global sea level in recent years, collapsing of some population of wildlife and the habitats due to temperature rise, migration of many species farther north or to higher cooler areas, increase in the risk of wildfires, severe drought, crop loss and shortage of drinking water, yet some regions across the globe is experiencing increased rain and snowfall. Some species are thriving by devastating millions of forested acres across nations of the world, for example, Bark beetles feeding on spruce and pine tree. Hurricanes and other forms of storms are likely becoming stronger, floods and droughts becoming more common even getting to a level of "mega droughts" by 2100 as predicted. Severe tropical storm called cyclone idai was recently (March, 2019) witnessed in Mozambique, Zimbabwe and Malawi. Fresh water availability is becoming less. Hurricane Florence has caused numerous deaths and damage to infrastructure. Some diseases are spreading, for example, resurgence of the Zika virus in 2016. Ecosystem continues to change, for example, some species that cannot adapt are becoming extinct.

Causes of global warming and climate change

People and nations dependent on fossil fuels (oil, gas and coal) have changed the situation of the world. Fossil fuels are today burnt in volumes and transformed into their oxidized state. Carbon dioxide (CO_2) is used to power factories, run cars, generate electricity, heat up houses during cold weather and applicable in other forms of innovations. As fossil fuels burn, the burning fuels release carbon dioxide (CO_2), greenhouse gases and other pollutants into the atmosphere. These air pollutants, greenhouse gases and carbon dioxide collect into the atmosphere, and absorb sunlight and solar radiation that have bounced off from the earth's surface, thereby resulting into global

warming (Macmillan, 2016). The largest source of heat-trapping pollution in the United States, for example is the burning of fossil fuels and coals to make electricity. About two billion tons of CO_2 are produced every year in US. The transportation sector constitutes the second largest source of carbon pollution in the US. Though, breakthroughs in atomic science have enriched lives, it is not without negative consequences on the environment (Decamous, 2012). Carbon dioxide (CO_2) is among certain gases that are known to enhance the atmospheric natural "greenhouse effect". Since the time of Industrial Revolutions in Britain, (perhaps from 17th century), a significant amount of CO_2 from fossil fuel use, methane from livestock production and nitrous oxide from agricultural activities are released into the atmosphere (Daggash, 2018). These greenhouse gases have resulted in the rise of global temperatures at an unprecedented rate in geographical era. Physics laboratory experiment by Irish Scientist, John Tyndall supported the theory that the earth radiates the sun's energy back into space in the form of infrared light (Flam, 2019). Infrared light was shone through various gases. It was found by the scientist that oxygen and nitrogen have no heat-trapping effect, but carbon dioxide does.

Scientists over the years have learnt how to calculate and measure the amount of CO_2 that was being added to the atmosphere from coal burning. The atmospheric CO_2 is changing the earth's energy balance and superimposed upon a background of natural variation. The natural variation is caused by the shifting ocean currents that affect surface temperatures of the oceans. The amount of greenhouse gas-related heating going into the ocean depends on currents known as El Nino and La Nina (Flam, 2019). During the El Nino phase, the currents affect the surface temperatures of the oceans with warmer water coming to the surface. La Nina occurs when cooler water comes to the surface, allowing the oceans to absorb heat – like a big sponge. These events, according to Natural Geographic Society (2015), work on fairly short and predictable cycles, with effects not lasting beyond few years. Another cause of the natural variation apart from shifting ocean currents described above is the changes in solar output and the effects of volcanic eruptions. Multiple analyses portray the long-term trend of global warming to be upward and unabated. Another cause of global warming or thermal pollution is deforestation (Asim, 2012). Uncontrolled falling of trees for different purposes has not been helpful to the human environment. The continued reliance on fossil fuel-powered generator as alternative source of electricity in the absence of supply from the national grid is a major threat to Nigeria's climate change plans.

Reasons for concern over global warming and climate change

Extreme weather condition is having serious consequences for the health and safety of people around the world. Respiratory infections and other health hazards associated with the extreme weather condition are on the increase. Cases of meningitis and other heat related sicknesses are rising particularly in Africa. Recently, heat waves helped create the conditions for large wildfires in the West, leading to the loss of lives and homes (Freeman, 2018). The impact of rising temperature are not just waiting for a far-flung future, but the effects of global warming are appearing right now. Scientists have agreed that the earth's rising temperatures are fueling longer and hotter heat waves, more frequent droughts, heavier rainfall, problem of flooding and erosion and more intense hurricanes. Certain weather events like the increasing heat waves are attributed climate change. Living things are being harmed as the weather becomes increasingly warmer. Rising temperature is disrupting wildlife and their habitats. For instance, specie known as Adelie penguin in Antarctica, Western peninsula has its population dropped by 90% or more. Polar ice caps and glaciers are melting causing sea levels to rise (Encyclopedia Britannica, 2012). Ice is melting world over, especially at the Earth's poles. For example, in Montana's Glacier Natural Park, the number of glaciers has declined to fewer than 30 from more than 150 in 1910 (National Geographic Society, 2015). Much of the melting ice contributes to sea-level rise which is occurring at a faster rate in recent years. The real concern with the build-up of greenhouse gases is the earth getting more energy from the sun than the earth is sending back into space. Energy is not only warming the atmosphere, but it is also melting ice and warming the oceans' water. It is also based on scientific findings that global warming is essentially irreversible, unlike some other pollution problems. This fact is not appreciated in dealing with global warming.

In a recent meeting of the American Chemical Society, Caltech Chemist, Nate Lewis estimated through calculation that even if the world stopped burning fossil fuel, it would take 10,000 years for the atmosphere to revert to its pre-industrial composition. In addition, the oceans are undergoing a chemical change that will take even longer to reverse. It cannot easily be predicted exactly how climate change will play out – only that it is likely to be much worse if there is no efforts to address carbon emissions. Gathering of information on climate change assembled over numerous years has uncovered signs of an evolving atmosphere. The planet's normal surface temperature has increased around 1.62^{O}F (0.9^{O}C) since the end of the nineteenth century, caused primarily by expanded carbon dioxide and other man-made emissions into the atmosphere. The warming mostly happened in the previous 35 years with the hottest years on record occurring since 2010 till date. Worldwide ocean level is quickening marginally every year since the commencement of industrial revolution. The sea level expansion according to Conference Series (2018) is the result of pumping more carbon dioxide into the air which is being ingested into the seas. The African continent also stands the risk of being struck by the impact of climate change, according to the United Nations Environment Programme (UNEP). By 2020 as estimated by UNEP, between 75 and 250 million people on African continent are projected to be exposed to increased water stress due to climate change; and, agricultural yields from rain-fed agriculture can be reduced by up to 50% (Punch, 2018). Global warming of 2^{O}C would subject over 50 per cent of the continent's population to risk of undernourishment. Of all human activities, agriculture is the most sensitive to weather. Normal weather conditions are associated with good crop yield and positive economic impact. The weather and climate characteristics of any place on earth determine the types of crops that are grown for food, animals that are reared, mode of dressing, types of shelter and even religious beliefs of the inhabitants. Nigeria is a member of the global community has climate change as one of her focal areas, considering the global awareness being raised on threats to the existence of living things.

Creating awareness on global warming and climate change through conferences

Despite the signing of the UN framework convention on climate change more than 20 years ago, the world remains backward in finding solutions to the problem of human induced climate change. The challenge is on how to reduce the emissions of all greenhouse gases, CO_2 emissions from fossil fuel use and de-carbonizing the world's energy system. Also included is the question of reducing certain industrial gases with high warming potentials and reduction in methane emissions from the oil and gas sector. Scientists have devised methods of directly looking at the atmosphere of the earth's environment in the past. Discoveries made have enabled the present knowledge that the concentration levels of greenhouse gases since the industrial revolution are higher than what was obtained some hundreds of thousands of years ago (National Geographic Society, 2015). Computer and climate models, furthermore, have enabled scientists/ environmentalists to understand and be able to predict the earth's climate and long-term weather patterns. This can be achieved, for instance, by simulating how the atmosphere and oceans absorb energy from the sun and transport it around the globe. Several conferences have been held on annual basis to tackle the problem of environmental degradation, global warming and climate change under different international and national umbrella bodies. Such conferences on environment include the International Conference on Resource Sustainability (icRS), the United Nations Conference on Environment and Development (UNCED), the International Conference on Sustainable Natural Resources Management under Global Change, the United Nations Climate Change Conference etc. The agenda of these conferences on environment aimed to arouse people's awareness and instill positive attitude, values and skills that promote effective management of the environment (UNCED, 2019). The conferences also laid emphasis on the need for environmental education by nations of the world (Nwankwo, Esemua & Orefor, 2015). These conferences aimed at bringing together leading environmental researchers and entrepreneurs to exchange ideas an in all aspects of climate change and global warming. Topics usually focused on in the conference include climate change as it affects climatology, health, oceans etc. global warming effects and causes, biodiversity, carbon cycle, energy policy, renewable energy to mitigate climate change.

The worldwide alleviation programme was set in 1992 by the United Nations Framework Convention on Climate Change (UNFCCC) and it was meant to proffer solution by harnessing global co-operation on moderation activities intended to lessen discharges and increase the measure of ozone harming substances expelled into the atmosphere. The UNFCCCs have formal and yearly conferences held in the framework of the United Nations. The parties involved meet to assess progress made by member nations in dealing with climate change. The conference tries to negotiate and establish legally binding obligations for developed countries to reduce their greenhouse gas emissions. The first UN Climate Change Conference of the parties was held in1995 at Berlin. The United Nations Climate Change Conference (UNCCC) had the popular Paris Agreement in 2015 and held at Paris, France. The Paris Agreement, as reported by Daggash, (2018), is a global treaty to limit temperature rise to "well below $2^{O}C$ relative to pre-industrial levels" by the end of the century. That of 2016 was held at Marrakesh, Morocco. The conference, UNCCC negotiated a global agreement on the reduction of climate change. The commitments were estimated to limit global warming to $27^{O}C$ by 2100. For example, the European Union (EU) suggested a term known as 'Intended Nationally Determined Contributions (INDCs). The suggested INDC by the EU is a commitment to 40% reduction in emissions by 2030 compared to 1990. During the 2018 United nations Climate Change Conference held at Katowice, Poland, the World Meteorological Organization released a report stating that 2017 atmospheric carbon dioxide levels reached 405 parts per million (ppm), a level not seen in three to 5 million years (Wikipedia, 2019). On 3rd December, 2018, the renowned British naturalist, Sir David Attenborough told delegates at the conference that "Right now, we are facing a man-made disaster of global scale, over greatest threat in thousands of years: climate change. If we don't take action, the collapse of our civilizations and the extinction of much of the natural world are on the horizon."

Another 15 year-old climate change activist, Greta Thunberg posited during the 2018 conference on 4th December "What I hope we achieve at this conference is that we realize that we are facing an existential threat. This is the biggest crisis humanity has ever faced. First we have to realize this and then as fast as possible do something to stop the emissions and try to save what we can save." Other Environmentalists that spoke to the 2018 conference participants include Dalai Lama, Al Gore, Antonio Guterres (the Secretary General of the United Nations) all told delegates that the world faced the single most important moral choice in history of humanity. The grave consequences of global warming beyond 1.5 degrees will mean disaster for billions of people around the world (Wikipedia, 2019). A US energy expert and environment official, Presten Wells Griffith said on 10th December, 2018 that "Alarmism should not silence realism." Nations of the world should stop concentrating efforts on economic prosperity and energy security, but should also give commensurate/ complementary practical attention to pursuit of environmental sustainability. The 2018 conference agreed on rules to implement the Paris Agreement of 2015 which centred on how governments of nations will measure and report on their emissions-cutting efforts and ways to provide financial help for poor countries.

Curbing the problem of global warming and climate change

The harsh weather condition affects everyone regardless of political affiliation. To reduce global warming emissions, policy makers and government must find solutions that are free of partisan politics. Swift, significant and equitable actions need to be taken urgently to curb heat-trapping emissions worldwide. Policies, behaviour and technologies that encourage less waste, economical use of the earth's resources and protection of the environment must be put in place. Scientists say the world have roughly few decades left to avoid the most severe consequences of climate change. Protecting our environment from dangerous climate change and CO_2 emissions requires the use of alternatives to fossil fuels; and cuts in emissions worldwide. The use of energy-efficient technology and cleaner fuels must be embraced. Use of environmentally friendly fuels such as bio-fuels is recommended in lieu of fossil fuels and coal. Scientists need to develop new ways to modernize power plants, generate cleaner electricity and burn less gasoline while driving. Human beings have to reduce activities that emit gases into the atmosphere. Tree planting must be encouraged to enhance the process of photosynthesis which will consequently reduce the amount of CO_2.

Conservation of heat energy through geo-engineering is to be encouraged. Several nations and regions of the world have lately established climate policies aimed at curbing global warming and climate change problems. (Union of Concerned Scientists, 2019). But the recent announcement by President Trump of the withdrawal of United States of America from the Paris agreement of 2015 is not encouraging. It is heart-warming, however, that millions of citizens across US pledged their loyalty to the agreement and efforts to limit future warming stepped up (Denchak, 2017). The US has a big role to play in limiting global warming to $1.5^{O}C$. All hands must be on deck to curb the environmental menace. Governments of nations of the world must find ways to limit the amount of greenhouse gases emitted into the air. Individual citizens have roles to play in reducing global warming emissions. Individuals can reduce home energy consumption by using better energy efficient appliances. Even when cars and motorbikes are used in travelling, efficiency in fuel combustion must be ensured. Emission of carbon monoxide or fumes of carbon dioxide due to incomplete combustion of fuel from exhaust pipes need to be checked. Elected officials in government must enact policies and laws on environment that will reduce environmental degradation and emissions into the atmosphere (Freeman, 2018). Individuals must voice concerns through the social media by speaking up and sending messages to legislatures and policy makers to make laws that limit carbon emission. For example, sanctions could be placed on organizations or nations that fail to utilize the renewable energy options. United Nations Climate Change Conference (UNCCC) targets and indicators include de-carbonizing the energy system to ensure clean energy for all, and improve energy efficiency with targets for 2020, 2030, and 2050. This includes reducing non-energy related emissions of greenhouse gases through improved practices in agriculture, forestry, waste management and industry; adopting incentives to curb climate change and promote technology transfer to developing countries.

National Environmental Standards and Regulations Enforcement Agency (NESREA) was established 2007 as an agency of the Federal Ministry of Environment. NESREA has been charged with the responsibility to protect and develop the environment's biodiversity, conservation and sustainable development of Nigeria's natural resources and environmental technology. Her duty also includes co-ordination and liaison with relevant stakeholder in compliance with international agreement on matters of enforcement of environmental standards and regulations covering desertification, forestry, oil and gas, chemicals, hazardous wildlife, pollution and sanitation (NESREA, 2018). On the other hand, the Nigerian Meteorological Agency (NiMet) was established as an agency and presently under the Federal Ministry of Aviation to observe Nigerian weather and climate. NiMet also provides meteorological, hydrological and oceanographic services in support of National needs and within the framework of global practice in science of meteorology. For example, on 24th March, 2019, the Nigeria Meteorological Agency (NiMet) has warned African countries to brace up and be prepared for hotter weather and water shocks as temperature rises in 2019 and that Nigeria should expect thunderstorms, lower than normal rainfall and flooding etc. This was disclosed in Abuja by the DG of NiMet, Prof. Sani Mashi during the celebration of 2019 World Meteorological day with the theme: "The sun, the east and the weather" (Mashi, 2019). Farmers were advised on what to do to avoid crop loss. Lots of diseases flourish under high temperatures. Therefore, avoid overcrowded rooms and over congestion. Allow access to outdoor air, Mashi (2019) has asserted . People need to modify their way of living. NiMet also generates services and products (such as seasonal rainfall prediction used in agriculture, marine transport, hydro electric power generation, construction, health, insurance and commerce. NiMet came into existence by an act of the National Assembly enacted in May, 2003 and became effective on 19th June, 2003 following presidential assent. It has the duty to advise the Federal government on all aspects of meteorology, issue weather (and climate) forecasts for the safe operations of aircrafts, ocean going vessels and oil rigs. Nigeria must adjust her energy plans and shift from being part of the problem creator to being part of the problem solver. Efforts should be made to improve energy efficiency of renewable electricity and to end natural gas flaring. The need to transit from dependence on fossil fuel to dependence on renewable energy sources must be emphasized. The need to switch over to energy sources such as solar and hydro power must be embraced.

Implication for curriculum design in science, technology and engineering programmes

Students and teachers' knowledge, perceptions, attitudes and behaviours as well as teaching-learning approaches towards climate change and the mitigation strategies must be well articulated in the science and technology curriculum design. The design of learning experience and activity must be such that motivate and inculcate positive impact on students' willingness to take action for conservation. Environmental friendly behaviours such as recycling, afforestation, reducing energy use and exploration into alternative source of energy apart from fossil fuel (biodiversity) must be practiced among students. The implication in the long run is that students will be able to demonstrate high level of awareness and positive attitudes towards climate change and global warming issue. Students' knowledge, motivation and critical thinking ability about the issue will be encouraged if the curriculum emphasizes active experimentation, providing them context to explore and make sensible meaning of the concrete real life experiences. Schools should be engaged to teach recent changes in climate such as global warming, greenhouse effect and related issues on environmental degradation such as deforestation practices and environmental legislations to deal with these concerns. The aim is to equip learners with functional knowledge and capacities on how to take responsible action in dealing with these concerns.

The climate change education and related issues can either be approached through a single subject discipline (for example, Geography) or be engaged from an interdisciplinary social studies perspective, Lambert and Hopkin (2014) postulated that in making curriculum of climate change in science and technology education, consideration must be given to three factors: the student's attributes, the way the subject-matter is taught and the broad social purposes of education. The way the subject matter is taught is usually influenced by teacher's knowledge and attitudes. The challenge as put forward by Chang and Pascua (2017) was a call for science and technology curriculum design that takes into account more research on Climate Change Education (CCE) which in turn would impact practice in geographical and environmental education. In teaching topics on climate change, there is need to develop learners who can critically and accurately engage findings and discourse about natural phenomena; and be able to take action towards making the living environment safe and conducive. Curriculum designers must prove the relevance of climate change discourse by making learning less complex and uncertain.

Conclusion

Nigeria has given serious attention to handling climate change issues since 1992, through the establishment of the defunct Federal Environmental Protection Agency (FEPA) in 1988. Nigeria joined the party to the UN framework Convention on Climate Change (UNFCCC) in 1994 and ratified its Kyoto Protocol in 2004. In September, 2012, according to Punch (2018), approval was given to create the Nigeria Climate Change Policy Response and Strategy, whose strategic goal is to foster low carbon, high growth economic development and build a climate-resilient society. Much impact has not been felt from that. Today, the Department of Climate Change, Nigeria co-ordinates activities towards the implementation of the climate change convention and UNFCCC Conference of Parties 23 Kyoto protocol agreement. This is being done in collaboration with other relevant government organizations, non-governmental organizations, academia and private sector. Nigeria signed the Paris Agreement on Climate change, under the leadership of President Muhammadu Buhari at the UN General Assembly in New York, 2016. Hencee, Nigeria is empowered with the responsibility of securing and ensuring healthy environment. Nigeria presently is confronted with the problem of desertification advancing southward, potential submergence of coastline stretch along the Atlantic Ocean, biodiversity, aridification impacting agriculture and water quality (FME, 2015). The 2014 World Climate Change Vulnerability Index grouped Nigeria among the 10 most climate-vulnerable countries, and Lagos as the 10^{th} most vulnerable city in the world (Punch, 2018). The on-going oil spillages constitute a threat to living beings. Species are being destroyed and resources necessary for survival depleted or degraded. The ecosystem is being destroyed. Therefore, there is need for an urgent change of attitude among the citizenry to climate and environmental-degradation related issues.

Recommendations

1. The Federal Government of Nigeria has affirmed that 64 million tons of carbon dioxide being emitted per year can be saved by 2030 if gas flaring is eliminated. To this effect Nigeria must firstly work on the mind-set of her citizenry to support efforts aimed at curbing global warming. Solutions such as reforestation and forest protection must be integrated.
2. One other way of solving the problem is by educating the populace on the threats and the need to desist from practices that endanger the eco-system. This can be achieved through the formal and informal education sector. The subject of environmental education must be included in the curriculum learning contents of schools right from the Basic education level classes. If students are not critically and properly engaged in climate change discourse and taking action on conservation, chances are high that they might likely lose out in a climate changing world. There and then, pupils and students should be enlightened on the dangers, need and efforts to protect the environment.
3. Workshops, symposia and research work on environmental protection must be encouraged at all levels. When students and the larger populace are knowledgeable and empowered through the school curriculum and enlightenment campaign on the need for a sustainable environment, the results reduce the vulnerability to risk associated with the environment.
4. The rest of the populace who are not in school can be enlightened through public media links, radio, television and social media awareness campaign on environmental issues. People have to be enlightened on problems of bush-burning, dumping refuse on water paths, deforestation, over-fishing, irregular hunting of wild-life and other harmful practices that upset the ecosystem.

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PERCEPTION OF TECHNICAL TEACHERS ON THE CLIMATE CHANGE INFORMATION NEEDS FOR INCLUSION IN TECHNICAL VOCATIONAL EDUCATION AND TRAINING CURRICULUM

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Abstract: *This study investigated the perception of technical teachers on the inclusion of climate change information needs in technical and vocational education training curriculum. Four research questions guided the study and one null hypothesis. The study adopted descriptive survey design. A researcher-made questionnaire structured in a five point rating scale was used to collect data for the study. The instrument was face validated by three experts and a reliability coefficient of 0.81 was obtained with Cronbach's coefficient method. The population of this study was 121 respondents made of technical teachers teaching and climate change experts in the study area. There was no sampling and sampling techniques in this study. Data was collected and analyzed using mean for research questions, while z-test statistics for the hypothesis at 0.05 level of significance. The findings of this study revealed that TVET teachers are not involved in climate change information needs dissemination, in fact they do not engage their students in climate change adaptation strategies which could be as a result of non-inclusion in the curriculum. A number of climate change information needs were considered appropriate for inclusion in TVET curriculum. Based on the findings, the study concludes that TVET teachers consistently agreed upon integration of climate change information needs in TVET curriculum for sustainable environmental protection. The researchers recommended among others that curriculum planners among other relevant agencies should make stringent efforts to include climate change information needs in the TVET curriculum.*

Keywords: *Perception, Climate Change, Information Needs, TVET, Curriculum Relevance*

Introduction

Climate change is the statistics of weather over a long period at time. According to Bello (2013), the climate system is an open system and is in a steady state over a given period of time. According to him, if this steadily state is disturbed as a result of changes in one or more component making up the system or there are changes in the amount of solar radiation powering system, the climate will move over to a new state of equilibrium to produce a new climatic state. Bello therefore, defined climate change as the long-term persistence of either positive or negative anomalies of a given or combination of climate events above or below the norm that characterizes climate change.

Climate has significant effect on the livelihood of the people and indirectly making it difficult for people especially the agricultural and construction industries to adapt to climate change. Rising temperature, precipitation and extreme weather events occur very frequently leading towards global warming and this changing climate could decrease production and cause a lot of destruction (United Nation Development Programme, 2010). To meet the challenges of climate change, there is a need to brace up the TVET curriculum to play a vital role to cope with the risks of climate change in Nigeria.

Climate change is the statistics of weather over a long period at time. According to the World Methodological Organization (2011) climate change information and prediction services enable better management of climate variability through incorporation of science and technology based practices into planning, policy and practices on the global, regional and national scale. While progress has been made in generating climate change information in sub-Saharan Africa, majority of the African countries continue to suffer the full impacts of climate change (Tarhule, 2005). Massive deficits in the transmission of early warning messages in highly vulnerable countries, where climate information needs are rarely accessible to millions of rural poor whose livelihood are climate dependent (Lugon, 2010). This may be due to the fact that there is no informant. The inclusion of climate change information needs in TVET curriculum will curb this scenario.

In preparation against negative effect of future climate change, Olusina and Odumade (2012) used Geographic Information Systems to model future climate of Nigeria for 50 years (2000 - 2050) by comparing climate data from Nigerian Meteorological Services with World Climate model and application of their variation to obtain polynomial for predicting future temperature and rainfall change for Nigeria covering the period. The finding of the research indicated that;

(a) future range of the changes in rainfall 192mm to 198mm.

(b) future range of the changes in maximum temperature to be between $1.59^{O}C$ to $2.48^{O}C$.

(c) expected negative and positive variations in rainfall across Nigeria,

(d) increase in temperature,

(e) coastal regions to expect average increase of 100mm rainfall monthly during rainy season.

This however is a pointer for all stakeholders in the built environment in Nigeria to adapt to climate change flooding (Nigerian Environmental Study Team, 2013). The question agitating the mind of these researchers is; should climate change information needs be included in technical and vocational education training curriculum?

The knowledge of climate change can only be made available and useful through the information needs. Climate change information needs is a policy response to climate change that seeks to reduce the vulnerability of social and biological systems to climate change effects (Apata, Samuel & Adeola, 2009). Information needs means the anticipated knowledge of the adverse effect of climate change which will help in taking appropriate actions to present or minimize the damage it can cause, or taking advantage of opportunities that may arise. Information needs has the potentials to reduce adverse impact of climate change and to enhance sustainable environmental protection. In the year 2012, 363 people were feared dead while 2.1 million citizens were displaced across Nigeria as a result of floods. According to the National Emergency Management Agency (NEMA), 30 states out of 36 in Nigeria were affected by that flood experience and it was concluded as the worst that has ever happened in the past 40 years, causing damages of an estimated value of 2.6 trillion Naira (Nigerian Environmental Study Team, 2013). Flooding has been observed as one of the climate change causative natural disasters generated by human activities which consequently hinder sustainability environmental protection (Adeofun, 2011).

Climate change is an environmental issue, therefore Environmental Education which according to Shrivastava, (2006), is the process of providing learning experiences to obtain the knowledge, understanding, skills and awareness with the desirable attitudinal changes about man‟s relationship with natural and man-made surroundings, stands the appropriate tool for exposing the individual into the awareness of what the environment he has to interact with is, and also, how to explore and still protect the environment in order to avert the existing environmental problem which has left the world over with sleepless night. Hence, Moyinoluwa (2013) concluded that the new approach is to see education as primarily a process by which the individual learner is provided with skills to organize his knowledge and to increasingly become more functionally and efficient in all his or her intellectual and service delivery efforts.

It is glaring that Nigerians are faced with problems ranging from soil water management, high temperature, systems of adaptation, drought, flood, continental drift, volcanoes, ocean currents, earth's tilt, comets, meteorites among others. All living things are affected by the climate systems and in particularly by the climate extremes which threatens safety of lives and property and sustainability of socio-economic activities. Since weather and climate know no natural, geographical, political or disciplinary boundaries, cooperation amongst relevant institutions become very necessary to put in place a robust and effective mitigation and adaptation measures to the variability and change of the climate systems in order to achieve the much desired stabilization. It is therefore not surprising that climate change remains one of the greatest challenges of our time towards attainment of sustainable environmental protection and calls for reinforced interdisciplinary cooperation to stem its devastating consequences. These problems among others necessitated this study.

Purpose of the study

The main purpose of this study is to find out the perception of technical teachers on the inclusion of climate change information needs in technical and vocational education training curriculum. The specific objectives are to:

1. Find out the perception of technical teachers on the integration of climate change information needs in TVET curriculum.
2. Determine the extent to which technical teachers involved in climate change information needs dissemination.
3. Determine how often technical teachers engage their students in climate change adaptation information.
4. Determine the climate change information needs considered appropriate for inclusion in TVET curriculum

Research questions

1. What is the perception of technical teachers on the integration of climate change information needs in TVET curriculum?
2. To what extent are technical teachers involved in climate change information needs/dissemination?
3. How often do technical teachers engage their students in climate change adaptation information?
4. What are the climate change information needs considered appropriate for inclusion in TVET curriculum?

Hypothesis

H_{O1}: There is no significant difference between the mean response of climate change experts and technical teachers on the climate change information needs considered appropriate for inclusion in TVET curriculum.

Methodology

Survey research design was adopted for the study. The study was carried out in Adamawa State which is located in the North-East region of Nigeria, with a geographical coordinates of 9° 20′North, 12° 30′ East and a land mass of about 39, 742, 12 km² (Adebayo & Tukur, l999). The population of this study was 116 respondents made of technical teachers teaching in the three Government Science and Technical Colleges, Federal Science and Technical Colleges and a Vocational Centre within the study area. The population for this study was manageable hence, there was no sampling and sampling techniques in this study. The entire population was used as sample in the study. A 20-item structured questionnaire developed by the researchers titled "Perception of Technical Teachers on the Inclusion of Climate Change Information Needs in TVET Curriculum" (PTTICCINTVETC)" was used for data collection. The instrument was validated by three experts in Technology Education Department, Modibbo Adama University of Technology, Yola. The instrument was trial tested using 5 respondents from a technical college that is not part of the sampled population. The data collected was analyzed using Cronbach Alpha Correlation Co-efficient which yielded 0.81. The coefficient indicated high internal consistency which proved that the instrument is reliable to be used for the study. The data collected was analyzed using mean to answer research questions whereby a mean cut-off point of 3.50 was used for decision making. Any mean score of 3.50 and above was agreed upon while any mean score below 3.50 was disagreed upon. The research hypothesis was tested using z-Test at 0.05 level of significance.

Results

Table 1: Mean of the Perception of Technical Teachers on the Integration of Climate Change Information Needs in TVET Curriculum

S/N	Statement	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_G$	Remark
1.	Tutoring of climate change through TVET curriculum is key to sustainable environmental protection	4.11	3.76	3.94	Agreed
2.	Technical teachers can foster climate change adaptation strategy with the inclusion of information needs in the TVET framework	3.57	3.20	3.52	Agreed
3.	Technical teachers are confident that the TVET schools will drive climate change information needs	3.70	3.94	3.82	Agreed
4.	Technical teachers will be better facilitators of climate change information needs	3.82	3.42	3.76	Agreed
5.	Climate change information needs is essential in every module of TVET curriculum	3.57	3.04	3.49	Disagreed

Key: $\bar{X}_1$ = mean rating of climate change experts, $\bar{X}_2$ = mean rating of technical teachers, $\bar{X}_G$= Item mean

Result from the Table 1 revealed that technical teachers unanimously agreed on the inclusion of climate change information needs in TVET curriculum. The technical teachers are of the opinion that teaching and learning of climate change through TVET curriculum is key to ensuring sustainable environmental protection (with a $\bar{X}_G$ = 3.94). Technical teachers also opine in confidence that the TVET schools will impart climate change information needs. However, the teachers slightly disagreed with climate change information needs being essential in every module of TVET curriculum. In conclusion, technical teachers are of the opinion that there is a need for the inclusion of climate change information needs in TVET curriculum.

Table 2: Mean of the Extent Technical Teachers are Involved in Climate Change Information Needs/Dissemination

S/N	Statements	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_G$	Remark
6.	Technical teachers hold town hall seminars/orientation on climate change information needs	2.47	3.58	2.67	Disagreed
7.	Most technical teachers possess critical knowledge of climate change information needs	3.15	3.31	3.19	Disagreed
8.	Technical teachers are aware of climate change information needs beyond flooding	3.41	2.98	3.35	Disagreed
9.	Technical teachers carryout community sensitization on variability/extreme weather conditions	3.12	3.11	3.13	Disagreed
10.	Technical teachers require training and retraining on climate change information needs	3.82	3.42	3.76	Agreed

Key: $\bar{X}_1$ = mean rating of climate change experts, $\bar{X}_2$ = mean rating of technical teachers, $\bar{X}_G$ = Item mean

Table 2 shows that the respondents disagreed with almost all the suggested items on their involvement in climate change information needs/dissemination for sustainable environmental protection. Hence, technical teachers established that they do not give information on climate change. Technical teachers have limited knowledge of climate change and so need training and retraining on climate change information needs to facilitate the sustainable environmental protection vision.

Table 3: Mean of the Extent Technical Teachers Engage the Students in Climate Change Information Needs/Dissemination

S/N	Statements	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_G$	Remark
11.	Students are mostly involved in climate change adaptation strategies discussion classes	3.41	2.98	3.35	Disagreed
12.	Construction students are caution on variability /extreme weather conditions	3.12	3.11	3.13	Disagreed
13.	Students are taught of the need to dissemination climate change information needs	3.70	3.94	3.82	Agreed
14.	Seldom, students are told to identify safe and unsafe climate conditions	3.82	3.42	3.76	Agreed
15.	Students are taken on climate change adaptation strategies field trips	3.57	3.04	3.49	Disagreed

Key: $\bar{X}_1$ = mean rating of climate change experts, $\bar{X}_2$ = mean rating of technical teachers, $\bar{X}_G$ = Item mean

Result on how often technical teachers engage their students in dissemination of climate change information needs, respondents were of the opinion that students are told of the need to disseminate climate change information. The teachers also agreed that sometimes, students are told to identify safe and unsafe climate conditions. However, three out of the five suggested items were disagreed upon.

Table 4: Mean of the Perception of Technical Teachers on Climate Change Information Needs Considered Appropriate for Inclusion in TVET Curriculum

S/N	Statements	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_G$	Remark
16.	Information on adaptation measures	3.91	4.47	3.15	Agreed
17.	Information on mitigation	3.57	3.20	3.52	Agreed
18.	Information on causes	3.57	3.38	3.55	Agreed
19.	ICT use in information need on variability/extreme weather conditions	3.48	2.96	3.54	Agreed
20.	Information on occupation diversification	3.67	3.40	3.64	Agreed

Key: $\bar{X}_1$ = mean rating of climate change experts, $\bar{X}_2$ = mean rating of technical teachers, $\bar{X}_G$ = Item mean

Research question 4 which sought to find out the climate change information needs considered appropriate for inclusion in TVET curriculum, respondents agreed with all the suggested items as being appropriate for inclusion in TVET curriculum. That is, climate change information needs is required to be included in the TVET curriculum for sustainable environmental protection.

Table 5: z-Test Analysis of Difference between Response of Climate Change Experts and Technical Teachers on the Climate Change Information Needs Considered Appropriate for Inclusion in TVET Curriculum

Respondents	N	X	S^2	z-cal	z-crit	Remarks
Male Teachers	105	3.38	0.07	1.95	1.96	Not Significant
Female Teachers	11	3.18	0.04			
Total	116					

Where: P< 0.05, N = Number of Respondents, x = Mean, SD = Standard Deviation, z-cal = z-calculated value, z-crit = z- critical value.

Table 5 revealed that z-cal is 1.95 and is less than the z-crit of 1.96 at 0.05 level of significance. Hence, the null hypothesis was accepted indicating that there is no significant difference between the mean responses of climate change experts and technical teachers on the climate change information needs considered appropriate for inclusion in TVET curriculum.

Findings and discussion

The result obtained from this study shows that technical teachers are of the opinion that climate change information needs should be included in the TVET curriculum**.** This is in consonance with the assertion of Shrivastava, (2006), that the process of providing learning experiences to obtain the knowledge, understanding, skills and awareness with the desirable attitudinal changes about man's relationship with natural and man -made surroundings, stands the appropriate tool for exposing the individual into the awareness of what the environment he has to interact with is, and also, how to explore and still protect the environment in order to avert the existing environmental problem which has left the world over with sleepless night**..** Also, the technical teachers' opinion is due to the significant roles of TVET to facilitate the sustainable environmental protection vision. Hence, the inclusion of climate change information needs will expose TVET students to environmental protection awareness, the interrelationship between the TVET and climate change information needs and how to use technological knowledge and vocational principles to facilitate the sustainable environmental protection vision. To this end, TVET students will be exposed to the constructive application of principles of technology and vocations in the society**.**

Also, result showed that technical teachers established that they have limited knowledge of climate change and so need training and retraining on climate change information needs to facilitate the sustainable environmental protection vision. However, Moyinoluwa (2013) concluded that the new approach is to see education as primarily a process by which the individual learner is provided with skills to organize his knowledge and to increasingly become more functionally and efficient in all his or her intellectual and service delivery efforts.

The study found that technical teachers to some extent do not engage their students in climate change information needs and dissemination. This might be due to the non-inclusion in the TVET curriculum. If the module is integrated, this will go a long way in promoting sustainable environmental protection in Nigeria. The study also revealed that climate change information needs is urgently required to be included in the TVET curriculum to facilitate the sustainable environmental protection vision. In the light of this, climate change information needs have to be applied in the TVET curriculum under safety education to complement the existing content. The study also found that there is no significant difference between the mean responses of climate change experts and technical teachers on the climate change information needs considered appropriate for inclusion in TVET curriculum.

Conclusion

Based on the study findings, TVET teachers unanimously agreed upon the inclusion of the urgent need of climate change information needs in the TVET curriculum. Technical teachers also established that they have limited knowledge of climate change and so need training and retraining on climate change information needs to facilitate the sustainable environmental protection vision. Perhaps due to the fact, it is not part of the curriculum. Conclusively, the study revealed climate change information needs considered appropriate for inclusion in TVET curriculum to in include: Information on adaptation measures, causes, mitigation among others. Also considered appropriate is the information and communication technology use in information need on variability/extreme weather conditions. This is because TVET helps create and stimulate consciousness, curiosity, critical thinking and skills to create jobs as well as bring about national and by extension global development. Stringent approaches are generated in startling circumstances due to the knowledge of climate change information needs in the TVET curriculum. Responses on the climate change information needs considered appropriate for inclusion in TVET curriculum were found not to be significantly different.

Recommendations

1. Curriculum planners and other relevant agencies should make stringent efforts to include climate change information needs in the TVET curriculum.
2. There should be close monitoring to ensure conformity to avoid misinterpretation or misuse of information.
3. Technical teachers require training and retraining on climate change information needs.
4. Nigerian government and other non-governmental organizations should as a matter of urgency develop and implement climate change information needs in TVET curriculum to facilitate the sustainable environmental protection vision.

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REFORMING AUTOMOBILE TECHNOLOGY EDUCATION CURRICULUM FOR CLIMATE CHANGE

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Abstract: *Emissions from motor vehicle exhaust contribute much in the pollution of our environment and this has a significant impact on the global warming or climate change. Therefore, this paper looked into the influence of such emissions in the environment and general health of the public. Solutions to this development will only be achieved through the reformation of automobile technology education curriculum which will enable scholars and general public to understand; the impact of automobile emissions in climate change, need for inclusion of catalytic converter in motor vehicle and possible ways of reducing emissions from motor vehicle. Conclusion was drawn based on the issues discussed.*

Keywords: *Automobile, Technology Education, Curriculum Reform, Climate Change*

Introduction

There is no much distinct between technical education and technology education. Technical education is the acquisition of skills and techniques in a chosen occupation or professional to enable an individual earn a living. Sanusi (2003) defined technical education as a training for an individual to help him acquire skills, knowledge and attitude in a particular occupational area for employment with respect to societal needs. In the same vein technology education is a type of education that provides a wider range of skill levels from basic entry level skill to highly technical skills requiring a high degree of specialization and competence, (Elom, 2012). The primary purpose of both type of education is to impart to recipients, skills, scientific knowledge and competence that can enable them work very effectively in industrial and commercial ventures through a systematic and well prepared progrmme training and instruction. Technology education has many programmes as a course of study. Some of these areas of study include; building technology education, electrical/electronics technology education, automobile technology, metal work, woodwork, Air condition and refrigeration etc.

Automobile technology is one of the major study areas in technology education. Automobile technology education is therefore, the study of motor vehicle or automechanics. As a course of study, it can be offered in technical colleges, colleges of education (technical) polytechnics and universities. Automobile is a self moving object. Auzuibuike (2018) described automobile as a passenger vehicle designed for operation on ordinary roads and typically having four or more wheels. It may be either a gasoline or diesel internal combustion engine and more recently electrical. Also Uneke (2015) stated that automobile technology refers to a vehicle consisting of four wheels or more and powered by an internal combustion engine. Automobiles are used to transport people and items from one location to another location. After years of various designs, inventors were able to develop a functional general decisions that is utilized by major Automakers as the foundation of their designs. Automobiles generally use gasoline to fuel the internal engine, but technological advances have led to the design of vehicles that can run using electricity, solar energy and water. Automobiles have different systems but they work together for them to be functional. These systems are classified according to their functions in automobile technology curriculum for the effective study of the contents. Curriculum is the plan for action or a written document, which include strategies for achieving desired educational goals or ends. (Ijiga, 2010) said it all involves all programmes of activities designed by the school to enable learners attain, as far as possible desirable educational goals or ends. Automobile technology curriculum should be reformed from time to time because of the tremendous changes in technology which influence conditions in our environments.

Curriculum reform is the modification of an existing curriculum with the hope of providing a better curricular programme (Fafunwa 1997). It is the introduction of novelties in terms of content and practice, the alteration of what is established, a novel content, practice and method. One of the unstable factors that may cause for curriculum reform is the change of climate. Climate change, or global warning and environmental pollution/degradation are new realities staring the human community in the face today. With their deleterious effects. The effects of climate change are very disturbing in our day to day activities. Climate change is a significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. It may be a change in average weather conditions (Ijiga and Ujah 2015). Climate change is caused by factors that include; oceanic processes, biotic processes, variation in solar radiation received by earth, human induced alteration of the natural world such as the emissions from motor vehicles.

Motor vehicle emissions are one of the leading cause of air pollution (Van & Dutty, 2000). In the same vein, Sharma and Eneh (2011) stated that, in case of noise pollution, the dominant source is the motor vehicle, producing about 99% of all unwanted noise worldwide. In Nigeria something must be done in order to cope with the climate change because some common types of pollution have main effects on humans. Adverse air quickly can kill organisms, including humans and ozone pollution can cause respiratory disease such as cardiovascular disease, throat inflammation, chest pain and congestion, (Lorenz, 2007; Kallman, 2008; Eneh, 2011). Therefore, curriculum of automobile technology should be reformed to create awareness among teachers, scholars and uses of motor vehicle on some of the dangerous outcome of motor vehicle driving and highlight some of the remedies to emissions from the motor vehicle. Thus, knowing the impact of automobile in climate change, understanding the need for catalytic converter in motor vehicle, and ways of reducing emissions from motor vehicle.

Impact of automobile emission in climate change

For years now, many scientists and other scholars have been raising concerns about climate change and the consequences of the warming of earth. And excessive amount of carbon in the atmosphere contributes to global warming, with emissions from factories and power plant being a major contributor to increased levels of atmospheric carbon. However automobile emissions are another major source of carbon. Emissions from automobile increase pollution levels, which lead to all manner of health problems. Understanding automobile carbon emission and what car owners can do to reduce it will go a long way toward addressing the effects of carbon emissions (Kerstetter 2004). Carbon traps heat in the atmosphere, preventing it from escaping from the earth. Some scientists theorize that this has led to a warmer earth over the past century, increasing the odds of severe weather patterns, droughts and other problems. Consequently, governments around the world have it a goal to reduce their carbon emissions. Reducing emission from vehicle is key to this effort. Carbon emissions include a number of different chemicals and particulates that are produced when fuel is burned in an engine. Some of the major substances found in a vehicles exhaust include carbon (iv) oxide, ozone and carbon monoxide. Other chemicals often found in exhaust gasses are, Benzene and nitrogen oxides. Many of these chemicals serve an important purposes in different parts of atmosphere, but they can have had bad consequences when human beings inhale them directly. Therefore, Global warming endangers our health, jeopardize our national security, and threatens other basic human needs. Some of the impacts include high temperatures, rising seas, and severe flooding and droughts and they are increasing commonly. Our personal vehicles are a major cause of global warming. Collectively, cars, and trucks account for nearly one-fifth of all emissions, emitting around 24 pounds of carbon (iv) oxide and other global warming gases for every gallon of gas. About five pounds comes from the extraction, production, and delivery of the fuel, while the great bulk of heat trapping emissions comes from vehicle tail pipe. Vehicle emission have a number of harmful effects on human health. Although people with healthy livings are affected by these chemicals, individuals with living problems are at a particularly high risk of being harmed by vehicle emissions. Those who suffer from conditions such as asthma chronic obstructive pulmonary diseases (COPD) experience worsening symptoms when they are exposed to excessive amounts of vehicle exhaust.

Many of the chemicals found in vehicle emission have been identified as carcinogens. Some experts have suggested that about half of cancers related to outdoor air pollution can be tied to vehicle emission. Reduce emission and there will be fewer cancer causing chemicals in the air that people breathe every day. Furthermore, irritants in vehicle exhaust can cause the obstruction of airways and other breathing problems and contribute to other health issues. (Sharma & Eneh, (2011). The elderly and young children are also at a higher risk of having an adverse reaction to vehicle exhaust than other members of the population.

Need for catalytic converter in the motor vehicles

A catalytic converter is an exhaust emission control device that reduces toxic gases and pollutants in exhaust gas from an internal combustion engine into less-toxic pollutants by catalyzing a redox reaction (an oxidation and a reduction reaction). Catalytic converters are usually used with internal combustion engines fueled by either gasoline or diesel including lean burn engines as well as kerosene heaters and stoves. There are two types of catalytic converters, two-way converters and three-way converters. Two-way converters combine oxygen with carbon monoxide (O) and unburned hydrocarbons (HC) to produce carbon dioxide (CO_2) and water (H_20). In 1981, two-way catalytic converters were rendered obsolete by three-way converters which also reduce oxides of nitrogen (NO). However, two-way converters are still used for learn burn engines. This is because three-way converters require either rich or stoichiometric combustion to successfully reduce (NO).

Although catalytic converters are most commonly applied to exhaust systems in automobile, they are also used on electrical generators, forklifts, mining equipment, trucks, buses, locomotives, and motorcycles. They are also used on some wood stoves to control emissions. This is usually in response to government regulation, either through direct environmental regulation or through health and safety regulations. Catalytic converters require a temperature of $800^{O}F$ ($426^{O}C$) to effectively convert harmful exhaust gases into inert gases, such as carbon dioxide and water vapour. Therefore, the first catalytic converters were placed close to the engine to ensure fast heating. However, such placement can cause several problems. One of these is vapor lock. As an alternative, catalytic converters were moved to a third of the way back from the engine, and were then placed underneath the vehicle. Two-way catalytic converter was a 2-way oxidation, sometimes called oxi-cat. Thus means two simultaneous tasks:

1. Oxidation of carbon dioxide: $2C+0_2 = 2CO_2$.
2. Oxidation of hydrocarbons (unburnt and partially burned fuel) to carbon dioxide and water: $C_xH_{2x}+2 + (C3x +1)/2)O_2 + XCO_{2\,(x+1)}\,H_2O$ -a combustion reaction.

This type of catalytic converter is widely used on diesel engines to reduce hydrocarbon and carbon monoxide emission. Three-way catalytic converters (TWC) have the additional advantage of controlling the emission of nitric oxide (NO) and nitrogen dioxide ($N0_2$) both together abbreviated with No and not to be confused with nitrogen oxide (N_2O), which are precursors to acid rain and smog, since 1981, three-way (oxidation-reaction) catalytic converter have been used in vehicle emission control systems in the united states and Canada. A three-way catalytic converter was three simultaneous tasks

1. $2CO + 2NO = 2CO_2 + N_2$
2. Hydrocarbon + $NO = CO_2 + H_2O + N_2$
3. $2H_2 + 2NO = 2H_2O + N_2$

Oxidation of carbon monoxide to carbon dioxide: $2CO + O_2 = 2CO_2$

Oxidation of unburnt hydrocarbons HC to carbon dioxide and water in addition to the above NO reaction.
Hydrocarbon + $O_2 = H_2O + CO_2$

These three reaction occur most efficiently when the catalytic converter receives exhaust from an engine running slightly above stoichemtric point.

Ways of reducing emissions from motor vehicles

Since most pollution from motor vehicles is due to the burning of fuel, you can reduce pollution from these sources by burning less fuel, burning fuel cleaner and burning cleaner fuel.

1. ***Burning Less Fuel***:
   (a) Next time you purchase a vehicle, buy the most fuel efficient vehicle that meets your average daily needs, larger vehicle or trailer for the occasional large wound.
   (b) If you have more than one vehicle, use the most fuel-efficient one possible.
   (c) Use transit vehicle or van-pool as often as you can. Doing so three times a week can reduce your fuel consumption up to 50%
   (d) Use bike or walk to avoid fuel use entirely.
   (e) Telecommute (work from a home-based location via phone or internet) to reduce driving.
   (f) Minimize during by working and playing closer to home.
   (g) Plan errands to avoid unnecessary driving.
   (h) Accelerate gradually-a smooth start uses
2. ***Burn Fuel Cleaner:***
   (a) Keep your vehicle well-tuned and tires inflated properly to reduce emissions.
   (b) Combine errands into one trip-vehicles pollute less when they are warmed up.
   (c) Avoid idling-idling exhaust contains more pollutants than running exhaust.
   (d) If you purchase a new vehicle, look for a low emission vehicle (LEV).
3. ***Burn Cleaner Fuel:***
   (a) Low-sulfur gasoline reduces pollutants by 10-15%
   (b) 85% ethanol fuel (E85) can be used in flexible fuel vehicles.
   (c) Other alternative transportation fuels such as natural gas a bio-diesel are most practical for fleets of vehicles.

Fortunately, it is not difficult for individuals to reduce the carbon emissions from their vehicles. First, existing vehicle owners who are not planning on buying a new car any time soon should focus on their driving behavior. Driving only when absolutely necessary and combing many errands into one trip will reduce driving time, and less time spent on the road means reduced carbon emissions. Families and individuals who own more than one automobile can also consider getting rid of extra ones. This usually reduces the amount of time the owner spends on the road. Secondly all vehicle owners should keep their vehicles properly maintained. Have the exhaust system on a vehicle checked for leaks. And install a pollution control system if there is not one in place or that the existing one needs replacing. Such steps will reduce the amount of chemicals released into the atmosphere. Finally, vehicle owners should make sure to drive as efficiently as possible. Increased weight leads to more fuel use, so vehicle owners should not carry unnecessary weight in the trunk or passenger sections of their vehicles. Consider switching to a vehicle that gets more miles to the gallon and thereby uses less fuel and produces less emissions. These easy steps will go a long way to helping solve the problem of excessive carbon emission from motor vehicles.

Conclusion

From all indications, emission from motor vehicle exhaust contribute much in the climate change or global warming of our envionremnt. It is very pertinent that the curriculum of automobile technology should be reformed from time to time so as to create enough awareness among scholars and the generally public the implications of motor vehicle emissions. This problem should be identified through the changes in school curriculum so that full knowledge of these emissions should be understood and subsequently solutions or remedies be disclosed.

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CLIMATE CHANGE AWARENESS AMONG SCIENCE AND TECHNOLOGY TEACHERS OF SECONDARY SCHOOLS IN MINNA METROPOLIS NIGER STATE

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Abstract: *Climate change awareness is much needed for public support in its mitigation and adaptation. In this regard, public education is critical in raising levels of awareness on the subject. This research was designed to assess the level of climate change awareness among Science and Technology Teachers of Secondary Schools in Minna Metropolis of Niger State. Objectives of the study were to: assess teachers' level of climate change awareness, identify factors that causes climate change, effects of climate change on the society and strategies for reducing the effects of climate change. Descriptive survey design was adopted in which some 95 randomly selected respondents were drawn from 15 secondary schools within Minna Metropolis of Niger State. A structured questionnaire was administered to obtain data on teachers' knowledge and opinion on climate change. The findings of the study showed, among others, that the level of climate change awareness among secondary school science and technology teachers in Minna Metropolis of Niger State is not significantly low. Teachers registered a medium level of awareness albeit gaps in their knowledge. Hence, it was recommended that stakeholders should step-up climate change capacity building among the scence and technical teachers.*

Keywords: *Climate Change, Environmental Protection, Sustainablity, Technology Education*

Introduction

Interest in education about climate change has increased in recent years, attributable in part to expanded funding and leadership for educational programmes that address climate change (Anderson, 2012; UNESCO, 2009), the addition of climate change to educational curriculum guidelines (NRC, 2012), mounting awareness of unusual weather patterns (Trenberth, Fasullo & Shepherd, 2015), and the deepening concern of the likelihood of global environmental, social, and economic changes due to climate change (Adger, et al. 2013; Moorhead, 2009). Climate change constitutes one of the 21st century key challenges to development the world over (UNDP, 2007). As such, climate change and global warming have become issues of global concern in the recent decades. This is evidenced by the flurry of conferences, campaigns, reports and researches on this subject since the Rio Earth Summit in 1992. While there are natural causes of climate change, the current warring trend has been largely blamed on human activities mainly the burning of fossil fuels, industrial pollution, deforestation, and land use changes (IPCC, 2007; Weart, 2010). Global attention on climate change was sort for the first time by the Brundtland Report, Our Common Future, which stated that the unsustainable development practices of humankind have pushed the world's climate to a warming trend (UNWCED, 1987). On the contrary, the public's concern on climate change was not triggered by the Brundtland's report, but by the unusual northern hemisphere heat wave and drought of the summer 1988 (Christianson, 1999). Numerous studies conducted since then reveal that the vast majority of people across the world, especially in developing countries, are still unaware of climate change despite their high vulnerability to the impacts of climate change (Bostrom, *et al.*, 1994; Bord, Fisher & O'Conner, 1998). However, despite their awareness of changing weather patterns, people in Africa, are poorly informed about global climate change. The low level of awareness on climate change across sub-Saharan African countries is attributed to limited awareness campaigns on one hand and the fact that African countries have got too many problems ranging from poverty to political conflicts on the other hand hence climate change is never a priority issue (UNDP, 2007). Just like awareness, perception of climate change varies across regions in the world. Various studies show that people in developing countries are more likely to perceive climate change as a threat (GlobeScan, 2006). Contrary results were, however, reported by Pugliese and Ray (2009) who states that climate change is more likely to be perceived as a serious problem in the developed world than in developing countries,

despite developing countries being the most vulnerable to climate change impacts. Nevertheless, perception of climate change as threat has been increasing over the years (UNDP, 2007). In Nigeria effort has been made to create awareness about climate change, though not much was achieve. This study was designed to fill this gap by assessing the level of climate change awareness among secondary school teachers in Minna Metropolis of Niger State.

Statement of the problem

Climate change is real and its impacts have become obvious in Nigeria necessitating the need for reducing its cause and impact at the country level. However, causes, effects and mitigation of climate change require the public to be fully aware and perceive climate change as a problem of global concern. Science and technology teachers will thus have a critical role to play in the national climate change awareness campaign as educators of young Nigerians. Hence, some science and technology teachers in Nigeria may have limited understanding of climate change and this may affect their delivery on this subject. Therefore, the study sought to assess the level of climate change awareness among science and technology teachers in Minna metropolis of Niger State.

Research questions

1. What is the level of awareness on climate change among science and technology teachers in Minna Metropolis of Niger State?
2. What are the causes of climate change as perceived by science and technology teachers in Minna Metropolis of Niger State?
3. What are the effects of climate change on the society as perceived by science and technology teachers in Minna Metropolis of Niger State?
4. What are the strategies for reducing the effects of climate change as perceived by science and technology teachers in Minna Metropolis of Niger State?

Hypotheses

H_{O1}: There is no significant difference between the responses of male and female teachers on the causes of climate change as perceived by science and technology teachers in Minna Metropolis of Niger State.

$H_{O@}$: There is no significant difference between the responses of male and female teachers on the effects of climate change as perceived by science and technology teachers in Minna Metropolis of Niger State.

H_{O3}: There is no significant difference between the responses of male and female teachers on the strategies for reducing the effects of climate change as perceived by science and technology teachers in Minna Metropolis of Niger State.

Methodology

The design of the study was a survey research design. The population comprised of all the Science and Technology Teachers teaching in secondary schools in Minna Metropolis of Niger State. The sample for the study consisted of 95 Science and Technology Teachers drawn from secondary schools in the study area. Structured Questionnaires were used to obtain specific information from a representative sample of these teachers about climate change. To ensure validity of the instrument, the instrument was subjected to face validation by three experts in Environmental Science Education. The trial test for determining the reliability coefficient of the instrument was carried out using 30 science and technology teachers in Federal Capital Territory, Abuja. The reliability coefficient of the instrument was found to be 0.67 using Cronbach Alpha. Data were analyzed using frequency, percentage, mean and standard deviation to answer the research questions while hypotheses formulated were tested using t-test statistics at 0.05 level of significance.

Results

Table 1a: Awareness of Climate Change

Awareness	Frequency	Percentage (%)
Yes, aware	90	94.74
No, not aware	5	5.26
Total	**95**	**100%**

Table 1a indicated that 90 respondents (94.74%) were aware of climate change while 5 respondents (5.26%) were not aware of climate change.

Table 1b: Medium of Disseminating Information on Climate Change

S/N	Medium	Frequency	Percentage (%)
1.	National Radio station	75	83.33
2.	Vernacular radio station	68	75.56
3.	Television	90	100.00
4.	Newspapers and magazines	55	61.11
5.	Internet	50	55.56
6.	Public libraries	10	11.11
7.	Seminar/workshop	15	15.00

Table 1b indicated that 83.33% of respondents that were aware of climate change got the information through National radio station, 75.56% through Vernacular radio station, 100.00% through Television, 61.11% through Newspapers and Magazines, 55.56 % through Internet, 11.11% through Public libraries and 15.00% through Seminars and Workshops.

Table 1c: Degree of Respondents' Knowledge of Climate Change

Status	Frequency	Percentage (%)
Much	55	61.11
Little	35	38.89
Total	**90**	**100.00**

Table 1c showed that majority (61.11%) of the respondents that are aware knew much about climate change while minority (38.89%) of the respondents that know little about climate change.

Table 2: Mean and Standard Deviation of Respondents on the Causes of Climate Change

S/N	Item	Mean	Std. Dev.	Remark
1.	Deforestation	3.60	1.01	Agreed
2.	Combustion of fossil fuels	3.51	0.92	Agreed
3.	Poor agricultural practices (Example, fertilizers)	2.79	0.72	Agreed
4.	Air pollution from industries	3.33	0.83	Agreed
5.	Poor management of waste	2.95	0.92	Agreed
6.	Quantity of greenhouse gases in the atmosphere	3.05	0.95	Agreed
7.	Strength of the sun	2.66	0.82	Agreed
8.	Changes in the Earth's orbit	2.58	0.77	Agreed
9.	Changes in the orientation of the Earth's axis of rotation	3.00	0.76	Agreed

S/N	Item	Mean	Std. Dev.	Remark
10.	Climate change is caused by CO_2 content of the oceans	3.62	0.66	Agreed
11.	Climate change is caused by meteorite impacts	2.95	0.89	Agreed
	Grand Mean and Standard Deviation	3.09	0.84	Agreed

The data presented in Table 2 revealed that all 11 items had average mean values ranging from 2.58-3.62. This showed that the mean value of each of the items was above the cut-off point of 2.50, indicating that Science and technology teachers are of the view that those items are the causes of climate change. The table also showed that the average standard deviation (Std Dev) of the items ranged from 0.66-1.01, an indication that the respondents were not very far from the mean and one another in their response.

Table 3: Mean and Standard Deviation of Respondents on the Effects of Climate Change

S/N	Item	Mean	Std. Dev.	Remark
1.	Leads to rise in sea level	3.52	0.99	Agreed
2.	Leads to food shortages	3.58	1.01	Agreed
3.	It is associated with the increased frequencies of droughts and floods	2.65	0.93	Agreed
4.	It may lead to expansion of rivers and lakes	3.30	0.67	Agreed
5.	Leads to shrinking of lakes and rivers	2.93	0.74	Agreed
	Grand Mean and Standard Deviation	3.20	0.87	Agreed

The data presented in Table 3 revealed that all the 5 items had average mean values ranging from 2.65-3.65. This showed that the mean value of each of the items was above the cut-off point of 2.50, indicating that Science and technology teachers are of the view that those items are the effects of climate change in the society. The table also showed that the average standard deviation (Std. Dev.) of the items ranged from 0.67-1.01. This indicated that the respondents were not very far from the mean and one another in their response.

Table 4: Mean and Standard Deviation of Respondents on the Strategies for Reducing the Effects of Climate Change

S/N	Item	Mean	Std. Dev.	Remark
1.	Switching to electric vehicles	3.20	1.03	Agreed
2.	**U**nplugging all devices when not in use	3.33	0.98	Agreed
3.	Suppressing population growth	2.78	0.77	Agreed
4.	Putting a stop to chopping of forests	2.65	1.10	Agreed
5.	Foregoing use of fossil fuels	2.88	0.78	Agreed
6.	Encouraging the use of public transport always	3.02	0.89	Agreed
7.	Educating people on climate change	3.56	0.69	Agreed
8.	Saying no to the use of plastic	2.96	0.93	Agreed
	Grand Mean and Standard Deviation	3.04	0.90	Agreed

The data presented in Table 4 revealed that all the 8 items had average mean values ranging from 2.65-3.56. This showed that the mean value of each of the items was above the cut-off point of 2.50, indicating that Science and technology teachers are of the view that those items are the strategies for reducing the effects of climate change. The table also showed that the average standard deviation (Std.Dev.) of the items ranged from 0.69-1.10. This indicated that the respondents were not very far from the mean and one another in their response.

Table 5: t-test Analysis of the Mean Response of Male and Female Science nd Technology Teachers on the Causes of Climate Change

Category	N	X	Std. Dev.	Df	t-tab.	t-cal.	Sig.	Decision
Male Teachers	50	3.14	0.92					
				88	1.96	0.493	0.00	Accepted
Female Teachers	40	3.05	0.81					

The t-test analysis in Table 5 showed that there was no significant difference between mean response of male and female science and technology teachers on the causes of climate change. This was indicated by the overall calculated t-value of 0.493 which is less than the t-tabulated of 1.96 at degree of freedom of 88 and 0.05 level of significance. As a result, the hypothesis was accepted. In other words, male and female science and technology teachers did not differ significantly in their responses on the causes of climate change.

Table 6: t-test Analysis of the Mean Response of Male and Female Science and Technology Teachers on the Effects of Climate Change

Category	N	X	Std. Dev.	Df	t-tab.	t-cal.	Sig.	Decision
Male Teachers	50	3.23	0.90					
				88	1.96	0.324	0.00	Accepted
Female Teachers	40	3.17	0.85					

The t-test analysis in Table 6 showed that there was no significant difference between mean response of male and female science and technology teachers on the effects of climate change. This was indicated by the overall calculated t-value of 0.324 which is less than the t-tabulated of 1.96 at degree of freedom of 88 and 0.05 level of significance. As a result, the hypothesis was accepted. In other words, male and female science and technology teachers did not differ significantly in their responses on the effects of climate change.

Table 7: t-test Analysis of the Mean Response of Male and Female Science and Technology Teachers on the Strategies for Reducing the Effects of Climate Change

Category	N	X	Std. Dev.	Df	t-tab.	t-cal.	Sig.	Decision
Male Teachers	50	3.07	0.97					
				88	1.96	0.417	0.01	Accepted
Female Teachers	40	2.99	0.85					

The t-test analysis in Table 7 showed that there was no significant difference between mean response of Male and Female science and technology teachers on the strategies for reducing the effects of climate change. This was indicated by the overall calculated t-value of 0.417 which is less than the t-table of 1.96 at degree of freedom of 88 and 0.05 level of significance. As a result, the hypothesis was accepted. In other words, male and female science and technology teachers did not differ significantly in their responses on the strategies for reducing the effects of climate change.

Findings and discussion

1. It was discovered from Table 1 that majority of the teachers 90(94.74%) were aware of climate change. Also, 55(61.11%) of the teachers that were aware knew much about climate change. All the teachers 90(100.00%) that were aware of climate change got the information through Television. These findings is in line with the findings of Ochieng (2014) who carried out a study on climate change awareness and policy implications among secondary school teachers in Kisumu City, Kenya and discovered that majority of the teachers were aware of the climate

change although there was significant gap in their level of awareness. He also pointed out that library was considered most appropriate means of climate change information dissemination followed by the internet and local radio stations respectively while national radio stations and television were perceived the least appropriate.

2. Table 2 provided answer to research question 2. The result shows that majority of the teachers agreed that all 11 items are the causes of climate change. The hypothesis tested also revealed no significant difference in the opinions of male and female teachers. This finding is also in line with the findings of Ochieng (2014) who discovered in his study that secondary school teachers in Kisumu City, Kenya have some understanding of the basics of climate change though with gaps in their knowledge. These results corroborate the concerns expressed by RoK (2013) and Otieno, Pauker and Maina (2009) both of whom states that Kenyans are poorly informed about climate change and hence portrays significant gaps in their knowledge of the same. British Geological Survey also attributed the causes of climate change to factors like strength of the sun, changes in earth's orbit, quantity of greenhouse gases in the air, etc. Table 3 showed that the teachers agreed that the listed items were the causes of climate change. The hypothesis tested also revealed no significant difference in the opinions of male and female teachers. This finding is in agreement with the finding of Ochieng (2014) who pointed out that food shortages was considered the most significant effect of climate change, followed by increased frequency of droughts and floods, sea level rise.
3. The result in Table 4 revealed the views of the teachers on strategies for reducing the effects of climate change. The result showed that majority of the teachers agreed that the items were effective strategies for reducing the effects of climate change. The hypothesis tested also revealed no significant difference in the opinions of male and female teachers. This finding is supported by Lindsay Luke (2017) who carried out a study on The effects of climate change considerations in environmental assessment: A case study of British Columbia's Liquid Natural Gas Sector stating that effect of climate change can be reduced by switching to electric vehicles, unplugging all devices when not in use, etc. Kashyap Vyas (2019) also identified ways to reduce climate change to include putting a stop to chopping of forests, by encouraging the use of public transport, educating people on climate change and saying no to the use of plastic.

Conclusion

Climate change is a complex subject usually surrounded with a lot of skepticism hence the need for conclusive evidence to support climate change reality. The findings of this study have also revealed that science and technology teachers in Minna Metropolis of Niger State are aware of climate change. By implication, the relatively high level of awareness on climate change recorded by secondary school teachers is a positive ingredient in the country's policy on climate change knowledge transfer. Further, the study revealed that secondary school teachers in Minna Metropolis of Niger State perceive some factors as causes and effects of climate change. However, it is imperative that climate change awareness campaign be carried out among secondary school teachers to improve their understanding of climate change and enhance their capacity as agents of climate change knowledge transfer in the classroom.

Recommendations

1. The government should embark on comprehensive awareness creation programmes for secondary school teachers highlighting the content as well as methods for capacity building to ensure that teachers' understanding of climate change is improved.
2. The Ministry of Education, Science and Technology should organize seminars and workshops on climate change for teachers, especially those teaching subjects that have topics climate change to help them acquire current knowledge on this subject.
3. The Ministry of Education, Science and Technology should also develop and circulate learning materials on climate change to all secondary schools in Minna Metropolis of Niger State.

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THE NEED FOR ENHANCING GREEN SKILLS INTVET FOR PROMOTING ENVIROMENTAL PROTECTION FOR SUSTAINABLE DEVELOPMENT

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Abstract: *The development of green skills in Technical vocational and trainingeducation is central to the nation's desire of becoming industrialized and self reliant. However, present reality in Nigeria indicates that it will take more than mere refocusing of TVET education in its present form to make it more relevant, responsive and effective.Hence, for Nigeria to advance technologically there is need to strengthen the curriculum of Technical vocational and training education towards green technology. This paper discusses the Green jobs in TVET, TVETTraining inGreen Technology, The state of the present TVET curriculum towards acquiring green skills. challenges of technical vocational and training and the need for sound technical vocational and training for green skills. It was recommended, among others that, the curriculum of technology education should be reviewed within a timeframe of 3 years in other to keep in pace with technological advancement.*

Keywords: *Green Skills, TVET, Enviromental Protection. Sustainable Development*

Introduction

In the 21st century, economic power of a countrydepends on its nature of environment or abundant natural resources Nigeria Education Research Development Centre (2008) these resources areenvelopes by series of challenges. These sad state of being give birth to trends in the environment such as global warming, changing weather patterns, floods, drought, rising seale and scarcity of natural resources require adaptation measures. These changes are being felt all over the world especially where sustainable development is compromised. Okwelle (2011) viewed Sustainable development as development which meets the needs of present generations without compromising the ability of future generations to meet their own needs. Human population is obliged to change their production patterns to cope with changes in physical environment of planet Earth. A global green technological need is greater in scale and achievable in short time is required. Green skills are those skills needed for practical application of knowledge from environmental science to conserve the natural environment and resources in harmony with mother nature and ecology (World Bank, 2010). These skills intend to improve the economy without harming the environment. It is a new development paradigm that creates new growth engines. These green skills help in transforming the economy. It will also green the economy a n d ultimately affect skill needs and consequently the trainin gneeds. The green skills restructuring will call for 'upskilling' to enable workers and enterprise to move from declining to growing sectors and occupations.

Green jobs in TVET

The extent to which technical training institutes have provided relevant training courses, established and followed new regulations and developed new technologies is not known. New skills will be needed by workers in current occupations and industries in the process of greening existing jobs. Green jobs are defined as jobs that reduce the environmental impact of enterprises and economic sectors, ultimately to levels that are sustainable OECD(2011),. This definition covers work in agriculture, industry, services and administration that contributes to preserving or restoringthe quality of the environment while also meeting the criteria for decent work adequate wages, safe conditions, workers' rights, social dialogue and social protection.It also covers activities related to both mitigation of and adaptation to climate change. It Implies in its inclusivity and breadth that every job can potentially become greener. As time goes on and the transition to a green economy intensifies, what is considered a green job today might not continue to be so regardedLSE Cities(2013);. The understanding of green jobs also varies from one country to another.

TVET training in green technology

The introduction of green technology has marks a turning point in the history of looking for a solution that aims at reducing environmental damage (Naing, 2011). These were created by products and technologies for human conveniences. It promises to increase farm profitability while reducing environmental degradation and conserving natural resources, provide cheap renewable energy from wind, sun, sea tides and waves, biogas and biofuels (Shyamal, 2011). Such application of products, equipment and systems are used to conserve the natural environment and resources. These call for changes in students' curriculum to be of urgent priority based on localized needs, job analysis, adherence to national and international standards and work-based learning. These changes need to have components of generic and green entrepreneurship skills and recognition of prior skillsfrom the workplace (Unep, 2011). Teacher training curriculum have to be industry immersed with capacity building and support from industry. This transformation can only be realized through networking as a platform to support proposed strategies. Since new technology appears as a common need for all these gments, international, regional, national and industr y-based, networking are needed. While institutional networking would benefit the process of building capacity in thematic areas (World Bank, 2013),.Training on green skills must ensure matching green jobs that can absorb them. There shouldn't be any gap between education and jobs, in cases when countries' labor market is not fully prepared for green development.

The state of the present TVET curriculum towards acquiring green skills

Curriculum is a series of intended learning experiences through which educational institutions Endeavour to realize the hope of the society (UNESCO, 2011), posit that, it is the totality of all the experience that the students are exposed under the direction of the school. However, the present technology education is insensitive to any change in technology. Usman and Mustapha (2008) maintained that the economy of Nigeria has being rather stagnant, unable to respond to any change or stimulation and may remain insensitive as long as the national technology capability still remains poor. This in turn makes the nation to continue to depend on foreign technology and technologist. More so, present curriculum of TVET is not oriented to actual jobs in the abour market or to make the graduates to become self reliant. ILO(2013) have it that,the curriculum content of technology education is not derived from actual functions performed on relevant jobs, but rather based on theoretical foundations. Ogbu (2008) is also of the view that the present technology education curriculum lacks workshop instructional activities. This makes the students graduate without any appreciable saleable skills

Challenges of technical vocational and training

The green skills development cushioned some changes in the structures of the economy and occupations of a nation and this obviously demand a commensurable skill adjustment. Some of these challenges are noticeable in the following trades

1. In Construction industry, one of the major challenges facing its numerous stages relates to construction process, one among of such innovation is the building information modeling (BIM). Dabo, Rishi and Musa (2012) define Building information modeling as technology and associated set of processes to produce, communicate and analysis building models. Building information modeling is a new approach to integrated project delivery in which a single comprehensive repository of the facilities data fromconceptual operation and maintenance is generated and coordinated concurrently. This is seen as an enabler that may help the building industry to improve its productivity.
2. In automobile technology, the most pronounced development is "HYBRID" Vehicle. A hybrid Vehicle uses multiple propulsion system to provide motivepower (Abdulgafar, 2011). This most refers to gasoline-electric hybrid vehicles, which uses gasoline /petrol to power the internal combustion engine and recharge their batteries, by capturing kinetic energy via regenerative braking.

3. Similarly, Electrical/electronic technology has also registered some innovation as in GSM repairs and satellite repairs and maintenance. Onyuekwe (2006) in his study or work on entrepreneurship to be introduced in the curriculum of Electrical/Electronic, lamented that there are other relevant courses which are professional which need to be included in the curriculum are GSM repairs, satellites settings and repairs etc
4. In lightt of the greening of economy, green occupations priority areas that TVET can focus on, include engineering technician, construction technician, organic agriculture technician and power generation technician - solar, wind, biogas and hydro, etc. (Abdulgafar, 2011).
5. Year in year out, the world of TVET has registered new innovations and technological advancements. Therefore, there is the urgent need to strengthen the curriculum of technology Education to meet the challenges of modern technology. Similarly, changes in technology have made training and retraining oftechnical and vocational education training of technicians, craftsmen and graduates to become highly skilled.

The need for sound technical vocational and training for green skills

The world technology today is witnessing an accelerated growth in technology, allied, semi-professional occupation and great number of other occupation for considerable vocational technical education.The graduates and students are required to possess some technical knowledge in additional to green skills (Ogbu, 2007) .This will minimize the impacts of human activities on the environment. This technology is needed across all sectors. Green investments, particularly in renewable energy and construction, are potentially significant engines for job creation (Kennedy, 2011). It is therefore, imperative to further strengthen the curriculum through innovation for proper development in the world of technology. This is because some of their occupation requires not only manual skill, but also a high qualified personnel's trained in accordance with the principles of technology Education needed for the nation to advances technologically.Osuala in Usman (2012) shared this opinion that Nigeria must be ready to accept the challenges brought about by modern technology and must develop potentials of her citizens through a systematic programme of vocational training for Nigeria. To compete favorably with other developing nations in an era of rapid economic and technological change, Nigeria has to improve her productivity throughout all sectorsof the economy. This requires a work force that is knowledgeable and has the flexibility, to acquire new skills for new jobs as the structures of the economy and occupation change. This availability of skillful workforce is critically depending on the functionality of the curriculum. Usman and Goshi (2012) pointed out that teacher within and outside the school systems should posses' adequate skills and competencies that will make them adaptable and productive so as to achieve national goals and objectives. But Okorie (2000) pointed out that some Educational teachers teaching subjects within the school are unable to perform any skill of a diversified nature and the teachers are not trained to repair or maintain implement or operate them. This is a clear indication that the existing curriculum is not very adequate in meeting the goals and objective of technology Education. Therefore, it will be of advantage and urgent need to strengthen the curriculum of technology for good technical capabilities in the country

Conclusion

Green Technology is the ability to develop the modality procedure and process to use what is available in terms of natural resources to produce what is needed in all spheres of human needs like medicine, agriculture, housing, transportation, education and politics.Green . Technology is a study which is essentially procedural and which uses knowledges and green skills as resources for action rather than a regarding them as ends in themselves.. This Technology can be summed up as the entire field of investigation, design, development, application and methods of rendering or making processes or machines self-acting or self-moving. Moreso, the implementation of the present curriculum is poor. This posed hchallenges to the programme due to incapability of the programme to function effectively as it is suppose to be. This explains why some countries do not have the needed manpower or close down some industries because of shortage of manpower to

man the industries. To compete favorably with the developed nations in an era of rapid economic and technological change, Nigeria must make human resource development her priority. Human resource development requires not only capital investment, but also a workforce that is knowledgeable and has the flexibility to acquire new skills or new jobs as the structures of the economy and occupations change. The inadequacies of the existing technology education curriculum demand strengthening on the bases of emerging technologies. The new curriculum must be of analytical nature that involves identification of jobs and tasks for green skills acquisition at the laboratory levels. The utilization of analytic curriculum has the promise of addressing the challenges of implementing technical education now in existence

Recommendations

1. The curriculum of TVET should be constantly reviewed after every 3 years in other to meet up with innovation brought about in accordance to global order in technology.
2. Workshop materials should make available for successful acquisition of the green skills .
3. The teachers of technology should be particular in the development of the curriculum.
4. The TVET should be made in such a way that will equipped student with green skills and competencies.

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VOCATIONAL TECHNICAL EDUCATION AND TRAINING: STRENGTHENING THE CURRICULUM FOR NATIONAL DEVELOPMENT IN PERSPECTIVE

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Abstract: *It is generally accepted that the development of a country is related directly to the educational level of its people. It then follows that, countries of the world that are considered to be the most developed technologically and economically are also those countries which are distinguished by the excellence of their educational systems.This paper discusses the importance of curriculum in teaching and learning technology education. The paper also notes some challenges of technology education trades, the state of present technology curriculum and discusses the need to strengthen the curriculum.Some recommendations made include, the review of curriculum of technology education in response to the demands of emerging technology and quest for national development.*

Keywords: *Curriculum Development, National Development, Emerging Technology*

Introduction

In the 21st century, economic power of a country does not depend on its population size or abundant natural resources but rather on technology (NERDC, 2008). Therefore, for a nation to achieve a technological driven economy or to compete with other developing nations in an era of rapid economic and technological change, human resources development should be her priority. In order to improve Nigeria's productivity in all sectors of the economy requires a workforce that is knowledgeable and has the flexibility to acquire new skills for new jobs as the structures of the economy and occupation changes. Vocational and technical education involves the acquisition of skills and competencies that can help the individual to function productively in industrial and commercial occupation. Federal Republic of Nigeria (2004) sees vocational and technical education as that aspect of education that gives its recipients an opportunity to acquire practical skills as well as basic scientific knowledge. Apagu and Mele (2010) viewed vocational and technical education as that system of education that provides the trained manpower needed for rapid technological and industrial development. The main objectives of vocational and technical education in Nigeria are the provision of trained and skillful personnel who will be enterprising and become self reliant economically (FRN, 2004). In general terms, vocational and technical education involves the acquisition of skills and competencies that can help the individual to function productively in industries and commercial occupations. The vocational and technical courses content as arranged, called for the performance or practical work types of learning which call for constant training and retraining. Abdulgafar (2011) viewed vocational training as learning activity which contribute to successful performance and tangible economic and social gains. While retraining is define as a process of upgrading existing skill or acquiring a new one. Kennedy (2011), Apagu (2012) and Dogara (2012) viewed retraining as subjecting or exposing an individual to further training and practice after initial training. On the other hand, it involves providing additional training to people who were already in other to boost their morale of becoming professionals in their area of discipline and to further enhance their ability in terms competence to handle some challenges or changes in their area of endeavor. The aspiration of any nation to transform into a great country can only be possible if there are competent and dedicated teachers to impart the needed knowledge, attitude and skill, (Teachers Registration council of Nigeria (TRCN) 2003). This is because the teacher is themajor practitioner of the educational system. It implies that teacher holds the key to nation building. In light of the above, the federal government of Nigeria has appreciated this critical role of the teacherby providing an enabling policy on education for national growth (FRN, 2004).

The aim of the teacher education in Nigeria is to produce highly motivated, conscientious, and efficient class room teachers, for all level of our educational system and to provide teachers with the intellectual and professional background adequate for their assignment and to make them adaptable to any changing situation not only in the life of their country, but in the wider world,(Usman & Joel, 2012). One among the teacher education programmes enshrined in National policy on education is technology Education. It is offered in the nations' tertiary institutions, mostly the Universities. The products of this system of education are expected to acquire skills and competencies to teach students of technical Colleges, Craftsmen and technicians, who in turn are expected to man ournationandmake our technological capabilities sensitive to any technological advancement. Inti (2008) stressed that for Nigeria to compete with other developing nations in an era of rapid technological and economic change, the country need a workforce that is knowledgeable and has the flexibility to acquire emerging skills for new Jobs as the structure of the economy and occupation changes. However, present development status of Nigeria indicates that it will take more than a mere refocusing of technical education in its present format to make it more relevant, responsive and efficient. To achieve the above lofty objective and for Nigeria to advance technologically, there is the needto have the curriculum of technology Education strengthen. Onweka in Usman and Joel (2012) viewed curriculum as a series of intended learning experience through which educational institutionsendeavour to realize the developmental status of the society. Okoro in Inti (2008) maintained that, curriculum is the totality of all the experiences that the students are exposed under the direction of the school. This can all be obtained and attained if only the curriculum is strengthened. Strengthening the curriculum simply refers to readdressing the curriculum to encompass innovations or changes or to make the curriculum powerfultomeet with the challenges of technological development

Importance of curriculum to technology education

Technology Education is an instrument or vehicle for national development which can be achieved through curriculum. Okofor and Odigbo in Usman and Joel (2012) viewed curriculum as a master plan of an appropriate set of activities and experiences involving both human and materials resources for the attainment of the desired technology education outcomes. The plan is centered on both learners and national interest or needs depicting the progressive and constructive view of what the currents should be. The curriculum can also lead to the production of appropriate manpower of a nation. In light of the above, Aleazi (1993) asserted that a functional curriculum has such qualities as integrative, relevant comprehensive, balanced functional and instructional, flexible and evaluative in nature for changes to occur in learners. Abdullahi, (2008) in support of the above statement enumerated the objectives of a functional curriculum as:

(a) The development of spiritual, mental and physical well being of the student.

(b) The development of skill by which students acquire knowledge and understanding of the skills

(c) Prepare the students to earn living.

(d) Developing of creative ability.

(e) The development of esthetics senses of the students. etc

The foregoing objectives should constitute the fabrics of the curriculum designed to meet technology education goals. The most important features of technical and vocational Educational and training curriculum are its orientation towards the world of work and its emphasis on the acquisition, of employability skills. When the curriculum is fully implemented these systems will be effective to train the skilled and entrepreneurial workforce that Africa needs to create wealth for freedom from poverty. Another important characteristic of the curriculum is that it can be delivered at different levels of training. This means that, the curriculum can respond not only to the needs of different types of industries, but also to the different training needs of learners from different socio-economic and academic background and prepare for gainful employment and sustainable development even though the objectives of technical education hold promise , there are associated implementation challenges.

The State of technology education curriculum

Curriculum is a series of intended learning experiences through which educational institutions Endeavour to realize the hope of the society. Okoro (2006) posit that, it is the totality of all the experience that the students are exposed under the direction of the school. However, the present technology education is insensitive to any change in technology. Usman and Mustapha (2008) maintained that the economy of Nigeria has being rather stagnant, unable to respond to any change or stimulation and may remain insensitive as long as the national technology capability still remains poor. This in turn makes the nation to continue to depend on foreign technology and technologist. More so, present curriculum of technology education is not oriented to actual jobs in the labour market or to make the graduates to become self reliant. Olaitan et al. (1999) have it that,the curriculum content of technology education is not derived from actual functions performed on relevant jobs, but rather based on theoretical foundations. Ogbu (2008) is also of the view that the present technology education curriculum lacks workshop instructional activities. This makes the students graduate without any appreciable saleable skills. This explains why some countries do not have the needed manpower or close down some industries because of shortage of manpower to man the industries.

The world of technology today is witnessing an accelerated growth in technology, allied, semi-professional occupations and great number of other occupations that require considerable technical Education training. The graduates and students are required to posses some technical knowledge in addition to manual skills for effective performance in emerging occupations. It is therefore, imperative to strengthen the technical education curriculum on the bases of new developments. This is because some of theiroccupa, the present technology education is insensitive to any change in technology. Usman and Mustapha (2008) maintained that the economy of Nigeria has being rather stagnant, unable to respond to any change or stimulation and may remain insensitive as long as the national technology capability still remains poor. This in turn makes the nation to continue to depend on foreign technology and technologist.

Nations require not only manual skills, also training in other domains of work behaviour. Osuala in Usman (2012) in his observation pointed out that Nigeria must be ready to accept the challenges brought about by modern technology and must develop potentials of her citizens through providing a systematic programme of vocational training for Nigerians. To compete favorably with other developing nations in an era of rapid economic and technological change, Nigeria has to improve her productivity throughout all sectorsof the economy. This requires a work force that is knowledgeable and has the flexibilityto acquire new skills for new jobs as the structures of the economy and occupation change. The production of skilled workforce greatly depends on implementing functional curriculum. Nzewi in Usman and Goshi (2012) pointed out that teachers within and outside the school (technical teachers inclusive) systems should posse's adequate skills and competencies that will make them adaptable and productive so as to achieve national goals and objectives. HoweverOkorie (2000) stressed out that some teachers are unable to perform any skill of diversified nature and technical teachers are not trained to repair, maintain, implement or operate tools and equipment. This is a clear indication that the existing curriculum is not very adequate in meeting the goals and objectives of technology Education. Therefore, it will be of advantage and urgent need to strengthen the curriculum of technology for the development of technical capabilities in the interest of national growth

Conclusion

Technology is the ability to develop the modality procedure and process to use what is available in terms of row materials to produce what is needed in all spheres of human needs like medicine, agriculture, housing, transportation, education and politics, It could be imported, copied or developed indigenously. Technology is a study which is essentially procedural and which uses knowledges and skills as resources for action rather than a regarding them as ends in themselves.. Technology can be summed up as the entire field of investigation, design, development,

application and methods of rendering or making processes or machines self-acting or self-moving. Man is now exploring the possibility of life in other planets as a result of great advance in our technology. Federal Ministry of Education, National Master Plan, stated that, technology is one of the most materials, techniques and sources of power to facilitate the production of goods and services. However, the development in primitive technology was marked with passage of time when bows, arrows, catapults and other contrivances replaced the use of bones, implements and sharp and pointed edges stones to hunt or subdue wild animals by primitive men. To compete favorably with the developed nations in an era of rapid economic and technological change,Nigeria must make human resource development her priority. Human resource development requires not only capital investment, but also a workforce that is knowledgeable and has the flexibility to acquire new skills or new jobs as the structures of the economy and occupations change. The inadequacies of the existing technology education curriculum demand strengthening on the bases of emerging technologies. The new curriculum must be of analytical nature that involves identification of jobs and tasks for skills acquisition at the laboratory levels. The utilization of analytic curriculum has the promise of addressing the challenges of implementing technical education now in existence.

Recommendations

1. The curriculum of technology Education should bereviewed when the need arises in the face of changing technology.
2. Curriculum materials should be made available for successful implementation of the curriculum content.
3. The teachers of technology should participate in the development of the curriculum.
4. The curriculum content should focus on the skills acquisition in the four domains (cognitive, affective, psychomotor and perceptual) of work behavior.
5. The curriculum should be in modular and analytical in nature for the enhancement of logical pedagogy.

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INFORMATION AND COMMUNICATION TECHNOLOGY IN TVET AS A TOOL FOR CLIMATE CHANGE INFORMATION AND SUSTAINABLE ENVIRONMENTAL PROTECTION IN NIGERIA

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Abstract: *Information and communication technology (ICT)embedded solution has been employed by some countries towards climate change information and sustainable environmental protection. Climatic challengesbeing faced in Nigeria require that government, Technical Vocational Education and Training (TVET) institutions, nongovernmental agencies (NGOs) and international bodies continue to work in close collaboration in order to promote the use of ICTs as a catalyst for change and sustainable development. Adaptation of mitigation strategies, response to emergencies, and balance on the ecosystem due environmental pressures are some vital issues that should be given greater attention by relevant stakeholders. This paper therefore highlights the roles ICT can play in climate information change and sustainable environmental protection in Nigeria. The paper equally recommends amongst others that massive investment on weather and disaster management ICT tools and equipment; training of personnel on the use of ICT tools in emergency and rescue operation and management; and of ICT tools' operation to suit local peculiarities of the country as some of the strategies on using ICT embedded tools in tackling climate change information and sustainable environmental protection in Nigeria.*

Keywords: *Information and Communication Technology,TVET, Environmental Protection, Sustainability*

Introduction

Climate change and environmental problems are topical issues across divergent fields of human endevours. This is as a result of the different ways it affect people. The continued exploitations of the environment for its resources come with its associated problems. The magnitude of these impacts require the adoption of novel and innovative approaches to solving environmental problems, natural resources management and eco system balance so as to overcome the effects of climate change and natural uncertainties associated with the environment. The use and adaptation of ICTs is an important component of this process.Efforts to understudy climate changes and provide a wide range of solution to some of identified problems gave rise to climate change information. Today, a world without ICTs is unthinkable (ITU, 2012). ICTs are integrated into almost every part of the world society and economy. With the increasingly widespread use of ICTs,it has changed people's lives and boosted economic growth and due to this success. Conversely,it has equally become a growing contributor to environmental degradation when misused.According to International Institute for Sustainable Development (2008), there are complex connections and tradeoffsamong the positive benefits, negative impacts, rebound effects and unintended consequences for the environment that flow from the development, use and disposal ofICTs throughout the economy and society.The society we live in according to Summak and Samancioglu (2011) is constantly changing. These changes are parts of human needs.

Information and communication according to Awe (2010) are still human needs. The author posits that the needs could be in all spheres- social, educational and commercial. Science and Technology provide enablers for satisfaction of human needs. Technology according to Otto and Albion (2004); Voogt and Knezek (2008) in Summak and Samancioglu (2011) itself if not well integrated into problem solving situations can cause problems for the environment or any other spheres of activity embarked upon by man. According to Houghton (2009) both developed and developing countries face many environmental challenges, including climate change, improving energy efficiency and waste management. These challenges including sustainable environmental protection and ecosystem biodiversity balance are key narratives requiring urgent attention and interventions. The authors have equally pointed out that ICT focus on environment related matters should domicile in:

(a) Climate change mitigation,
(b) Mitigating other environmental pressures,
(c) Climate change adaptation, and
(d) International co-operation.

The subject of ICTs and the environment covers a wide range of fields such as: using ICTs to improve practices in agriculture and forestry; monitoring atmospheric and water pollution;waste management and recycling; disaster warning and relief; improving the efficiency of the energy, transportation, goods and services sectors; and ICTs as a source of toxic waste. In view of this background, this paper therefore explores areas in which ICT embedded in TVET can be utilized in providing climate change information and sustainable environmental protection in Nigeria.

Conceptual framework

Information and Communication Technology (ICT) covers any product that will store, retrieve, manipulate, transmit or receive information electronically. ICT creates room for improvement on problem solving capacity for man. ICT according to Anderson & Baskin in Mudasiru (2007) encompasses software, hardware, and even the connectivity.Accordingto Christensson (2010) and Rouse (2018), ICT focuses on the use of technological tools for managing and disseminating information. In the education industry including TVET. ICT is integrated technologies for gathering, processing, delivering and storing information (Nisar, Munir & Shad (2011), Ghavifekr, Afshari& Salleh, 2012 and Techopedia (2018)). Similarly, Adesote&Fatoki (2013) and Filiz&Yasemin (2015) pointed out that ICT involves all the technologies employed in order to facilitate the collection, storage, retrieval and communication by the fastest means.According to Techopedia (2019) transactions are likely to get more complex than they are and that only the individuals who keep pace with the technology change can cope in any ramification of the pace.

The major problem of scientific and technological literacy in Nigeria is how to adequately link scientific and technological knowledge of the citizenry with their everyday life. According to Shamin, Aktaruzzaman& Clement (2011), scientifically and technologically illiterate person is considerably circumscribed in playing his/her full role in the socio – economic development of his/her community. To him Technical Education should qualify the students in technical skills and abilities which they can apply appropriately and correctly to the concrete problems they may encounter in their lives and work. Technical Education according to Suriana (2012) and Ndubuaku, Okafor & Mojekwu (2016) is an important and indispensable tool in achieving sustainable development for many nations. By this implication, it becomes obvious that Technical Education and ICT are two side of the same coin. Therefore ICT embedded in TVET should play pivotal role in providing climate change information and solving environmental related problems in Nigeria.

The word 'sustainable' means a way of using any natural substance without harmful interference and exhaustion for a long time. According to Essien (2004),"sustainable development has to do with meeting the needs of the present generation without denying future generation access to the same natural resources for their own needs". Preservation of the natural environment according to Sustainable.org (2019) is essential for maintaining environmental sustainability. Wikipedia (2019) averred thatsustainability entails people maintaining change in a balanced environment, in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations. Sustainable environmental protection must be taken into account when deploying ICT embedded devices for according to Daly (2003) in Houghton (2009) the relationship between ICTs and the environment is complex and multifaceted, as ICTs can play both positive and negative roles.Looking at ICTs as tools for dealing with environmental issues from a developing and emerging country perspective, ITU (2008) in Houghton (2009)noted six application categories that can characterize ICT applications in climate change information and sustainable environmental protection using platforms embedded in ICTs. These are:

1. ***Environmental Observation*:** Terrestrial (earth, land, soil, water), ocean, climate and atmospheric monitoring and data recording technologies and systems (remote sensing, data collection and storage tools, telemetric systems, meteorological and climate related recording and monitoring system), as well as geographic information systems (GIS).

2. ***Environmental Analysis*:** Once environmental data have been collected and stored, various computational and processing tools are required to perform the analysis. This may include land, soil, water and atmospheric quality assessment tools, including technologies for analysis of atmospheric conditions including GHG emissions and pollutants, and the tracking of both water quality and availability. The analysis of data may also include correlating raw observational data with second order environmental measures, such as biodiversity.

3. ***Environmental Planning*:** At the international, regional and national level, planning makes use of the information from environmental analysis as part of the decision-making process for the purpose of policy formulation and planning. Planning activities may include classification of various environmental conditions for use in agriculture and forestry and other applied environmental sectors, and is often focused on specific issues such as protected areas, biodiversity, industrial pollution or GHG emissions. Planning may also include the anticipation of environmental conditions and emergency scenarios, such as climate change, man-made and natural disasters.

4. ***Environmental Management and Protection*:** Involves everything related to managing and mitigating impacts on the environment as well as helping adapt to given environmental conditions. This includes resource and energy conservation and management systems, GHG emission management and reduction systems and controls, pollution control and management systems and related methodologies, including mitigating the ill effects of pollutants and man-made environmental hazards.

5. ***Impact and Mitigating Effects of ICT Utilization*:** Producing, using and disposing of ICTs require materials and energy and generate waste, including some toxic waste in the form of heavy metals. ICT use can mitigate the environmental impacts directly by increasing process efficiency and as a result of dematerialization, and indirectly by virtue of the secondary and tertiary effects resulting from ICT use on human activities, which in turn reduce the impact of humans on the environment.

6. ***Environmental Capacity Building*:** Efforts to improve environmental conditions rely on the actions of individuals and organizations. Capacity building includes efforts to increase public awareness of environmental issues and priorities, the development of professionals, and integrating environmental content into formal education.

The Role of ICT in climate change information

1. ***Surveillance:*** Surveillance means keeping a watch on any object (as a result of suspicion that something may happen). Surveillance using ICT tools can be achieved under different circumstances especially in gathering (information and tip-offs). The use of weather forecasts is all preventative and preemptive strategies to ensure an all round information disposal system. Aerial surveillance including the use of unmanned aerial vehicle and drones is another area where ICT will play a pivotal role in weather and environmental management in the country. Despite the enormous cost implications, this option will find useful application in Niger Delta and desert areas where the terrain may be difficult to operate. Other critical areas of surveillance using ICT based platforms include: internet (computer) based traffics analysis for weather and climate updates including social networks, data analysis, data mining and profiling and satellite imagery. Due to limited applications of some these ICT based platforms in the country, the regulatory agencies may in tandem with existing legal and legislative framework enhance local adaption to meet peculiar challenges facing the country.

2. ***Quick Response to Emergencies:*** ICT based platforms when effectively deployed in the country will also quicken the rate of response to emergency situations. Rural telephony is of pivotal role in this scheme as rural dwellers and those in remote places will be offered the chance of notifying the rescue agents and security operatives in cases of danger. Dedicated telephone lines and numbers that are easy to memorize will be provided for citizens to call and inform agents of adverse weather conditions within or around their communities.
3. ***Training of Personnels:*** Operatives and all those involved disaster management in the country will be offered specialized training through the use of ICT enabled devices. Experts' views from countries that have managed similar situations in the past would be sought. The training and education of the personnel involved may even be real time online. The views so obtained will be tailored to suit the Nigeria peculiar situation since no solution may satisfactorily serve the same situation in different locations. This is borne out of the fact that human beings are dynamic and hence require different approaches in behavioral management.
4. ***Deployment and Logistics:*** Deployment and logistic needs of rescueworkers for operations to a large extent how effective and efficient the command rely on ICT based platforms. Needs ranging from consumables to medical supplies are guaranteed and replenished faster if communication is established between emergency centers or workers deployed at frontlines.
5. ***Record Keeping and Retrieval:*** Record keeping and retrieval are made faster with the use of handheld and portable ICT devices. For instance instead of carrying large maps for operations in a desert location, the workers could easily establish contact with a hand held device linked with satellite based global positioning system (GPS) and know exact position of their movement.
6. ***Performance Evaluation and Feedback Mechanisms:*** The performance of workers engaged in operations could be evaluated using ICT enabled platforms to ascertain their level of compliance with rules of engagement in such situations. The performance evaluations could form a yardstick for measuring future similar operations in any location in the country. This is aimed at checkmating workers from indulging in diversion of relief materials, human right abuses and other excesses.
7. ***Sensitization and Public Enlightenment Campaigns:*** ICT enabled platforms and devices are very useful in carrying public enlightenment campaigns to the citizens in disaster management. The public are informed of impending adverse weather conditions and any other relevant information. This helps in educating the populace and workers involved in disaster management operations. The campaigns could be in form of education and inculcation of worthwhile values and ethics; cultural and religious tolerance, respect for constituted authority, patriotism and national consciousness. Information sharing especially among relief agencies and paramilitary system or circle is very useful in the effort at climate change information and disaster management.

Challenges to the Use of ICT as a Tool in Climate Change Information

Regrettably, ICT operations in Nigeroa still operate under the following conditions. These conditions pose hindrances to achieving climate information change and sustainable environmental protection in Nigeria.

(a) Erratic power supply.
(b) Low internet connectivity in rural areas.
(c) High cost of broadband/connectivity.
(d) Unresolved interconnectivity issues among network operators.
(e) Equipment compatibility issues arising from upgrade in communication networks.
(f) High rate and unregulated taxation to network providers.
(g) Lack of synergy among regulatory agencies, network providers and institutions that produce technical manpower.

Conclusion

The interest in integrating ICTs within climate change information strategies should be a collaborative endeavor among the many stakeholders and committed institutions such as government agencies, TVET institutions, NGOs and international bodies in developing countries. The capacity of ICT to mitigate the harmful effects of climate change imposes a responsibility of policy makers and all stakeholders of the ICT, to promote the technology as an effective tool to combat climate change. The development of policy, provision and enabling environment that drives massive ICT infrastructure investments and availability of broadband for national development should be vigorously pursued by all stakeholders in developing country like Nigeria.

Recommendations

The Nigerian landscape has become associated with different forms of natural and environmental hazards despite concerted efforts of present and past governments. Based on the foregoing, it is therefore recommended that there should be:

1. Massive investment on weather and disaster management ICT tools and equipment.
2. Massive training of personnel on the use of ICT tools in emergency and rescue management.
3. Synergy in operation among different organs of government, rescue agencies and nongovernmental organizations in terms of communication, weather forecasting and intelligence gathering and sharing.
4. Transparency and accountability in the disbursement of budgets and security votes on climate and environmental related matters.
5. Enabling legislations and by-laws on the use of ICT enabled platforms in laws and jurisprudence.
6. Adoption of ICT tools' operation to suit local peculiarities of the country.
7. Inculcation of national values, ethics, norms to the citizens.
8. Integration of national data base such as national identity card, voters' card into a centrally and secured accessible platforms using ICT tools.

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BUILDING TECHNICAL CURRICULUM DEVELOPMENT AND CLIMATE ADAPTION IN TECHNICAL VOCATIONAL EDUCATION AND TRAINING TERTIARY INSTITUTIONS IN NIGERIA

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Abstract: *With increasing global concern about climate change, the building construction industry is facing the challenge in term of the measures to evolve that focuses on the adaptation and resilience of buildings to climate change. This reviewed paper considered the development of building technology curriculum and climate change adaptation in Technical Vocational Education and training (TVET) institutions in Nigeria. The paper discusses the effect of climate change on building needs for climate change adaptation, climate change and curriculum development as well as building technology curriculum development and climate change adaptation. Based on the issues discussed, it was recommended that, climate change education and disaster risk management should be integrated into the building technology curriculum and climate change information units should also be established in TVET institutions, among others.*

Keywords: *Building Technology, Curriculum Development, Climate Change, Adaptation*

Introduction

Climate is often referred to as a long-term weather pattern that describe a specific region or place due to features such as temperature, precipitation, humidity, windiness etc. Jackson (2019) defined climate change as the mean state and variability of these features over some extended time period. Climate change occurs when changes in Earth's climate system results in new weather patterns that remains in place for an extended period of time. Jain (2018) identified the causes of climate change to include, fossil-fuel combustion, deforestation, green house gasesin the atmosphere, such as carbon dioxide, methane and water vapor.Others causes are periodic change in Earth's orbit and axial tilt with respect to the sun, tectonic movement which change that sharp, size and position and elevation of the continental masses, and the brightness of the sun which continues to increase as the star ages and passes on an increasing amount of the energy on earth atmosphere over time. The effect of climate change on building performance is obvious (Camilleri, Jaques & Isaacs, 2001). In agreement this fact, Wilde and Coley (2012) also stated that buildings can be vulnerable to climate change. Project planning and design are determined in large part by the landscape, geography and local weather. Building strategies and materials are tailored to suit a particular climate. In addition to the effects felt by citizens and residents, extreme weather events can derail building project, endanger works and increase construction cost. There is increase in background deterioration of a building as a result of climate agents by more frequent maintenance and by improvement in material technology and design. The relevant building codes and standard based on long term measured data such as wind and temperature need to become flexible enough to account for changing climate within the lifetime of a building.

Adaptating, the environment to climate change is one of the need of the society. The building technology curriculum is therefore expected to offer both potential and practicizingprofessionals in construction industry the opportunity to explore critical topics for the future of the building environment and natural resources. This can be made possible by exploring ways to use design and technology to create buildings that contribute to a more human and environmentally responsible world. Integrating climate change adaptation into the building technology curriculum become imperativeconsidering the destruction climate change has wrecked on buildings. Olarenwaju and Anfowase (2015) stated that extreme has house caused terrible damages to houses and service facilities in building in Nigeria. Beyioku (2016) also stated that coastal flooding and erosion and rising water table have caused failures in building foundation in southern part of Nigeria Thus, the rational of this study is to integrate climate change adaptation into the building technology curriculum development.

Effects of climate change on buildings

Climate change remains a serious development threat to the present generation with dreadful impact manifesting disproportionately across globe. Nigeria as a developing country is likely to be adversely affected by the impact of climate change giving its vulnerability and low response capability (Abdulwaheed and Ojigi, 2018). The severity of the effect of climate change on building can lead to building failure. In some cases, an increase in extreme climate can cause rapid damage requiring replacement of the whole building elements.Molitch-Hou (2018) stated that the effects of climate change on building are already being felt globally. Nigeria is not an exemption, both poor and rich countries have been plaquedwith hurricanes, and storms exacerbated by excess moisture generated by global warming, causing some island nation to literally drown. This reality of climate change is affecting the sustainability of buildings and infrastructure in some coastal area.

In Nigeria currently, the erosion of low-lying coastal and non coastal regions of Nigeria results in persistent building collapse with attendant loss of lives (Abdulwaheed and Ojigi, 2018). In year 2017, Olufemi (2018) stated that Nigeria witnessed series of climate – related disasters, ranging from the increased declining soil capacity as (which is unsuitable for building construction) to other natural disaster such as extreme weather events on buildings and occupants, among others. Some of the building along seashore, were submerged in water as result of flood, causing buildings to collapse and by implication raising the cost of construction in such areas. Studies have revealed a high reliance on government for flood protection, and often the blame for damages caused on buildings by natural hazards is placed on government rather than extreme natural events or on failure to take measure to adapt to climate change by those who choose to occupy the climate change prone area. The risk of a heat wave like that experienced across Europe in 2003 is thought to have doubled due to historicgreen house gas emission. The range of potential impact on buildings is expected to go beyond heat waves in Africa. Adeyinka (2017) identified other anticipated consequences of climate change in Nigeria to include; extreme wind, fewer periods of extreme cold; increased frequency of air and water pollution, rising and changes in the timing frequency and severity of flooding associated with it. All these have varying implication on the buildings. The physical constituents of built area and human activities within urban centres also interact with other climate drivers. Nigeria is therefore, highly vulnerable to the impact of climate change and as a matter of urgency, should take steps into reducing this vulnerability towards building resilience and adaptive capacity.

Need for climate change adaptation

Evidences have shows that climate change will have wide-ranging effect on the environment and on socior-economic related sectors, including building and infrastructure. Because of the speed at which change is happening due to global rise in temperature, flood and air waves, it is urgent that the vulnerability of developing countries such as Nigeria to climate change is reduced and their capacity to adapt is increased and action adaptation plans are implemented. Adaptation is a process through which societies make themselves better able to cope with uncertain future. United Nations Framework Convention on Climate Change - UNFCCC (2007) explained that adaptingto climate change entails taking the right measures to reduce the negative effects of climate change by making the appropriate adjustments and changes. Climate change adaptation also refer to actions that reduced the negative impact of climate change, while taking advantage of potential new opportunities. It involves adjusting policies and action because of observed or expected changes on climate. Adaptation can be reactive, occuring in response to climate impacts or anticipatory, occuring before impact of climate change are observed. In most circumstances, anticipatory adaptation will result in lower long-term costs and be more effective than reactive adaptation. There are many options and opportunities to adapt buildings to climate change. These range from technological options such as increased sea defense or flood-proof buildings on stilt to behavioral change (precaution) at the individual level. Brownstein (2019) stated that to adapt a typical building to climate change, many key elements of that building's design should be based on historic record of climate data.

As a measure towards climate change adaptation, the policy makers should embe climate change adaptation into the upcoming revision of building regulation, for example by mandating the use of future weather data and consideration of adaptation strategies. This imply that all buildings should have some degree of resilience, which must be driven by policy. Strategies for adapting buildings to climate change These strategies for climate change and adaptation which can be integrated into the curriculum.were outlined by Ward and Wilson (2019) as:

(a) Design of natural ventilation into buildings. In some climates, particularly those with low relative humidity, climates natural ventilation may be more practical as a backup cooling strategy that's can be used during power outages as a passive survivability.
(b) Providing landscaping to minimize cooling requirements. This can carefully also help channel cooling breezes into building to enhance natural ventilation during excessive temperature.
(c) Adapting to climate change will also require making our buildings more resilient to storms and flooding and thus, the need to prepare for rising sea level and restoring the ability of our land to absorbs water.
(d) Avoid building in flood prone areas, even where flooding is not remotely possible, building should be raise above the ground level with any type of pier foundation.
(e) Installation of specialized components to protect building from flooding.
(f) Use of construction materials that are noncombustible and highly resistant to thermal properties.

Climate change and curriculum development

Curriculum is a dynamic process involving learning experiences to meet to the changing needs of the society. In a time of threat of climate change to the environment, it is increasing obvious that the society need a transformation through appropriate curriculum development. The curriculum which consider the complex drivers behind societal change in pursuit of environmental objectives is desirable. Environmental objectives are goals set to attain in future, with targets as averifiable evidence that setobjectives are met (Condon,2012). Curriculum is a total learning experience that is well planned and purposeful to create positive improvement in the educational system to meet the need of the society and the environment. Alvior (2014) stressed that curriculum development has a broad scope, because it is not only about the school, the learner, and the teacher. It is also about the development of the society and the future of the environment. Alviorfurther explained that in today's curriculum development provide answers or solutions to the world pressing conditions and problems must be a chain of developmental process to protect the future environment for a better society. The school curriculum particularly at tertiary level of education must be developed to preserve the future of the environment, buildings and infrastructure to ensure the economic growth and stability (Ralkoofi, 2009). Incorporating climate change education into the curriculum to prepare the minds of the professionals in various fields of construction, especially the future players in the global affair of protecting the environment and infrastructure is the starting point for adaptation. The inclusion of the climate information need into the curriculum of building technology courses will be proactive educational policy action now to prevent and reduce future impact of climate change. Hence, the need to examine the curriculum of Building technology for TVET institutions.

Building technology curriculum

Building technology curriculum is designed to help students acquire skills needed to be successful in a construction field, such courses are usually offer as part of a full Certificate, Diploma, or degree programme at tertiary levels education. Building technology refers to the technical processes and methods used in constructing buildings, which has become an increasingly aspect of construction industry, has buildings have moved from beenevolution of standard types to becoming one of prototypes. The study of building technology therefore cover every aspect of building construction from the sub-structure through the super structure. The aspect of

construction management also form part of building curriculum or as graduates of such programme is equipped to work as a contractor or as manager if they gain sufficient construction experience. The learning outcome of Building Technology curriculum deals with the design, construction, use of maintenance of civil engineering structures such as buildings (Andersen, 2006). The main aspect of the course is hinged on structural engineering, construction and maintenance, building performance, construction management and structure.

The programme provide the students with knowledge and skills essential to their future careers in industry, research, education or authority. Based on the individual selection within the study programme, the student can learn to assess the structures and indoor environments with respect to their performance regarding the context specific loads and physical phenomena, comprehend the fundamental theories and concept of structural engineering and building physics and use them for designing steel concrete and timber structures. Building technology curriculum strives for the development of working skills like analytical and critical thinking, multidisciplinary team work and collaboration and communication for scientific and technical professionals. The aspects of professional ethics, social and environmental responsibility are also integrated into the programme. Construction EngineeringTechnologists (2019) itemized the area of study and skills acquisition that comprised building technology curriculum in tertiary institutions to include; site investigation and surveying, construction materials, components, system and techniques, building science, operation and maintenance, energy supply and efficiency, structural system, building engineering physics, modern methods of construction, Building modeling, structural principles, construction management. In addition to this area outlined, there is the need to incorporate specific area of training on sustainability in the adaptation of buildings to climate change.

Building technology curriculum development and climate change adaptation

Climate change education has historically been tied to theScience, Technology, Engineering and Mathematics (STEM) disciplines, but climate change is an issue that impacts political, social and economic dimensions and can be in an integrating context for all subjects. The inclusion of climate education into building technology curriculum development will be a right step in working towards adapting buildings and infrastructure to the climate change. UNESCO (2019) stated that the inclusion of climate change education for sustainable development programme as integral part of formal training aims to make climate education a more central and visible part of the international response to climate change. The programme help students understand the impact of global warming through innovative teaching approaches andquality climate change education. This call for synergy between meteorological agencies and TVET institutions. To achieve this, Prasad (2019) opined that new building construction codes, obtained from research on building sustainability and higher performance should form core part of the curriculum as it is being reviewed. The construction materials which are found not durable or not likely to withstand the effect of the climate change resulting from laboratory test and analysis should not be included into the content of the curriculum. The building design and structural principles and other specifications contented in the developed curriculum should equally conform with the new building codes and regulations. Disaster risk management and climate change adaptation should also form part of the building technology curriculum. This will equip the professionals within the construction industry, to effectively contribute to resilient and sustainable societies through the use of interdisciplinary concepts, methods and tools within disaster risk management and climate change adaptation. This will include risk assessment, capacity assessment preparedness and contingency planning and risk land use plannings; work with capacity development and project management and climate change adaptation at both local and national levels. Lund University (2019) stated that the inclusion of disaster in risk management and climate change adaptation will offer a mix of practical and theoretical learning with a strong focus on group work interaction between the students and teaching staff, as well as with important factors within the field of construction. Etinay (2018) also opined that knowledge of disaster risk management will emerge as a systematic approaches to reduce the impact of climate change in the environment, especially as it captures the dynamics of hazard, exposure and vulnerability of building resilience.

The inclusion of workers health and general safety against climate change in the curriculum of building technology will go a long way to safeguard the health of professionalsin the construction industry.Climate change has increased the risk of workers' health and safety. Workers, especially those who work in outdoor or hot indoor environmentare at increased risk of health stress and other related disorder, occupational injuries and reduced productivity at work. Extreme weather events related to climate change pose injuring risk to rescue and recovering workers. One major concern with climate change is worksite safety. Unpredictable rain and flooding can lead to deteriorating wood and slippery surfaces, increasing the risk of recordable injuries and crating unsafe working condition at the construction site. Higher temperatures can cause heat stress and lead to heat stroke, heat exhaustion and death (Grant, 2018). Levy and Roelots (2019) stated that reducing the risks of work-related illness and injuries from climate change, especially building construction sites, requires a three-pronged approach:

(a) mitigating the production of green house gases, the primary cause of climate change,

(b) implementing adaptation measures to address the overall consequences of climate change, and

(c) implementing improved measures of occupational health and safety.

Conclusion

There is no doubt that the buildings and infrastructure are at more risk in future from the impact of climate change in Nigeria. Concerted efforts therefore must be made to integrate climate change adaptation in the development of building technology curriculum as a measure aimed at equipping the competent construction industry with requisite knowledge and skills on climate change adaptation. Hence, the study of worker health and general safety against climate change should form part of building technology curriculum.

Recommendations

1. Climate change education should be integrated into building technology curriculum and also the need for a synergy between meteorological agencies and TVET institutions for effective implementation.
2. The relevant building codes and standard based on long term measured data, such as wind, temperature, load expectation, etc. should be included in the building technology curriculum which will take into account, predictions of increased risk and intensities, of extreme events.
3. Disaster risk management should form part of the building technology curriculum.
4. Works' health and general safety against climate change should be included in the building technology curriculum.

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PROTECTION OF EXTERNAL TIMBER STRUCTURES AGAINST THE ADVERSE EFFECTS OF VAGRANCE OF WEATHER CONDITIONS DUE TO CLIMATE CHANGE IN NIGERIA

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Abstract: *A cardinal role of technical and vocational education and training (TVET) is the study of technologies and related sciences to applythe findings toprovision of solutions to emergent industrial and environmental problems. This is done through the development of appropriate body of applicable knowledge, skills and competences for sustainable social economic development of the nation. Climate change,a human induced environmental phenomenon which was ignited by first industrial revolution in the early nineteen century in Europe through vast prevalence of carbon dioxide in the atmosphere, has evolved into complex global issues, impacting adversely on natural and artificial resources, including wood and wood products, in variety ways. Wood is a primary technology material which has symbiotic relationship with the climate as evidenced by the impacts of the weather conditions on the tree growth life cycle of wood and carbon feasibility.The vagrancy of weather conditions caused by climate change has significant impacts on the external timber structures, distorting some properties of timber members and other material accessories; thereby causing deterioration in their quality, fitness of purpose and durability. The durability of external timber structure may be protected by treatment with seasoning, wood preservatives chemicals and fire retardant. These will extend the life span of the timber structure and contribute to mitigation of the climate change.*

Keywords: *Climate Change, Economic Development, Timber Structure, Sustainability*

Introduction

Most palpable evidence of climate change is the systematic weather conditions, unusual duration of seasons, global warming, arbitrary atmospheric changes, sea rise, excessive flooding andhigh greenhousegas (GHG) emission into the atmosphere among others, which arethe resultant effects of the prevalence of vast amount of carbon dioxides in the atmosphere(Canada.com 2017).Reid, Huq, Inkinen, McGregor, Maqueen, Mayer, Murray and Tipper (2004) observed that climate change is visible in some geographical areas of the world in melting and disappearance of sea ice, lowering temperature, extreme erosion, flooding,permafrost, degradation, mounting temperature in some areas, release of more carbondioxide into air and global warming. Drawdoom(2012) cited in Canada.com (2018) stretched that tropical forest area, which Nigeria belongs, outside the temperate and boreal areas, covered twelve percent of the world land. Today, its five percent heat loss is taken to be responsible for up to nineteen percent of the GHG emission. Reid et al (2004) stretched that every year just less than ten percent of a carbon flux, approximately one hundred billion tones, is circulated between the forest and atmosphere through natural processes of photosynthesis respiration and combustion.Climate change (2007) noted that, this account for eight percent of the annual flux of carbonbetween all terrestrial ecosystem and atmosphere. Experimental results across forest in various regions of the world showed that forests are currently net sink of carbon dioxide plus nitrogen.This deposition may be a longer term feature of forest ecology due to varying land use. Forest produce have important role to play in the development of a sustainable carbon economy through the production of renewable fuel and products that produce lessGHGs emission per unit than most minerals or oil-based products. Wood products could reduce fossil fuel emission when substituted for materials such as steel, concrete or plastic which emit more GHG during production. Wood residue recovered during product chain may be used as alternative energy source of fossil fuel. Over fifty percent of wood used all over the world is used for paper boards and other light weight packaging,twenty percent is used for construction and the remaining fraction is used for variety of panels and chipboards. Timber is a forest produce derived from fell log of wood after conversion. Production of timbers breaks the carbon cycle as it longer part of the photosynthesis system; though it becomes effective carbon storeif the product remains intact within or outside the building without deterioration.

Material and methods

Kayo and Noda (2018) observed that in examining the environmental impacts and benefits of wood in the context of climate change, it is necessary to apply the concept of life-cycle assessment in which the environmental burden of a product throughout its life-cycle is quantified.Some studies held that biogenic carbon, that is, the carbon dioxide of wood in the life cycle assessment and carbon foot prints, is carbon neutral. That is they had no effect on carbon dioxide concentrations in the atmosphere. The biogenic carbon balance that is responsible for the carbon cycle is zero. This is based on the idea that carbon emitted by wood incineration or biodegradation in the end of life process is originally absorbed through photosynthesis during the growth process.Unlike during the growth process, water, moisture and other chemical substances, have discrete interaction with the residue chemical in the cell, cell wall and structural elements of the timber, without link with the carbon cycle. Rather than being part of the usual carbon cycle they areaccumulated or develop discrete relationship with structural elements of the wood, through evaporation or sole chemical reactions,which may strengthen or deteriorate the quality of the physical strength and facial appearance of the wood through the development of various types of defects. Probable defects include colour oxidation,mould stains, shrinkage, collapse, warp, distortion, surface checks and decay (Canada.com 2019; Koel 2009; and Reed 1985).

Timber is conditioned by the quantum of the interactive moisture content, moisture movement and preservative mechanism. These are connected with the seasoning of the timber, which has effects on the strength and physical properties of the used timber or weathering of the entire timber structure. Hilton (1970) noted that seasoning is the drying out ofcertain amount of free water and moisture contained in the cell cavities and cell walls of green timber, until it is balance with the equilibrium moisture of the environment or fibre saturation point of the timber. Seasoning of timber determines the relationship between the air, humidity, residual carbon and the timber. The presence of water or moisture affectson the cost,workabilityand dimension stability of timber. The durability of timber may be managed by controlling the activities of the wood destroying growths agentswhich may be influenced by the amount of moistureand in and out the timber.

Timber absorbs moisture and water from the environment and emits moisture into the atmosphere through evaporation. The rate of absorption or evaporation is a function of the weather conditions. Higher moisture and low humidity prevailed during the raining or wet season and similarly, low moisture content and high humidity prevailed during dry weather or season. The deterioration factor of moisture on the physical and strength propertiesof the timber may be controlled by seasoning and preservative chemical treatment processes.Vagrancy of weather conditions makes timber structures susceptible to weathering, insect and fungi attacks. These processes protect the timber structure; increase the durability and consequently the capability for mitigation of climate change through reduction of deforestation, low GHGs emission, carbon sequestration, and efficient material substitution. Material substitution by wood products such as in building components and furniture with an estimated life between ten to seventy five years is effective in removing carbon from atmosphere. Wood products with short life spans of two months to two years can have a beneficial impact of carbon dioxide savings.

External Timber Structures

External timber structures are timber structures other than the indoor timber structures. These include those structures that partly exposed to external environment of a building, like entrance doors, windows, roofs and stairways, and those used absolutely outdoor, gardens, streets or in the open (Koel, 2009). Kayo and Noda (2018) submitted that wood may be used for pile check dams, paved walkway, guardrails and noise barriers. Hilton (1975) noted that external timber structures include carpentry and joinery works like formwork; roof structures, dormer windows, entrance doors and prefabricated timber buildings. Wood can mitigate climate change through carbon storage in which carbon dioxide that is absorbed by growing trees is stored in harvested wood and by providing substitute for material that consume high quantity of energy and generate high amount of GHG in their production.

Effect of climate change on forest produce

External timber structure is subject to weathering as a result of exposure to severe weather conditions. In addition, at the end of life cycle or deterioration of the structure; timber members can be used as alternative energy source with reduced GHG emission. Walton (1975) and Koel (2009) described weathering as the deterioration caused by the mechanical and chemical breakdown of the wood when it is exposed to the actions of the weather, such as sun, rain and fog. Protection timber against weathering requires sealing of the wood surface and other exposed areas with preservative chemical to prevent moisture or water entering. The use of galvanized fittings are more appropriate as it will prevent chemical breakdown of the wood which often occurs around iron fasteners and fittings. External timber structure may also be protected from fire which is ignited by high heat or temperature during the dry season, hydro magnetic discharge or atmospheric heat resulting from global warming. Timbers may be coated with fire retardant chemicals to check the rate of "spread of flame" or stop flaming, depending up on the source and intensity of the fire.



Fig 1: Smooth Texture of Growing Tree
(Climate change increases forestation)
Source: Walton, 1975; Kayo and Noda, 2018; & Smedley, 2019



Fig 2: Telecommunication Pole
(Weathering and surface checks as a result of vagrancy of weathers)
Source: Walton, 1975; Kayo and Noda, 2018; & Smedley, 2019

Protection of external timber structure

Timber is carbon neutral; therefore it is tenable to limited chemical reaction within its structure. The prevailing moisture, heat,humidity and temperature of the environment may have direct impact on the structural elements of timber. The interaction havesignificant effects on some properties and durability of the timber when outside specific limits. Protection of quality, fitness of purpose and quality assurance of timber structure involved seasoning and preservation treatments. Walton (1975) and Koel (2009) stretched that seasoning reduces the moisture content of the green wood to a stage at which it is in equilibrium with the relative humidity of the atmosphere of environment where the wood is used. If the moisture content is lower than the equilibrium moisture content (EQC) by reasons of excessive heat or high temperature resulting from global warming, it may result to defects like shrinkage, splitting, warping, collapse, surface checks or dry rot. Higher moisture content beyond the (EQC) or the fibre saturation point (SSP) makes the timber susceptible to fungi and insect attacks, swelling, mould stains, wet rot or decay. Hardware on the timber structure may be subjected to corrosion of similar degradation in case ferrous metal or other types of metals and materials respectively. Seasoning improves strength properties of the timber, enhance the penetration of adhesives, preservative chemicals, finishes and fire retardants as applicable. It promotes dimension stability and prevents the incidence of distortion, surface checks and corrosion of ferrous metal and hardware fitted to the timber structure. Walton (1975) noted that if timber is used in ideal conditions and protected from the activities of the destructive agents like fungi, (decay), insects borer, termites, weathering and fire, it will last indefinitely. The durability, induced 'artificial durability' may be provided through preservative treatment.

Preservation of timber refers to any process used to prolong the serviceable life of the timber. Preservation of timber may be carried out through the use of water borne preservatives, tar oil, creosote and oil borne preservation. Application of the preservatives may be through pressure process, dipping, hot or cold bath, spray or brush application. The external timber structure may also be protected against weathering, which is caused by mechanical and chemical breakdown of the wood when it is exposed to actions of weather. (Koel, 2009). Kayo and Noda (2018) observed that various studies held that surface coating with paint last for about ten years while the pressure injection treated timber may last for about twenty years. The use of surface coating treatment generates reduced GHG emission.The GHG emission of timber structure is about sixty percent of that from steel structure and reinforced concrete structure. Protection of timber contributes to sustainable mitigation of climate change through reduced deforestation,forestation and reduced GHG to the atmosphere management forest strategy.

Analysis and discussion

Human induced climate change was ignited by sudden and uncontrolled discharge of high volume of carbon dioxide into atmosphere occasioned by the advent of first industrialization in Europe in the early nineteenth century. Then it was regarded as an indicator of socio-economic development. However, over time, becomes a complex global environmental phenomenon; disrupting the ecosystem, causedvagrant weather and irrational seasons,devastating natural and artificial resources, in variety of ways. The devastation may continue if not checked, in view of the growing industrialization, increasing population and urbanization. (Climate Change, 2007; and Canada.com 2018). The disrupted ecosystem is manifested in the vagrant of weather conditions,abrupt nature of seasons, global warming, differential sudden lowering and increasing temperature, inordinate humidity,massive flooding and growing heat wave in various parts of Nigeria. These has shown where the use of timber for external structure and still prominent.Wood maintains a symbiotic relationship with weathers and climate throughout its life cycle.Forest and trees contributed to sustainable carbon cycle. Tree growth is a function of different weather conditions. As a matter of fact, the annual cycle of weather represents a major determinant of the nature of trees, wood structure and properties timber. Forest produce and wood use may contribute to the aggravation and mitigation of climate change through deforestation, reforestation, carbon sink, carbon sequestration and sustainable carbon cycle.

External timber structure is susceptible to acute changes in weather conditions occasioned by the carbon zero status of timber, emission of high volume of carbon dioxide in the atmosphere and the climate change. Abrupt changes in temperature heat wave, humidity, atmospheric moisture and sea level rise have significant effect on the moisture content and working of timber members and other materials components or hardware of fitted to the external timber structures. Exposure to the vagrancy of weather conditions may result in weathering which Walton (1975) and Smedley (2019) emphasized asdeterioration caused by mechanical and chemical breakdown if the wood when exposed to severe weather conditions. These can only be ameliorated through seasoning and preservative treatment with the application finishes or fire retardant chemicals as thecase may require. The protection of external timber structure through seasoning, wood preservative treatment and application offire retardant chemicals enhanced the durability, fitness of purpose and quality assurance of the timber members, other materials like ferrous metal or galvanized metal hardware and accessories fitted, and the entire structure. Kayo and Noda (2018) observed that lack of decay over long periods of time, of log piles stored underground makes log piles one of the more promising repositories for long term carbon storage. This fact is applicable to treated timbers used in external construction works as efficient carbon store.

Increase use of forest wood and products can broaden social economic and environmental benefits as well contribute to climate change mitigation efforts in variety of ways.Wood removes carbon dioxide from the atmosphere. This is corroborated by Reil et al (2004) which noted that a major way to improve the carbon balance includes using greater proportion of wood produce with a longer useful life and increase recycling potentials. Wood is a biodegradable and renewable resource. It is also an effective store of carbon as long as the product remains intact under a protected condition, either outside or inside a building. At the end of its useful life the timber product can be dismantled, re-used and recycled for another use. The disused product can be used as fuel to substitute for fossil based energy, for its comparative reduced GHG emission. (Koel 2007 and Smedley 2019)

Conclusion

Canada.com (2019) submitted that carbon dioxide is the main cause of human induced climate change. Carbon dioxide has been emitted in vast quantity from the burning of fossil fuel due to rapid industrialization since the first industrial revolution in Britain in the early nineteen century.It is a very long lived, gas which means that it continuously affects the weather and climate system during its long resident time in the atmosphere. Forest, tree and wood have symbiotic relationship with the climate system. Carbon has effect on wood throughout its life cycle and beyond as an efficient carbon store, reduced emission of green house gas and efficient material substitution. The storage of carbon in the wood has strengthening and deterioration effects of the wood depending on the management strategies.

External timber structure is a wood produce subject to the basic characteristic of wood. Wood is a biodegradable and renewable resource, if subject to appropriate preservative treatment the useful time could be prolonged. External timber structure is susceptible to weathering and some defects like shrinkage, warp, collapse, dry rot, swelling, wet rot decay and surface checks. Weathering is caused by mechanical and chemical breakdown of wood when exposed to severe weather conditions. Working of the wood due to irrational movement of the moisture content of the timber may occur as a resulting in insect attacks, fungi attack, shrinkage, collapse, surface checksand other defects. (Walton 1974; Reed 1985; Reid et al, 2004; and Smedley, 2019)

The timber members and other material accessories or hardware may be protected by seasoning, treatment with wood preservatives and fire retardants to increase the durability, sustainable fitness of purpose and quality assurance. Protection of the external timber structure may contribute to sustainable mitigation of the climate change in Nigeria through reduced deforestation, promotion of reforestation, reduced green house gas emission, effective material substitution and efficient carbon store and carbon sequestration media.

Recommendations

1. Timbers for external structures should be well seasoned relatively to the equilibrium moisture content of the area of final use.
2. Timbers should be treated with the appropriate type of wood preservatives to improve the durability.
3. The structure may be treated with fire retardant chemicals or appropriate finishing, depending on the nature of the environment use.

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EFFECTIVE TECHNICAL VOCATIONAL EDUCATION APPROACHES FOR CLIMATE CHANGE INFORMATION FOR SUSTAINABLE ENVIRONMENTAL PROTECTION IN NIGERIA

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Abstract: *This write-up focuses on the effective Technical Vocational approaches for climate change information for sustainable environmental protection in Nigeria. The history of climate change and related approaches were discussed in this paper including concept of environmental protection as well as issues of prevention and adaptation processes. The approaches that Technical Vocational Education may play in preparing peoples to prevent, adopt and force the effects of climate change are presented. This include technical assistance, conducting research with a view to improve the quality of predictions of future changes to regional environmental conditions, changing the attitudes of people through education and public enlightenment to achieve a balance between ethics and the management of the environment. In light of these issues, it was recommended that TVE practitioners should rise to the challenge posed by climate change in Nigeria.*

Keywords: *Technical Vocational Education, Climate Change, Sustainability, Environmental Protection*

Introduction

The threat posed by climate change is a global challenge. It is a topical issue, generating heated debate and concerns among government, scientists, environmentalists, and advocates of a better society. Indeed, the controversy trailing the debate all over the world is confusing. The developed countries are at least coming to an agreement on how to approach the changes posed by climate change and how the effects can be lessened or reduced in countries that are affected. Nigeria is having a different perspectives on what really constitute climate change and whether its threat is worth investigating. Not long ago, the issue of economic meltdown swept across the globe with some experts claiming that Nigeria was immune to the shock of such financial cries. It is important to note that the complexity of this contemporary world is being shaped by the approaches of globalization and Nigeria can no longer afford to be complacent (Nwafor, 2006). The United Nations, of which Nigeria is a member, with other international organizations as partners, are in the forefront to make the world a better place for habitation through several innovative and encompassing projects. One of such example is the Climate Change Knowledge Network (CCKN), a project that tracks the impact of economic change and climate on India's agricultural sector. According to Brien and Leichenko (2000), the project is innovative because it uses the concept of "double exposure" which refers to the fact that climate change and globalization are occurring simultaneously, and that regions, sectors, ecosystems and social groups are often confronted by the impact of both processes.

However, overcoming climate change and the adverse conditions that it may precipitate have the inclination to be fractured by many ills tormenting Nigeria today, such as poor planning and implementation, inadequate resource allocation, corruption, outdated curriculum and poor governance practices (Wikinvest, 2010). Technical vocational education is an inescapable component of the intellectual capital required for any meaningful effort aimed at tackling the climate change issue and its associated approaches. Technical vocational education, if properly positioned, can provide tools which will support Nigeria in strengthening knowledge, skills, attitudes and the capacity for adaptation to a changing and vulnerable physical environment. Nigeria is currently faced with increasingly chronic degradation of natural resources, greater prevalence and severity of natural and man-made disasters, such as desertification, oil spillage, flooding, internal social conflicts, and the potential displacement of persons. In this context, this article focuses on the effective technical vocational education approaches for climate change information for sustainable environmental protection in Nigeria including history of climate change, concept of environmental protection, and approaches for climate change information.

History of climate change

The first discoveries that helped explain recent climate change and global warming were in the 18th and 19th centuries. In 1753, Joseph Black discovered carbon dioxide by treating limestone (calcium carbonate) and 'magnesia alba' (magnesium carbonate) with acids. Black gives the name 'fixed air' to the gas discovers and later finds that 'fixed air' is present in the atmosphere, is produced during the fermentation of beer, and is contained in air exhaled by humans (Wikinvest, 2010). In 1827, Jean-Baptiste Fourier suggested that an atmospheric effect kept the earth warmer than it would otherwise be. In 1896, Svante August Arrhenius, a Swedish Chemist, proposed that carbon dioxide emissions from the burning of coal would enhance the earth's greenhouse effect and lead to global warming. The climate of the earth has changed throughout history. Prior to the industrial era, the sun's variability and volcanic activity in terms of changes in the earth's orbit, changes in the sun's intensity. Changes in greenhouse gas concentrations and changes in ocean currents affect the climate from region to region and the world over. Climate change is a slow train that has been coming for more than century, but even slow trains eventually reach their destinations (Wikinvest).

At the 2007 UN, Climate Change Conference in Bali, the world's nations agreed to negotiate on a deal to tackle climate change. In addition, the United Nation (UN) Conference in 2010 turned-out to be a pragmatic platform for a global deal to tackle climate change by the participants. The salient constituents of this consensus include:

(a) Overall target limit of two (2) degrees Celsius on temperature rise.
(b) Measures that developed and developing countries are taking an climate change in the UN agreement.
(c) Assessment system to track how countries are living up to their promises on emissions.
(d) Green climate fund to support how carbon initiatives of developing countries.
(e) Tackling menacing trees destruction.
(f) Provision for developing countries to access low carbon technologies.

Concept of environmental protection

Environment is a French word 'environ' which means 'encircle' and encompasses, within it the land, water, flora, fauna, living creature, forests and everything on the earth. Environment in its genetics sense comprises of air, water, land, the things imbibed and also embedded in the land (Ball & Stuart, 1991). The environment is the life support given by the creator to mankind. Sometimes in the past the three components of the environment – air, soil and water – were pure, virgin, undisturbed, uncontaminated and basically most hospitable. But, today progress in science and technology is also leading to environmental degradation and serious ecological imbalance, which in the long run, may prove disastrous for mankind (Sharma, 2012). In quest for economic development, which seeks to increase the quantum of economic output without caring about the short and long-term short-changes of human and material resources arising from the process, the activities of peoples and nation's conquer and wreck the world, rather than sustain it for the present and future generations. Rapid industrialization has left with us polluted rivers, contaminated soil, depleted wildlife and exhausted natural resources. As a result, man has threatened the survival of man himself and other biota on the earth (Bhasin, 2001).

In the era of globalization driven by ICTs and all the efforts by Nigerian government towards adoption of ICTs as a means of bridging information gaps and marginalization in the global market system, electronic wastes (e-wastes) are common in Nigeria and worse still, discarded and disposed of in manners that enhance their environmental pollution. Yet, Nigeria has no recycling or management policy on e-waste, some of which contain hazardous and toxic chemicals, unlike the United States of America (USA), where the Electronic Waste Recycling Act or Senate Bill 50 was signed into law in 2004 (Emeh, 2011). The Strategic Environmental Assessment (SEA) – The application of Environment Impact Assessment (EIA) principles to policies, plans and programmes is yet to receive mandatory status in Nigeria (Nwafor, 2016).

Effective TVE approaches for climate change information

The intellectual framework of this is built on revealing the approaches of TVE and creating a prism from which to view those approaches that could impact the information for climate change problems in Nigeria. In November 2001, UNESCO adopted a recommendation concerning TVE. The document directed member states including Nigeria to take whatever legislative or other steps necessary to give effect to the principles set forth in the recommendation. These ambitious goals set by UNESCO and the international community, together with regulatory bodies and academic institutions were aimed at ensuring that the learning needs of all young people and adults are met through equitable access to appropriate learning and life skills programmes. The various TVE curricula of tertiary institutions in Nigeria approximate that of UNESCO's principles and are updated frequently.

The approaches of TVE were clearly conceived by the planners and stated very expressly to show the direction of change envisioned for all countries of the world. The document specifies in concrete terms how to create open and flexible educational structures to cater for upward mobility in learning and work. It also abolishes barriers between levels and areas of education and the world of work, and between school and society Watson, Zinyoera & Moss (2011). It envisage the objectives to, lead to an understanding of the scientific and technological aspects of contemporary civilization in such a way that people comprehend their environment and are capable of acting upon it while taking a critical view of the social, political and environmental implications of scientific and technological change. The implication therefore is that TVE through these approaches is given the necessary empowerment and mandate to provide quality TVE and training to effectively help students and workers develop their knowledge in science and technology across occupational areas, including those that address climate change related challenges. TVE approaches for climate change for sustainable environmental protection as follows: prevention, preparation and adaptation.

(a) Supporting governments, schools and communities,

(b) Technical assistance,

(c) Research programmes,

(d) Changing attitudes and ethics,

(e) Vulnerable populations in Nigeria

Prevention, preparation and adaptation

Scientists agree that some of the effects of climate change can no longer be stopped, but the process may be harnessed or slowed by stopping global warming. The way towards this goal is to halt the release of carbon dioxide into the atmosphere. Meludu (2010) added that most industrialized African countries, such as South Africa, generate 8.44 metric tons of the greenhouse gas carbon dioxide per person, and the least developed countries, such as Mali, generate less than a tenth of a metric ton of greenhouse gas carbon dioxide per person. There is no doubt that TVE is an integral part of science and also a partner in global education for all initiative, a tool that can be used in partnership with other agencies to prevent climate change where possible or prepare citizens to adapt to climate change. Professionals in TVE are directly involved through effective participation in environmental and climate change induced sectors as forestry, fishery, oil and gas, and mining.

TVE can be employed to increase clean energy job and to provide professionals services in the maintenance of machines, appliances and vehicles so that reduction in greenhouse gas emission are achieved. Areas that need the services of TVE workers are education and information on good eating habit, that is, avoiding pre-packaged foods, soft drinks and fast foods. Apart from dietary issues of high content of fat, sugar, and calories, resource materials and energy are depleted in producing the packaging for these foods. Secondly, people could be advised to travel differently, that is, walking and riding bicycles to reduce the use of cars and buses that use gasoline. Thirdly, practitioners could be involved in creating awareness for a 'green' culture. Ways that TVE content may be integrated are:

1. ***Supporting Government, Schools and Communities Through an Inclusive Curriculum:*** TVE practitioners can play a major role in supporting governments, schools and communities through building capacity for the promotion of environmentally sustainable programmes. Such programmes will increase public understanding of the interdependence between their environment, community, country and their lives. A child-based, facility-based, and skills-based curriculum could be designed by TVE experts to empower students' preparedness in natural disaster rick reduction techniques. Integrating timely communications, including awareness concerning projects and developments in every area of climate change. Advisory role, as a discipline TVE, has the capacity to make valuable impacts as advisors to improve the services of government agencies like the Nigeria Environmental Standard Regulation and Enforcement Agency.
2. ***Technical Assistance:*** TVE professionals are well equipped to provide technical assistance to consumers, businesses and home owners to enable them make choices that will assist in reducing greenhouse gas emission. Specific areas that need technical advice include, consumer purchasing decisions, transportation options, refrigerators and air conditioners, the use of smart meters and the use of energy saving lighting options, and the use of solar energy options.
3. ***Research Programmes***: The scientific community has embarked on multi disciplinary projects on global change research. McBen & McCarthy (2007) stated that programmes have emerged to answer questions of global significance aimed at reducing scientific uncertainties and improving the quality of prediction of future changes to global and regional environmental conditions, thereby ensuring better management of the earth's ecological resources. TVE professionals can be partners in this effort; it is important to collaborate in research so that government and agencies in Nigeria do not waste resources through the development of incompatible actions or through ineffective policy that are not effective in achieving climatically sustainable development.
4. ***Changing Attitudes and Ethics***: Many planning decisions on how to integrate human activities into the environment for the purpose of culture and aesthetic values need to be clearly understood. The planning of houses in our cities, building of parks, forest maintenance, farming systems, all are processes that should be influenced by ethics. How forests are managed depends on how furniture workers do about their work and the same can be said of agricultural workers. TVE professional can change the attitudes of people through educational programmes so that a balance between ethics and management of the environment may be achieved.
5. ***Vulnerable People and Places in Nigeria:*** In Africa, drought hazards and vulnerability are likely to be the most damaging locus of impacts of climate change (Downing, Ringius, Hulme & Wanghray, 2007). In Nigeria, people living in arid or semi-arid areas, coastal areas that are flood-prone, and are producing states face more challenges and need the services of TVE professionals for advice to enable them adapt to the environment with little or no challenge.

Conclusion

Anthropogenic activities aimed at economic development, which seeks to increase the quantum of economic output without caring about the short-and long-term short-changes of human and material resources arising from the processes occasion environmental degradation that must be managed and controlled in order to sustain the environment for the present and future generations. To this end, Nigeria has formulated environmental protection policy, many of the policies are dated and many fragmented. Many of them were not formulated with contributions from informed masses nor based on nationally generated baseline data thereby compromising socio-economic and climate difference. Now we have devastating erosion menaces across Nigeria with desertification in the north, dumping of toxic waste in Koko, oil spillage and floods in the south, lead gas poisoning in Nasarawa. This may just be the beginning. How prepared are Nigeria's emergency response related agencies and, in fact, the TVE professional? TVE professionals, as part of the scientific and technological community are well positioned to tackle the effect of climate change.

Recommendations

1. Governments (national, state and local) should be assisted by TVE professional to make the required legislation that will give effect to the principles set forth by UNESCO.
2. TVE curricula should be reviewed and revised continually to ensure that students are empowered in natural disaster risk reduction techniques.
3. TVE practitioners should use their understanding of science and technology to deal with challenges posed by climate change.
4. Continued research aimed at improving predictions of future climate changes should be pursued by TVE professionals.
5. Nigeria's environmental protection policies should be revised for their obsolesce and lack of currency.

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SUB-THEME 4

PRIVATE-PUBLIC-PARTNERSHIP (PPP) FOR SUSTAINABLE ENVIRONMENTAL PROTECTION

IMPERATIVES FOR PUBLIC PRIVATE PARTNERSHIP IN ELECTRICAL/ELECTRONIC TECHNOLOGY EDUCATION: INFORMATION NEEDS FOR SUSTAINABLE ENVIRONMENT PROTECTION IN OYO STATE, NIGERIA

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Abstract: *The paper presents a study imperatives of public private partnership in electrical/electronic technology education: information needs for sustainable environment protection in Oyo State, Nigeria. Security challenges arising from lack of adequate and timely information to take proactive measures are responsible for the alarming rate of insecurity in the Nigerian society and perhaps in preventing foreign investors from coming to invest in the country Therefore the research design adopted for the study was descriptive survey. The instrument for data collection was questionnaire tagged: Public Private Partnership on Electrical/Electronic Technology: Information Needs for Sustainable Environment Protection in Oyo State Questionnaire (PPPETINSEPOSQ). The questionnaire was validated by three experts in Electrical/Electronic technology education unit of Technical Education Department, Emmanuel Alayande College of Education, Oyo, and Oyo State using face and content validity. Test retest method was conducted twice in Kwara State with public institutions and private organizations as pilot study at an interval of two weeks to determine reliability of the instrument using Spearman Brown formular to obtain 0.70 reliability coefficients indicating that the study is appropriate and reliable for the study. Mean and Standard Deviation were used to analysis the data from the two research questions at 2.50 cut-off mark. It was found, among others, the dire need to harness state-of-the-art electrical/electronic technology gadgets for information needs on environmental protection and security. Hence, it was rexommended that there must be cooperation of public and private sectors for optimum environment protection in terms of security of life and properties of the citizenry*

Keywords: *Public Private Partnership, Technology Education, Sustainable Environment*

Introduction

Private Public Partnership (PPP) is the synergy, collaboration, unification, linkage or cooperation existing between two or more organizations or sectors involving Private organizations and Public institutions working together to provide human and materials resources required for the mutual understanding so as to meet the said target or goals. PPP are increasingly popular ways of fostering development by drawing up together investment and expertise from both the Public and Private sectors purposefully for the improvement of goods and services. PPP as viewed by Ande (2012) is the type of business or organization in which two to twenty people agree legally to set up and manage a business outfit with the sole aims of making profit. According to Olabiyi, Okafor and Ebenezer, 2014 described PPP as a means of bringing about a shared set of incentives, common culture for the development of career and improve the goods and services through the jointly provision of infrastructural facilities among the participants. Partnership otherwise known as collaboration or synergy which involves co-operation, work or act together between two or more people, or organizations in the Public or Private sectors for mutual understanding and benefit to be derived by both having agreed to set up and manage a business and outfit with sole aims of making or realizing profit (Holland, 2011; and Ande, 2012) Tansen (2013) refers Private Sector as the industries, commercial training institutions and employers as well as non-governmental training providers which include not profit making organizations, employers such as NGO, while Public Sector refers to governments of neither Federal, State nor Local with numerous ministries under them involving or participating in training youths or students for the contribution of their quotas into the development of the economics growth of Nation having acquired quality and modern education for updating their knowledge of science and technology (Olabiyi, Okarfor & Ebenezer, 2014). However, Deish (2005) posed that PPP exists when the Private Sector joins with Public Sector in pursuant of a common goals to achieve.

The Personnel composition and structure of any PPP is unique, according to Okoye and Okewelle (2013), that:

(a) the Public Sector appoints representatives who are authorized by their sector (such as Federal, State or Local Government); and
(b) the Private Sector (such as civil groups or organizations) would elect or appoint representative.

Therefore, there is need for the sources of information on EETE that would be of highly benefits for sustainable environment protection and provide security consciousness to our environment especially at this time of crime galore ramparting in Nigeria. Accordingly, the National Board for Technical Education (NBTE) (2001) outlined the goals and objectives of the programme of EETE as follows: construct simple Electrical/Electronic circuit when necessary for use in modification or as a part of major construction; erect, assemble and install simple Electrical/Electronic equipment; Carry out routine maintenance and repair of simple Electrical/Electronic Installation and equipment; select and use appropriate instruments to carry out simple tests and measurements on all types of Electrical/Electronic Installation and equipment under various conditions; operate relevant equipment and installations whenever required; prepare simple bills of quantities and specifications related to Electrical/Electronic engineering works among others. Consequent upon the above outlines of NBTE, the information are required for the needs of utilizing Electrical/Electronic Technology (EET) gargets such as Closed Circuit Television (CCTV) and drones of various types built upon as a products of electrical and electronic technology would expose hideout of criminals while at the time required collaboration between public and private for the technology gargets to be installed on strategic places and manned by the security personnel for sustainable environment protection in Oyo State and Nigeria in particular so as to curb down crimes such as kidnapping, ritual sacrifice, miscreants, street urchins, cultist, rapist, armed robbery and host of other forms of security challenging of the society. Others developing and developed countries such as America and some European countries are using EET. Information gargets as the art of sources of information needs in revealing hideout of crimes, monitoring and disseminating information for the personnel to curb down all evil vices (Loraima & Pablo, 2010), This type of using EET gadgets however are needful especially in Oyo State and Nigeria in particular at this time around where information or messages of revealing evil vices are required for the security of life and properties need of the citizenries. Today technological innovations in informatics and telecommunications are once more revolutionizing capacity to store, transmit, access and use information to expose the den of menace for security of environment. Rapid progress in electronic, telecommunications and satellite technologies permitting high-capacity data transmission at very low cost, has brought about the quasi-neutralization of physical distance as to no barrier communication this time around as earlier experience in the year past.

Statement of the problem

Overzealous and over ambition of many youths nowadays particularly in Nigeria have become rampart and the alarming rate for which of not allowing nature to have its way, inpatient and not-waiting for their appointed time to secure their God destiny in their lives. This, among others eventually leads many youths to be involved in crimes of any form of the others such as kidnapping, Armed robbery, Boko-haram, Yahoo Yahoo and all other untold social evil vices presently evolving the society. This might be responsible for the alarming rate of insecurity in the society at global level and perhaps preventing foreign investors from coming to invest in the country, Consequently, Nigeria are having high numbers of unemployment rate of youths with little that are already available in the miniseries and the government parastatals that could not go round for the teeming population of job seekers. However, at this prevailing situation, adequate information with modern technology gargets couple with private public partnership are required to curb-down menaces otherwise the level at which the perpetrating evils are going would bring about anarchy and commotion to the existing peaceful coexistence in Nigeria. The questions therefore are: what are the information needs, what are the areas of partnership urgently required and type of electronic technology gadgets for the exposure needs for the information?

Research questions

1. What areas of partnerships are required for the provision of electrical/electronic technology gadgets to the information needs for sustainability environment protection in Oyo State, Nigeria?
2. Are there modern available electrical/electronic technology gadgets for surveillance placed in strategic positions to revealing the information needs for the environment protection in Oyo State, Nigeria?

Methodology

The research design adopted for the study was descriptive survey. This is because the items seek for the views, opinions and information of the respondents. The population for the study was five hundred (500) consisting of private organizations personnel and public officials as respondents using stratified and ballot multi sampling technique for the selection that cuts across every towns within Oyo State of Nigeria. The towns involved are Ibadan, Oyo., Ogbomosho., Iseyin and Saki where public institutions and private organizations could be found in the State. The instrument for data collection was questionnaire tagged: Public Private Partnership on Electrical/Electronic Technology: Information Needs for Sustainable Environment Protection in Oyo State Questionnaire (PPPETINSEPOSQ).Five Likert scale of Strongly Agreed= (5), Agreed= (4), Disagreed= (3), Strongly Disagreed=(2) and Undecided=(1). The questionnaire was validated by three experts in Electrical/Electronic technology education unit of Technical Education Department, Emmanuel Alayande College of Education, Oyo, and Oyo State using face and content validity. Test retest method was conducted twice in Kwara State with public institutions and private organizations personnel as pilot study at an interval of two weeks to determine the reliability of the instrument using Spearman Brown formular to obtain 0.70 reliability coefficients indicating that the study is appropriate and reliable for the study. Mean and Standard Deviation were used to analysis the data from the two research questions at remarks of cutoff points above 2.50 and 0.50 as Adequate (A) and below 2.50 and 0.50 as Not Adequate (NA) having used SPSS Version 22 for the data analysis.

Results

Table 1: Mean Ratings and Standard Deviation Response by the Respondents on the Areas of Partnership Required for the Provision of Electrical/Electronic Technology Gadgets for Surveillance to Provide Information Needs for the Environment Protection in Oyo State, Nigeria

SN	ITEM	SA	A	D	SD	U	X	SD	REMARKS
1	Working hands and hands with one another for the needs of security information needs within the environment.	250	150	25	15	10	2.75	0.64	A
2	Contributing to the financial needs of the security needs information of the environment.	200	150	100	20	30	2.90	0.67	A
3	Helping to purchase modern electrical/electronic technology gadgets for surveillance for the needs of information of the environmental protection.	150	150	100	50	50	2.85	0.58	A
4	Ensuring to the monitoring of the movement of inhabitants of the environment for protection.	260	160	80	50	70	2.80	0.57	A

SN	ITEM	SA	A	D	SD	U	X	SD	REMARKS
5	Disseminating and alerting the gadgets security information to all member of the community of the environment for protection.	280	150	20	20	30	2.70	0.60	A
6	Updating the people with necessary information needs from the electrical/electronic gadgets for surveillance.	180	160	80	30	50	2.58	0.54	A
7	Providing necessary security personnel for the needs of electrical/electronic information technology gadgets.	190	170	50	40	50	2.73	0.62	A
8	Liaising with others security communities of the environment for protection.	200	150	80	20	50	2.66	0.60	A
9	Assisting the Government agents such as policemen with necessary information needs to ensure adequate protection.	250	100	50	50	50	3.20	0.68	A
10	Complying with and abiding to the rule of laws of the country	220	100	50	50	80	2.65	0.56	A

Key: SA= Strongly Agreed, A=Agreed, D= Disagreed, SD=Strongly Disagreed U=Undecided, X=Mean ratings, SD= Standard Deviation and AR= Adequate.

Table 1 of the highest mean ratings and Standard deviation response by the respondents on the areas of partnership required for the provision of electrical/electronic technology gadgets for surveillance to provide information needs for the environment protection in Oyo State, Nigeria fell between 3.20 on item and 0.68 on item 9 while the lowest mean ratings and standard deviation fell between 2.58 and 0.54 on item 6 indicating that all the items of the public and private partnership are required for the financing and provision of EET gadgets in order to ensure environment protection for security.

Table 2: Mean Ratings and Standard Deviation Response by the Respondents on the Modern Available Electrical/Electronic Technology Gadgets Surveillance Placed in Strategic Positions to Reveal the Information Needs for the Environment Protection in Oyo State, Nigeria

SN	ITEM	SA	A	D	SD	U	X	SD	REMARKS
11	There are more than enough of closed circuit television sets for surveillance of criminal activities.	70	50	150	200	30	2.35	0.41	NA
12	There are enough of drones for surveillance of criminal activities.	80	80	160	140	40	2.40	0.47	NA
13	Closed Circuit Television sets for surveillance are positioned in strategic places to detect crime information needs	70	50	200	150	30	2..35	0.45	NA
14	Drones for surveillance are positioned in strategic places to detect crime information needs.	40	60	220	150	30	2.37	0.42	NA
15	The closed circuit television sets for surveillance are installed to cover a strategic of criminal activities.	40	50	260	120	30	2.40	0.46	NA

SN	ITEM	SA	A	D	SD	U	X	SD	REMARKS
16	The drones for surveillance are installed to cover a strategic of criminal activities.	35	35	230	180	20	2.36	0.43	NA
17	The closed circuit television sets for surveillance installed are functioning to detect criminal activities.	40	45	235	160	20	2.38	0.44	NA
18	The drones for surveillance installed are functioning to detect criminal activities.	40	35	230	170	25	2.36	0.43	NA
19	Close circuit television sets for surveillance of criminals' activities are not readily available for used.	50	60	245	120	25	2.40	0.45	NA
20	Drones for surveillance activities are readily not available for used.	45	50	250	135	20	2.42	0.46	NA

Key: SA= Strongly Agreed, A=Agreed, D= Disagreed, SD=Strongly Disagreed U=Undecided, X=Mean ratings, SD= Standard Deviation and NA= Not Adequate

Table 2 of the highest Mean ratings and Standard deviation response by the respondents on the modern available electrical/electronic technology gadgets surveillance placed in strategic positions to reveal the information needs for the environment protection in Oyo State, Nigeria fell between 2.42 and .46 on item 20 while the lowest mean rating and standard deviation fell between.2.35 and 03.41 respectively on item 11 indicating that there are neither not available, not enough to go round nor where the EET gadgets for surveillance available not functioning to perform the expected information needs for environment protection.

Discussion

Table 1 of mean ratings and standard deviation have recorded the highest of 3.20 and 0.68 on item 9 respectively, while the lowest of mean ratings and standard deviation fell between level 2.58 and 0.54 all above were the cut off points of 2.50 and 0.50 of highly required indicating that all the items must be adequately required for the information needs to ensure environment protection as according to Okoye and Okewelle (2013) in their findings study of Private Public Partnership and Technical Vocational Education and Training (TVET) in a developing economy.

Finally Table 2 of mean ratings and standard deviation response of the respondents on the availability of EET gadgets for surveillance to locate and detect the hide-out of criminal as instrument of providing information for the environment protection fell between 2.42 and .46 on item 20 while the lowest mean rating and standard deviation fell between.2.35 and 03.41 respectively on item 11 indicating that there are neither not available and where available not enough to go round nor the available EET gadgets for surveillance not functioning to perform the expected information needs for environment protection as Loraima and Pablo (2010) in their submission to the study findings on the importance and effectiveness of using gadgets to locate and detect criminals in European countries. Also, National Board for Technical Education (2001) emphasized the training of Electrical/Electronic Technology works personnel for the use of such.

Conclusion

From all indications of the items instrument responded to by the respondents on both the areas of partnership of public and private that they need to take stand and the electrical/electronic technology gadgets needs for the information of the environment protection shows that all the research instrument would help in no small measure in providing environment protection for adequate security and progress of the State in particular and the entire country in general and shun off anarchy.

Recommendations

1. There must be co-operation of public and private for the provision of every necessary assistance for the environment protection in terms of security of life and properties of the citizenry.
2. There must be provision of modern day electrical/electronic technology gadgets for surveillance of crimes hide-outs of hoodlums and miscreants within and out of Oyo State in particular and Nigeria in general.
3. The available modern day electrical/electronic technology gadgets should be installed at every available conspicuous places where hide-out of criminals could be revealed for information

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TECHNICAL SKILLS NEEDS IN AUTOMOTIVE MECHATRONICS AMONG AUTOMOBILE TECHNOLOGY EDUCATION GRADUATES FOR ENTREPRENEURSHIP IN BAUCHI AND GOMBE STATES, NIGERIA

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Abstract: *This study was to determine the technical skills needed of automotive mechatronics among automobile technology education graduates for entrepreneurship in Bauchi and Gombe States, Nigeria. The study adopted a cross-sectional survey research design, and no sampling was made because the number of the population was manageable. 31 respondents, which comprised of 25 ATE lecturers from all tertiary institutions awarding degree on the course and 6 master craftsmen in Bauchi and Gombe States Nigeria, were used as the population of the study. Total population sampling was used for the lecturers while chain-referral (Snowball) sampling was used for master craftsmen. Three research questions were formulated to guide the study. 53 items questionnaire made up of 3 sections were served as instrument for data collection and it was validated by three experts from the field of automobile technology education in Abubakar Tafawa Balewa University Bauchi. Cronbach Alpha was used to test the reliability of the instrument which yielded 0.79. 4-point rating scale with cut off point of 2.50 was used on the questionnaire. Mean and standard deviation were the statistical tools used with the help of SPSS (v.22) software. It was found among others that general and practical skills are highly needed among ATE graduates for entrepreneurship. Consequently, it was recommended that much emphasis should be laid in general and practical skills of ATE students in the Degree awarding institutions.*

Keywords*: General Skills, Practical Skills, Automotive Mechatronics, Entrepreneurship, ATE*

Introduction

The need for trained and skilled automotive technicians in Nigeria and the world over is greater than ever for several reasons. Automobiles are becoming more complex and require a higher level of knowledge and skills. Construction of parts and materials being used has changed over the last few years, meaning that all service work must be done to specified procedures to help avoid damage being done to the vehicle (Ibrahim, Shehu & Sa'idu, 2016). Technology of composite electrical and electronic components included in modern vehicles is referred to as Automotive Mechtronics (Halderman, 2012). This new technology becomes an avenue for creating new businesses to our teaming graduates because, Jalal (2015) stated that majority of Nigerian mechanics lack the sufficient skills and or equipment to properly maintain modern vehicles. This may not be unconnected with the computerized nature and the need for intensive reading of manuals during repair and maintenance of these vehicles, of which Automobile Technology Education (ATE) graduates have the advantage. In this day and age, a good service technician can find work in almost any city or town in the country, making the career an excellent choice. Hence, ATE graduates in Nigeria must be ready to acquire the right skills and be competent enough to become employers of labour (Audu, Musta'amal, Kamin, Saud, & Inti, 2014). Well-trained ATE graduates can become entrepreneurs. However, most of these students are graduating from tertiary institutions without the necessary entrepreneurial competencies (Okoli, 2009). He further maintained that these graduates do not possess entrepreneurial skills that will enable them plan, establish and manage a small business enterprise so as to become self-employed and self-reliant. This in turn results in massive unemployment among ATE graduates. In the same vein, Ifedi (2009) agrees that one of the main causes of unemployment among ATE graduates is fear to establish their own businesses. This calls for encouraging the graduates to establish their own businesses. The ultimate goal of ATE is to provide its graduates with the opportunities of acquiring the capabilities, abilities and competencies that will make them competent in their areas of specialization (Iliya, 2017). Hence this will support the objectives of the programme, which are: to enable its graduates to test, diagnose service and repair any fault relating to conventional motor vehicle main assembly, units and systems to the manufacturer's specification (NBTE, 2001).

ATE is expected among other things to assist individuals to acquire relevant occupational and technical skills, which would be used to start a business, expand the business and employ more people who in return would help in solving unemployment challenges in the country (Youth Employment & Social Support Operations YESSO, 2016). Automotive mechatronics servicing skills is an action approach that cut across electromechanical concept of design, repair and maintenance of modern automobile system. Therefore, graduates of ATE are expected to have an understanding of electronics and good diagnostics skills to be able to diagnose and service electronic systems in modern cars (Ibrahim, Okuta & Mamuda, 2017). Technical Vocational Education and Training (TVET) institutions should, in addition to academic skill, inculcate workplace skills such as creativity, problem solving, collaborative skills and higher order thinking skills in order to increase the student's flexibility and job mobility which will make them adaptable to the present and conceived changes (Amos, James & Adamu, 2016). The skills students acquired in TVET can be categorized into two namely: the general and the technical skills. The general skills are inclined to no specific profession but are needed for well functioning of an employee while the technical skills are the job-readiness abilities that make the graduate fit for employment in a vocation (Julius in Amos *et al.,* 2016). Skills are key elements in matching persons to jobs. However, the meaning of skills embraces many aspects and the concept is used in many different ways. Often the term is used as a general expression of the economic capabilities of people at and for work, but often its meaning is not separated from qualifications. Skills denote a specific technical aspect of capabilities as distinguished from knowledge and competence skills represent mainly the technical and/or operational task. Skills are required in the performance of jobs (European Training Foundation, 2019). The increasing effect of globalization and the rapid rate of technological changes in the workplace have been acknowledged in the recommendation by International Labour Organization ILO (20012) which states that all vocational and technical education (VTE) systems in the 21st century should be geared towards lifelong learning. In general, Technical Vocational Education and Training (TVET) have been recognized as tool for empowering people, especially the youths as a mean of poverty and unemployment reduction, hence improves economy of a country (Mamman, 2017). Furthermore, it encompasses the ability to accelerate economic growth provide marketable labour supply, minimize unemployment and underemployment as well as infuse technical knowledge. Therefore, by finding out technical skills needed of automotive mechatronics among automobile technology education graduates it is expected of them to get set for establishing businesses in Bauchi and Gombe states.

Statement of the problem

Automobile Technology Education (ATE) graduates are suffering unemployment after graduation due to the lost of focus. Because sometimes they perceived that the training they received while in school is not sufficient enough to practice it outside (Atsumbe, Okoro & Ogwo 2012; Cyril, Kumazhege, Idaya & Bawa, 2017). But Jalal (2016) maintained that graduates of auto-mechanics need to be encouraged in terms of latest auto repairs and maintenance. Also, the expansion in the production of modern automobiles and demand for higher quality has created a need in the automotive industry for workers in different areas of service and repair (Ibrahim *et al.,* 2016). This gives an opportunity for the upcoming ATE graduates to establish automotive mechatronics workshops for self reliant.

Research questions

1. What are the general skills needed by automobile technology education graduates on automotive mechatronics for entrepreneurship in Bauchi and Gombe States?
2. What are the practical skills needed by automobile technology education graduates on automotive mechatronics for entrepreneurship in Bauchi and Gombe States?
3. What are the equipment/tools needed by automobile technology education graduates on automotive mechatronics for entrepreneurship in Bauchi and Gombe States?

Methodology

The study adopted a cross-sectional survey research design. The researchers used this design because according to Creswell (2012) the design can examine current attitudes, beliefs, opinions, or practices of the target population. The study covered all lecturers of ATE in three (3) tertiary institutions offering the course at degree level in the area of the study. The population of the study consisted of twenty-five (25) ATE lecturers and six (6) automotive mechatronics master craftsmen in Bauchi and Gombe States. The entire population was employed for ATE lecturers as suggested byLaerd (2018), while chain referral (snowball) sampling was adopted for automotive mechatronics master craftsmen. The snowball sampling was used because the samples (AutoMech master craftsmen) were difficult to find (Dudovsky, 2019). A structured questionnaire was the instrument used to elicit the required data from the respondents for the study. This was developed by the researchers from extensive review of literature and based on the objectives of the research. The instrument was face and content validated by three experts from the Department of Vocational and Technology Education, Abubakar Tafawa Balewa University Bauchi, Bauchi State Nigeria. To determine the reliability of the instrument, it was pilot-tested in Modibbo Adama University of Technology Yola, Adamawa State which was not part of the study. Then, Cronbach alpha was used to determine the internal consistency and it yielded a coefficient of 0.79, thus the instrument was considered appropriate for use by the researchers. The questionnaires were administered by the researchers and the entire instruments were retrieved and analyzed. A four (4) point rating scale was used to determine the general skills needed, practical skills needed and tools/equipments needed on automotive mechatronics for entrepreneurship. Where; HN = Highly Needed, N= Needed, MN= Moderately Needed and NN= Not Needed for research questions 1, 2 and 3. Descriptive statistics (mean and standard deviation) were the tools used to analyze the data; also SPSS (v.22) was the software the researchers used for the analysis. The decision rule was that scores at 2.50 and above was accepted, otherwise rejected.

Results

Table 1: Mean Rating and Standard Deviation of Respondents on General Skills Needed by Automobile Technology Graduates in Automotive Mechatronics for Entrepreneurship in Bauchi and Gombe States (N = 31)

S/N	Item	Mean	SD	Remark
1.	Ability to Read and write effectively	3.84	0.374	Accepted
2.	Solve problems imaginatively	3.35	0.486	Accepted
3.	Creative thinking	3.90	0.301	Accepted
4.	Listen attentively	3.84	0.374	Accepted
5.	Identify skills needed to attract customers	3.81	0.402	Accepted
6.	Apply basic mathematical principles in solving problems	3.39	0.495	Accepted
7.	Honest and free with other workers	3.74	0.445	Accepted
8.	Aspiration to learn new things	3.84	0.374	Accepted
9.	Treat customers with dignity and respect	3.77	0.425	Accepted
10.	Identify skills needed to run small businesses efficiently	3.61	0.495	Accepted
11.	Ability to prepare estimate list of materials	3.42	0.502	Accepted
12.	Identify the risk involved in ownership of business	3.23	0.805	Accepted
13.	Ability to have forecast to meet objective	3.32	0.475	Accepted
14.	Ability to keep records for future use	3.06	0.680	Accepted
15.	Ability to procure and use materials effectively	3.65	0.486	Accepted
16.	Familiar with common terms used in the business	3.39	0.495	Accepted
17.	Ability to embrace team work	3.65	0.486	Accepted
18.	Consult other people's view	3.32	0.475	Accepted
19.	Ability to get along with others	3.61	0.495	Accepted
20.	Have effective communication skill	3.74	0.445	Accepted

The results presented in Table 1 indicated that all the twenty (20) items on the general skills needed by ATE graduates for entrepreneurship had their mean values ranging from 3.0 to 3.9 which were above 2.50. Hence, all the twenty items were needed by ATE graduates for entrepreneurship.

Table 2: Mean Rating and Standard Deviation of Respondents on Practical Skills Needed by Automobile Technology Graduates on Automotive Mechatronics for Entrepreneurship in Bauchi and Gombe States (N = 31)

S/N	Item	Mean	SD	Remark
1.	Ability to diagnose and service battery and charge indicator	3.32	0.475	Accepted
2.	Ability to describe battery ratings	3.39	0.558	Accepted
3.	Ability to operate digital instruments	3.58	0.564	Accepted
4.	Identification of OBD I and OBD II scan tools	3.84	0.374	Accepted
5.	Identification of OBD I and OBD II compliance vehicles	3.77	0.425	Accepted
6.	Ability to identify universal diagnosis equipment	3.87	0.341	Accepted
7.	Ability to locate DLC for different vehicles	3.90	0.301	Accepted
8.	Ability to locate and identify different sensors	3.84	0.374	Accepted
9.	Relay detection and identification	3.71	0.461	Accepted
10.	Ability to test diodes using digital meter	3.74	0.445	Accepted
11.	Ability to test transistor using digital meter	3.84	0.374	Accepted
12.	Ability to describe serial communication used on a vehicle	3.39	0.495	Accepted
13.	Ability to connect DLC with other modules	3.32	0.475	Accepted
14.	Ability to describe the basic operation of electrical components	3.29	0.529	Accepted
15.	Ability to enter information on a PC and diagnostic equipment	3.74	0.514	Accepted
16.	To interprete electrical wiring diagnosis	3.29	0.588	Accepted
17.	Demonstrate procedure for identifying DTC	3.39	0.615	Accepted
18.	Ability to retrieve and erase DTC on an electronic system	3.71	0.588	Accepted
19.	Ability to isolate faults in a controlled system.	3.87	0.341	Accepted

The results in Table 2 specified that all the nineteen (19) items on the practical skills needed by ATE graduates for entrepreneurship had their mean values ranging from 3.2 to 3.9 which were above 2.50.This showed that all the nineteen items skills were needed by ATE graduates for entrepreneurship.

Table 3: Mean Rating and Standard Deviation of Respondents on Equipment/Tools Needed by Automobile Technology Education Graduates on Automotive Mechatronics for Entrepreneurship in Bauchi and Gombe States (N = 31)

S/N	Item	Mean	SD	Remark
1.	Sets of screw driver	3.87	0.341	Accepted
2.	Sets of pliers	3.74	0.445	Accepted
3.	Sets of wire cutter	3.74	0.445	Accepted
4.	Clamp-On digital Multimeter	3.32	0.475	Accepted
5.	Battery jump box	3.39	0.495	Accepted
6.	Conductance tester	3.39	0.495	Accepted
7.	Inductance DC ammeter	3.35	0.486	Accepted
8.	Digital Multimeters	3.87	0.341	Accepted
9.	OBD I compliance scan tools	3.94	0.250	Accepted
10.	OBD II compliance scan tools	3.77	0.425	Accepted
11.	Lap top/Desk top computers	3.81	0.402	Accepted
12.	Charging system tester	3.77	0.425	Accepted
13.	Voltmeter	3.84	0.374	Accepted
14.	Ohm meter	3.81	0.402	Accepted

The results in Table 2 pointed out that all the fourteen (14) items on the equipment/tools needed by ATE graduates for entrepreneurship had their mean values ranging from 3.3 to 3.9 which were above 2.50.This showed that all the fourteen items equipment/tools were needed by ATE graduates for entrepreneurship.

Table 4: Descriptive Statistics of Technical Skills Needed of Automotive Mechatronics Among Automobile Technology Education Graduates for Entrepreneurship in Bauchi and Gombe States, Nigeria

Variables	N	Minimum	Maximum	Grand Mean	SD
General Skills Needed	31	3	4	3.5742	0.19869
Practical Skills Needed	31	3	4	3.6237	0.19705
Equipment/Tools Needed	31	3	4	3.6866	0.17945

Findings

1. All the items on general skills for entrepreneurship are highly needed among ATE graduates.
2. All the areas highlighted on practical skills of automotive mechatronics are needed for ATE graduates.
3. Equipment/tools on automotive mechatronics listed are required by ATE graduates for entrepreneurship.

Discussion of findings

The results presented in Table 1 to answer research question 1 indicated that there are twenty (20) general skills needed by ATE graduates for entrepreneurship. This finding coincides with that of Amos *et al.* (2016) in a study on assessment of skills required by graduates of radio, television and electronic work in technical colleges for self reliant in NE Nigeria. The authors found that all these skills were needed for self reliant.

In Table 2, it was indicated that all the nineteen (19) items practical skills set to answer research question 1 were needed for entrepreneurship among ATE graduates. The findings is in line with that of Halderman (2012) who emphasized that for a take up, these practical skills are enough to repair and maintain modern automobiles. More so, in Table 3 all the fourteen equipment/tools prescribed were needed by ATE graduates for entrepreneurship. This finding is in consonance with that of Jalal (2015) who stressed that most of the tools and or equipment needed in modern automobile repair are digital, not easy to access and operate by our mechanics.

Conclusion

Based on the findings of the study, there are general and practical skills as well as certain equipment/tools needed by ATE graduates in order to set up automotive mechatronics workshop for self reliant. Today, there are abundant of modern automobiles in Nigeria that always need repair and maintenance which our contemporary road side mechanics are having bottle neck with. Therefore, graduates of ATE may go into this business and become employers of labour.

Recommendations

1. Emphasis should be given to teaching of general skills for entrepreneurship to undergraduate students of ATE.
2. There should be enough practical on automotive mechatronics in order to make ATE graduates more pronounced in the area.
3. Government should provide a means of assisting ATE graduates with some of equipment/tool on automotive mechatronics for entrepreneurship.

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PRODUCTION AND TEST OF *CANARIUM*-CRETE FOR COMPRESSIVE STRENGTH WITHIN RURAL HOUSING IN PLATEAU STATE NIGERIA

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Abstract: *The canariumseeds were majorly available and suitable as canarium-crete constituentsintroduced as coarse aggregates because of their physical hardness, shape and size. A total of 100 experimental samples of canarium-crete test cubes and 100 standard concrete test cubes were produced from five different mix ratios and constituents of canarium-crete and concrete respectively. These constituents were weighed in parts of cement, fine aggregate and canarium seeds as coarse aggregate. All the canarium-crete constituents were sourced from Kwalla in Pankshin Local Government Area of Plateau State, in the North Central geopolitical zone of Nigeria. One research question and null hypothesis were formulated for the study, while research laboratory test results were used to answer the research questions. Experimental canarium cube samples yielded 7.18Nmm^{-2} to 20.28Nmm^{-2} and satisfied the compressive strength values, which can be suitable as blinding concrete, mass concrete and lightweight reinforced concrete, as an encouraging prospect forthe potential usage of canarium-crete in rural housing delivery. Analysis of Variance (ANOVA) was used to test the null hypotheses at 0.05 level of significance. Pairwise comparison test was performed wherethe null hypothesis was rejected. The study therefore recommended the application of canariumschweinfurthiibursecarea seeds, as agro-industrial waste for utilization as appropriate raw material to develop techno-entrepreneurship interest of teachers, learners, building materials entrepreneurs, industries and researchers towards canarium-crete products for rural housing potentials in particular and the biocrete appropriate technology prospects in general.*

Keywords: *Canarium-Crete, Compressive Strength, Rural Housing, Appropriate Technology*

Introduction

Introducing *canarium*-crete, of the biocrete category to the construction industry is an appropriate techno-enterprise idea that will promote the performance requirements of the product, in terms of strength and weight as encouraged by the National Building Code (2006) and used as a replacement byMohammed (2017). This is in line with the broad economic and social benefits ofbiocrete obtained by Nirmala andDhanalakshmi(2017). *Canarium*-crete is a biocrete material based on the mixture of *canarium*seed as coarse aggregate in concreting operations. In Europe, hemp fibre is often used, while in Malaysia coconut coir, oil palm kernel fibre or rice husk from agricultural waste have been used, to produce assorted biocrete building components (Arkitrek, 2017). The national policy on science and technology (FRN, 1996) alsoencouraged the promotion of integrating local resources into the production of building materials for industrialization. The African elemi tree or*canarium-schweinfurthii* is scientifically a deciduous angiosperm, widely distributed in East, West and Central Africa. The plant provides range of food, medicinal and industrial applications (Yilkini, 2016). The African olive fruit, also called *atili* in Hausa or *pe'et* in Ngas has fleshy skin which covers 1mm to 3mm layer of the edible flesh. The seed has oblong shape five sides and has approximate dimensions of 15mm to 20mm long and 8mm to 10mm wide. *Canarium*-crete is therefore, a derivative of biocrete coined by the researcher from the prefix *canarium* and the suffix, crete, together giving *canarium*-crete. The coinage of the word is to provide an important terminology of identification, for the research to protect the products of *canarium*-crete, the application of *canarium*-crete materials and building components for structural and general construction. Consequently, the desires of the National Building Code of Nigeria (FRN, 2006); FRN, 2018 & UNIDO, 1980) on encouraging the promotion and application of appropriate biocrete building materials like *canarium*-crete and appropriate technologies have been explored and exploited by the researchers through *canariumschweinfurthiibursaracea*. Concrete constituents bind together when mineral aggregates of varying sizes are mixed with water to produce a dense solid with high compressive strength, why not *canarium*-crete.

Statement of Problem

The specific challenge of rural areas is therefore, based on the problems of financing major building materials to improve the durability of houses. This situation is evident in the outlook of dwellings in rural areas. Meanwhile, oil mills in rural areas, where African olive fruits (*canariumschweinfurthiibursaracea*) are processed, are a large litter of agro-waste. Neglecting the abundance of the *canarium* or African olive seed, as an appropriate source of local building materials to waste is to ignore natural principle of promoting the reuse, recycling or integration of low cost or appropriate technologies into construction (Napier, 2014). At experimental levels, European Union (EU) Life (2007) reported that waste water treatment plants (WWTP)from biocrete to contain abundant elements, some of which are phosphorous, an important component, making up to 15 – 25 percent weight as $P_2 O_5$, which if left increases the hardness of water in the form of calcium and magnesium. In the housing sector, the work of Mohammed (2017) x-rayed massive global consumption of energy and environmental pollution in the manufacture of ordinary Portland cement (OPC). This process of employing biocretejustifies the position of Nirmala and Dhanalakshmi (2017) that; all round the world, present scenario in the construction industry is facing serious problems with price hike of raw materials. The Nigerian Building and Road Research Institute (NIBRRI) through FRN (2018) is intervening through research and innovation in the appropriate technology industrialization of building materials, to make them available at affordable costs. In this work, production and test of*canarium*-creteas a class of biocrete was accomplished. The product is envisaged to be strongenough to provide favourable compressive strengths. This is in order to close silent gaps in the technical and technology documentation of performance characteristics and concreting parameters of *canarium*-crete, by employing appropriate technology for rural educational building.

Research question

1. The corresponding research question that guided the study is; What are the compressive strengths of the different samples of *canarium*-crete cube specimens in the study?

Hypothesis

H_{O1}: There is no significant difference in the compressive strength of *canarium*-crete (bio-crete) cubes and the conventional concrete cubes.

Methodology

1. ***Compressive Strength Properties of Biocrete and Concrete:*** The general provision for the quality of concrete and biocrete shall apply to *canarium*-crete as prescribed by the National Building Code of Nigeria (FRN, 2006). Experimental and standard test equipment and methods are therefore continually modernized, so are improvements on testing methods, mean of analysis and interpretation of test data; nonetheless, studies, works and researches still rely on the strength of 150mm x 300mm cylinders of concrete, produced on the site and tested for compression at 28 days maturity, the same procedure done 90 years ago (Concrete Manual, 2012). The development of high strength concrete has also changed as reported by Annadurai and Ravichandran (2014) to posses' comprehensive strength of 34 Nmm^{-2} in 1950, in the 1960s concretes with 41 and 52Nmm^{-2} compressive strength were put to commercial use. Early in the 70s, 62Nmm^{-2} concrete was produced,concrete strength is usually the basis of acceptance or objection to the quality of concrete. Therefore, the specification or Standard or Code or Regulations are statutory documents commonly used to communicate the strength of concrete (with the compressive strength) being the commonest strength requirement for various structural parts.Some ideas on the strength values that may be required of concrete are represented in. In practice, cases are that, strength specimens may fail to reach the required performance standard value. In such situations, further testing of the concrete in place is usually specified. However, the required strength is based on the design parameters obtainable by the designer.Various standardization instruments specify the strength level requirements of

concrete in several concrete structural components. This can be determined for verification using well evaluated results according to the specifications. For economic benefits in material costs, the specified strength of very high strength concrete is based on the 56^{th} or 90^{th} day tests, rather than on the traditional 28^{th} day test results (Concrete Manual, 2012). Strength has thus remained the governing factor required for the judgment of the quality of concrete. The Manual however, gives a proviso that, concretes that fail to develop the required strength may as well be deficient in some aspects or of testing (NRMCA, 2013). The samples will be crushed with compressive testing machine to determine the compressive strength, which will be compared with that of conventional concrete. Strength is normally obtained by means of test cylinders and cubes. (Concrete Manual, 2012; Annadurai & Ravichandran, 2014). Studies of Shang, Yi and Tang (2012); Ahmed, Mallick and Hassan (2016) and Uduweriya, Subash, Sulfy and De Silva (2010) employed concrete cube specimens to test the compressive strength of concrete. Major steps on how to test the strength of concrete are outlined by National Ready Mixed Concrete Association (2003) to include using; cylindrical specimens of (150 x 300)mm, recording the mass of specimen before cappingcylinders with sulfur mortar, selecting and using cylinder that has not dried-out, measuring cylinder diameter in two locations at right angles to each other at mid-height, withthe ends of cylinder specimens perpendicular with the cylinder axis, having cylinder specimens centered in the compression-testing machine and loaded to complete failure, finally, calculate the compressive strength of the cylindrical sample concrete by dividing the maximum load at failure by the average cross-sectional area. The result of the work of Nirmala and Dhanalakshmi (2017) with biocrete of 1:1.5:3 proportion of cement to paper-mass and textile at 3%, 5%, and 7%yielded the compressive strength of up to 30.45Nmm^{-2} in 28 days. The result compared favourably to that of 0% paper mass and textile waste used as control concrete which was 28.13Nmm^{-2} at the same age. The laboratory machines and arrangements for testing the compressive strength of concrete will also be employed on testing the compressive strength of *canarium*-crete.

2. ***Design of the Study:*** The study employed true experiment as suggested by Uzoagulu (2011) to involve; materials, sample, products and laboratory investigation methods. In this research therefore, the experiment involved subjecting samples of *canarium*-crete and conventional concrete cube samples to laboratory investigation. The experimentation was in order to determine the compressive strengths, with the strength of traditional concrete serving as control material.

3. ***Area of the Study:*** The study was conducted inPankshin local government area of Plateau State, located at 9^{o} 10'N and 9^{o} 45E, in Central Nigeria. This is where *canarium* fruits and seeds are found in abundance. The geographical location of North Central geo-political zone, stated in Angulu (2017) is at; latitude 10^{0} 19' 60" North and longitude 7^{0} 45' 0" East, in the map of Nigeria. The zone collectively has five other states.However, the laboratory tests were carried out in the materials testing laboratory of Metropolitan Construction Company Limited (MCCL) Camp, located at Wuseli in Plateau State.

4. ***Materials and Method of Sample Collection:*** A total of 200 cubes were cast for the experiment. These were made up of 100 *canarium*-crete cube specimens and 100 conventional or control concrete cubes, they were respectively cast in order of the 10 cast-iron moulds made available in the materials laboratory of Metropolitan Construction Company Limited (MCCL), located at WuselliCamp. The 200 cubes were then sampled and treated for use to obtained and compute relevant results of the study. The conventional concrete cubes were used as control samples for the purpose of comparison with the *canarium*-crete cube samples. The 200 specimen cubes were stratified in two groups. At the first stage, 100 *canarium*-crete cubes and then, 100 conventional concrete cubes were cast. The processes of sourcing and identification of fine aggregates to casting, curing and testing started from July to September, 2018. At the second stage, each of the material groups were stratified into five experimental groups as; Groups 45, 30, 25, 20 and 15 in five different mix proportions (that is, extra rich, rich, normal, mass and lean or blinding proportions of 1:1:1, 2:3:6, 1:2:4, 2:5:10 and 1:3:6).

From each of the batches of 20 cubes, 16 and two sampled cubes were randomly picked-out of the curing pond and dried for the laboratory investigations to determine the compressive strength and rate moisture absorption respectively. The investigation was done at four maturation ages of 7 days, 14 days, 21 days and finally at 28 days old. The table provides that *canarium*-crete mixes were designed, while five standard mix ratios were used for producing the conventional or control concrete groups of cube specimens for the study. Therefore, eight cubes were randomly removed from each batch of *canarium*-crete and concrete cubes. This proved the total sampled size of 80 (*canarium*-crete and concrete) cubes from the population that were produced, cured and crushed for the determination of compressive strength. Thereby, leaving an untested number of 10 cubes, made up of ten from each group, from a total population of 100 cubes. The test involved compressive strength of 40 cubes of conventional concrete and *canarium*-crete samples each. The position of FRN (2016) requires that three cubes should be tested seven days after manufacture and another three on the 28th day of maturity. The crushing test samples were obtained based on the principles of McKay (1978), which recommends that, six cubes from four separate batches of concrete should be considered for strength and workability of concrete. Prior to construction, three cubes from each batch should be tested at seven days and three at 28 days.

5. ***Description of Materials and Sourcing:*** Sourcing and preparing *canarium*-seeds, cement, fine aggregates, coarse aggregates and water were done as follows:

   (a) *Canarium* seeds:The seeds were of assorted sizes and shapes (the seed has five sides, approximate dimensions of 15mm to 20mm long and 8mm to 10mm wide) and oblong in shape.

   (b) Cement:The ordinary Portland cement that was used conformed to the performance requirements of the National Building Code (2006). The source of the cement was from H. O. Ekeh and Sons Investment Nigeria Enterprises, a reputable cement dealer in Ashaka and Dangote brands of cement in Pankshin town.

   (c) Fine Aggregate**:** The fine aggregate used was obtained as rough river sand (4.75 mm), from River Dashan of Wuseli, in Pankshin local government area. The sand was analyzed for particle size distributionin the materials testing laboratory of Metropolitan Construction Company Limited (MCCL) Camp, located at Wuseli, in Pankshin local government area of Plateau State. The aggregate properties show gravelly sand.

   (d) Coarse Aggregate: The source of coarse aggregate for the study was the locally available quarried granite stones as obtained from the stock pile of MCCL at Wuseli Camp in Pankshin local government area of Plateau State..

   (e) Water: Water available in the camp laboratory of Metropolitan Construction Company Limited (MCCL) at Wuseli was used for mixing the *canarium*-crete and concrete cube samples. The water was of portable quality and thus a $_{p}$H value of six to eight and without organic matter.

6. ***Preparation of Materials and Cubes Production:***

   (a) *Canarium*-crete Cubes: These were made up of 80 sampled cubes, (150mm x150mm x 150mm) in size. The cubes were produced from five mix batches. To correspond to ratio; 1:1;1, 2:3:6, 1:2:4, 2:5:10 and 1:3:6 and cured for 7 days, 14 days, 21 days and a maximum of 28 days, prior to testing.

   (b) Conventional Concrete Cubes:The conventional concrete cubes were also 150mm x 150mm x 150mm in size. The cubes were cast from five mix ratios by weight of; 1:1:1, 2:3:6, 1:2:4, 2:5:10 and 1:3:6, as Groups 45, 30, 25, 20 and 15 concrete. The concrete cubes were used as control samples, having been cured for the maturity days of 7, 14, 21 and 28 days, before being subjected to laboratory testing procedure to obtain the compressive strength and rate of moisture absorption.

7. ***Cube Production and Test Procedure:*** The details employed in the MCCL Camp laboratory involved six preparatory steps and nine major steps for testing, in that order;
   (a) Batches of 150mm x 150mm x 150mm cubes were mixed dry and wet for uniformity.
   (b) Slump test was conducted as control variable.
   (c) The samples were cured for 7, 14, 21 and 28 days.
   (d) Relevant quality control forms of MCCL were used to record raw test results.
   (e) The joints of the moulds were noted to be water tight.
   (f) The concrete or *canarium*-crete mix was placed in three layers of equal thickness.
   (g) Each layer of the placed mix was tamped 35 times.
   (h) The final surface of the tamped layer was smoothened level with a hand trowel to flush the top of the moulds.
   (i) The concrete and *canarium*-crete cubes were de-moulded and cured in a water pond.
   (j) Four successive cubes each were crushed on the 7^{th}, 14^{th}, 21^{st} and 28^{th} age of maturity, to determine the compressive strengths of both concrete and *canarium*-crete cubes. This was done from the 26^{th} of July to 20^{th} of September, 2018.
   (k) The strength of every cube was read from the digital screen of the capacity compression testing machine and recorded in the standard MCCL laboratory quality control test forms.

8. ***Testing Equipment:*** Digital compression testing machine, steel moulds, slump cone, quality control record forms and charts, checklist and camera were employed in the following order:
   (a) Capacity Compression Testing Machine: An electrically powered crushing machine (Fig. 1) with digital display screen was used.



Fig. 1: Capacity Compression Testing Machine

- The cube was centrally placed between the upper and lower plates as shown in Fig. 1.
- The machine was switched on to boot and crush the cube to point of failure.
- Standard quality control forms used by Metropolitan Construction Company Limited (MCCL) were used to record the crushing load from the display screen of the machine.
- The compressive strength was obtained as a quotient of the load and area of the cube.

Results and discussion

The *canarium*-crete cubes yielded 8.40 Nmm^{-2} at the same age of maturation, as illustrated in Fig. 2. In conclusion, experimental Group 15 has the least compressive strength, but can still be used for blinding, as the compressive strength compares adequately with that of concrete specified in the National Building Code by FRN (2006).

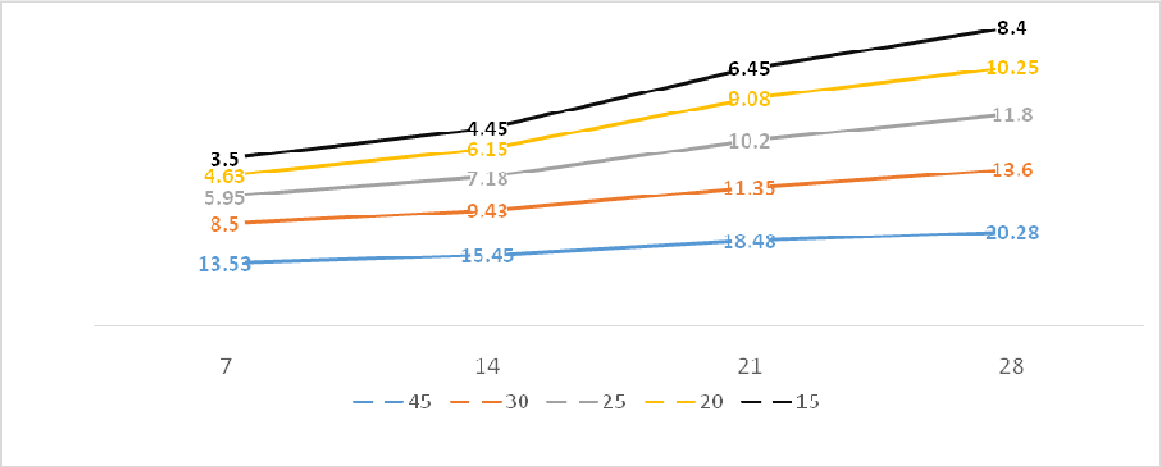


Fig. 2: Strength Chart of Experimental *Canarium*-creteCube Samples (Nmm^{-2})

The strength chart also presents the middle level strengths of experimental Groups 30, 25 and 20 of *canarium*-crete samples, ranging from 4.63Nmm^{-2} to 13.60Nmm^{-2}. From the charts, the findings of the research question four which sought to determine the compressive strengths of the different samples of *canarium*-crete samples for rural housing in the area of study show that *canarium*-crete satisfies the strength requirements for light reinforced concrete, mass concrete and blinding concrete, but falls far below those of concrete based on the experimental Groups and within the same days of maturity as shown in Fig. 3.

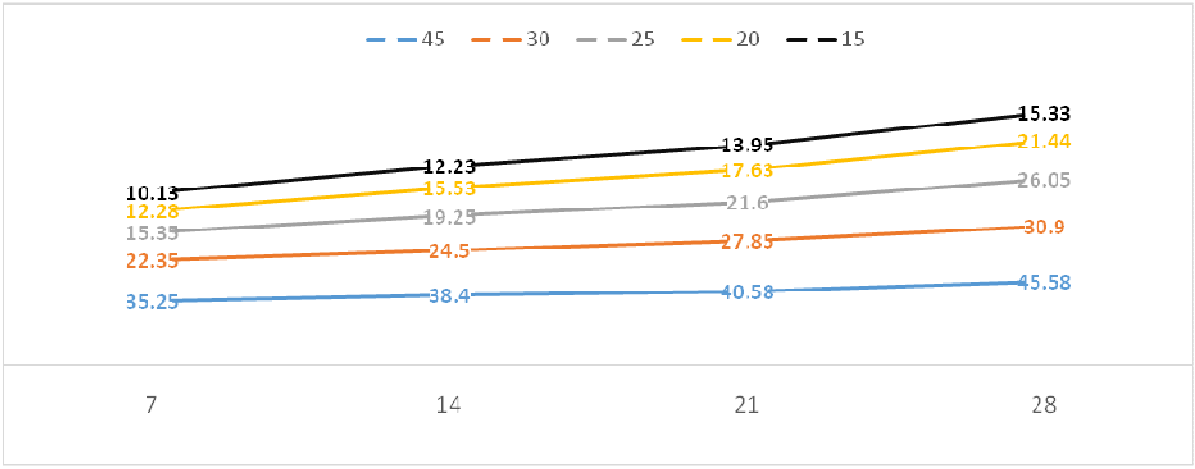


Fig. 3: Comparative Strength Chart of Concrete Cube Samples

Table 1: Analysis of Variance (ANOVA) of the Differences Between the Mean Compressive Strength of *Canarium*-crete and Concrete Cubes

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Dec.
Intercept	2249.192	1	2249.192	127.906	0.001	Rejected
Error	52.754	3	17.585			

Table 1 presents the significant difference in the comprehensive strength of the *canarium*-crete and concrete cubes. Since the p-value of 0.001 was less than the 0.05 significant level,it was concluded that there is significant difference in the compressive strength of*canarium*-crete and concrete cube samples, hence the Pairwise comparisons in Table 2.

Table 2: Pairwise Comparisonson theCompressive Strength of *Canarium*-crete and Concrete Cubes

(I) factor 1	(J) factor 1	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	13.525*	0.532	0.000	15.220	11.830
2	1	13.525*	0.532	0.000	11.830	15.220

Based on estimated marginal means

*. The mean difference is significant at the 0.05 level.

b. Adjustment for multiple comparisons: Bonferroni.

The results in Tables 1 and 2 present the ANOVA and Pair Comparisons results on the compressive strength of canarium-crete and concrete. The table shows which cubes have more or less compressive strength. The tables indicated that there is significant difference between *canarium*-crete cubes and concrete cubes, as the values are less than 0.05. It is therefore inferred that concrete cubes have higher compressive strength than *canarium*-crete cubes.

Findings and discussion

Based on the answers of the research question raised and the results of the tests and the formulated null hypothesis, which guided the study, the major findings of the study are as follows:

1. The richest group of *canarium*-crete (1:1:1) supplied the highest compressive strength of 20.28Nmm^{-2}.The weakest group of *canarium*-crete (1:3:6) proportion produced the result of the lowest strength of 8.50Nmm^{-2}.Other crushing strength values were also recorded after 28 days of maturity from the corresponding mix proportion to include; 13.60 Nmm^{-2} from 2:3:6, 11.80 Nmm^{-2} for 1:2:4 and 10.25 Nmm^{-2} for 2:5:10 mix proportion.All the strength values fall below those of the control concrete cubes, but are suitable for use as light weight reinforced concrete, mass concrete and blinding concrete.
2. The compressive strength (Nmm^{-2}) of the highest and lowest groups (45 and 15) of concrete cube samples provided (35.25, 45.58) Nmm^{-2} and (10.13, 15.33) Nmm^{-2} on day 7 and day 28 respectively.The strength of the same groups of *canarium*-crete tested at the same ages of maturity were; (13.53, 20.28) Nmm^{-2} and (3.50, 8.40) Nmm^{-2} accordingly.
3. The null hypothesis H_{01}, was rejected based on the Analysis of Variance (ANOVA). This was so becausethe p-value of 0.000 obtained was less than the alpha value of 0.05 level of significance. Furthermore, the Pairwise comparison conducted on the strength values of *canarium*-crete and concrete cubes also produced a determinant factor in favour of concrete. This is on account of the p-value being less than 0.05 level of significance.
4. *Canarium*-crete is a type of agro industrial waste material similar to other agro base concrete-like biocrete for infill walls, bricks and blocks useful as local building materials, as reported by Lim (2013); Azman and Bongkud (2013). The study found out that five mix proportions of (1:1:1, 2:3:6, 1:2:4, 2:5:10 and 1:3:6) of cement, fine aggregate and *canarium* seeds targeted at what can be created from waste (Alen&Iano 2009) with suitable compressive strength values of (20.28, 13.60, 11.80, 10.25 and 8.40) Nmm^{-2}. The finding agrees with the work of Mavridou and Banti (2016) in the production of biocrete concrete for healing cracks, reflecting light and waste water treatment plants. Such bio-tech developments are beneficial to rural housing in terms of the use of wastes in engineering application as affirmed by Nirmala and Dhanalakshmi (2017).

Conclusion

The study used well structured purposes, procedures, soil sample and mix design method for *canarium*-crete, suitable mix proportion, acceptable compressive strength. It is in agreement of (Aliyu, Ghani, Bello, Kasim & Martin 2014) that rural housing development problems can be solved by appropriate technological advancement and engineering, to the satisfaction of a broad specification of varieties of performance requirements, National Building Code (FRN 2006) and used in both structural and general construction works as encouraged by FRN (2016).The result of this study also confirms the position of Bredenoord (2016) by urging all tiers of government to use environmentally biocrete materials and technologies and local resources to promote sustainable rural housing, at cost effective margins.

Recommendations

1. C*anarium*-crete should be approved by the enforcing authority of building regulations as an appropriate material for housing delivery.
2. The building materials research institutes should collaborate with relevant ministries, departments and agencies to explore the discovered potentials of *canarium*-crete as a building material for rural housing delivery.
3. Training institutions and skill acquisition centres, affiliated professionals and agencies should emphasize the application of techno-entrepreneurship in research development and innovation on agro industrial waste for producing biocrete building materials.
4. NGOs and faith based organizations should establish training outfits in rural areas for the techno-entrepreneurial training in the production of appropriate building materials for rural housing delivery through technical vocational education and training.

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TECHNO-ENTREPRENEURIAL FRAMEWORK OF INTEGRATED SCIENCE, TECHNOLOGY, ENGINEERING, ARTS AND MATHEMATICS EDUCATION FOR SUSTAINABLE DEVELOPMENT OF RURAL COMMUNITIES

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Abstract: *The ANOVA analysis accepted* H_{01}*, from the mean responses of youths, adults and elders of Kwalla community over the perception on canarium seeds and usage of canarium-crete for rural educational building delivery. The studytherefore recommended the application of canariumschweinfurthii bursecarea seeds, as suitable agro-industrial waste for utilization as appropriate raw material for the production of canarium-crete building construction material asa suitable alternative to conventional concrete. This appropriate material approach has surely aroused the rural educational building development and techno-entrepreneurship interest of teachers, learners, building materials entrepreneurs, industries and researchers towards canarium-crete products for rural housing potentials in particular and the biocrete appropriate technology prospects in general. Recommendations were made on the consideration and approval of canarium-crete for technical, technological, housing performance and techno-entrepreneurial prospects and values, of canarium seeds, canarium-crete and biocrete in Central Nigeria in particular and the country in general, toward targeting the growing rural educational building and housing deficit in every community of the country.*

Keywords: *Canarium-Crete, Techno-Entrepreneurship, Housing Performance, Sustainability*

Introduction

A community is a system of systems integrated with each other in a cluster of families, within a geographical unit with statutory marks for maintaining simple institutions, legal and political identities. The level of science, technological, engineering, arts and mathematics (STEAM) educational facilities available in most Nigerian rural communities have been found to be such that only the literate members of rural communities ascend to key organizational positions. Consequent upon which most of the required resources which exist in limited quantities, spark-off competition for admission between the number of persons requiring STEAM education in schools, colleges, polytechnics and universities. This phenomenon has resulted into having a process whereby, a community is mobilized to identify its needs and problems within the environment in order to develop the zeal for more integration towards satisfying the identified needs, providing solutions and sourcing needed resources for sustainable rural development.

In the spirit of community organization, social changes are created in the economic, political and technological realms. Examples of such changes in the society include; transportation, communication, health, STEAM education, the economy, leisure, housing, culture and behaviour. Sources of these changes are hinged on the discovery of perception, diffusion of cultural traits, religious education of individuals, urbanization through industrialization and the application of STEAM education. Every community is therefore expected to pursue economic and social development that meet the needs of the present generation without endangering the ability of future generations to satisfy their needs and choose their lifestyle. So, sustainable living by communities require the conservation of finite resources in STEAM education, through direct reduction of amounts used, more efficient use and seeking alternatives. This is possible through the reduction of waste, recycling, harnessing local resources and minimization within a set of techno-entrepreneurial, social, cultural and institutional measures implemented with and for the inhabitants of rural communities, with the aim of improving the socio economic conditions, in order to achieve harmony and balance, both at the regional and national levels. Rural development in Nigeria is mostly centred on agricultural, trade and industrial programmes, while STEAM education is set to explore biocrete potentials from the techno-entrepreneurial perception framework of a typical rural community.

Statement of problem

For economic intensions and the need to improve science, technology, engineering, arts and mathematics (STEAM) education and skills, ruralites move. People with higher education in rural communities are also pulled-out to compatible job areas in urban communities with employment opportunities. Similarly, in rural communities where poverty or inadequate STEAM educational infrastructure exist, those who want to receive STEAM education have to migrate to other areas where such facilities are found. Rural areas being the source and origin of most materials used in building construction still experience the prevalence of shanty structures. The qualities of large proportion of the houses in rural areas are mostly of deplorable non-durable materials. The slums in urban areas are not any better. The problem is more pronounced by the fact that, the financial wherewithal of the greater population of the rural and urban poor, homeless and inadequately housed masses are too small to even build affordable houses as asserted by (Osazuwa and Cornelius, 2018). The basic building materials required to build more durable houses are either not available, or available at unaffordable prices.There are calls to encourage appropriate biocrete technology (Stulz, 1986) and techno-entrepreneurship (Therin, 2007), in order to sustain the rural housing environment. This cannot be achieved if African olive or *canarium*-seeds continue to be discarded at the expense of low-cost technology for rural housing development and delivery. The naturally hard shells of the seed have been treated as throw-away agro-waste to accumulate; the community thus becomes an ignition point for pollution agents, while potential techno-entrepreneurs and the building construction industry ignore the possible viability of local building materials. The study explored appropriate technology within the construction industry through the use of *canarium*-seeds, to produce *canarium*-crete. The study is therefore in response to the appropriate technology interest, to integrate agro or bio-waste into *canarium*-crete and also address the disposability problems encountered by oil milling communities with the seeds through STEAM education.

Research question

1. What is the techno-entrepreneurial potential of biocrete material for sustainable rural development?

Hypothesis

H_{O1}: There is no significant difference in the perception of youths, adults and elders in the usage of *canarium*-crete for sustainable rural development.

Techno-entrepreneurial framework and sustainable development

Techno-entrepreneurial framework is the structural concept, shape or order intended to serve as a support or guide for raising the procedure of achieving a given programme.Technology entrepreneurship has more to do with collaborative production based on the shared vision of technology, hence the concept of partnership in effectuation.This differs from the description of an entrepreneur in general; in terms of individual discovery, individual economic innovator, individual controller about the unknown, individual belief with lower information cost and an individual with certain personality traits as a charismatic leader.This makes techno-entrepreneurship to broadly involve successful innovation, managerial skills to utilize resources effectively, makes appropriate feasibility analysis, be skilful in marketing human resource management, financial management, manufacturing management and networks within risks. Risk is not seen as a new development by Carson (2008) but that many different ones recur in life. These include risk suffered, endured, ignored, realized, encountered, refused, taken, regretted, survived, faced, accepted, weighed, chosen, embraced and the ones to overcome. In the 1950s and today, the criteria of children at risk can be noticed in race, gender, poverty, ghetto culture, street childhood, broken home-parenthood, poor education, youthfulness, single parenting, under-age marriage and lack of professional training or job skills. Some productive skills studied as requirements for the production of teacher-made block laying and concentrating equipment by

Mafwalai (2010) include; design measurement, marking-out, cutting, chiselling, trimming, driving, boring, shaping or fabrication, sand-preparing or smoothing, assembling, painting, lettering, appropriate selection use and manipulation of tools, care of tools, observation safety and creative ability. The framework developed for techno-entrepreneurship by Blanco (2007) is a typical structure for STEAM to follow.

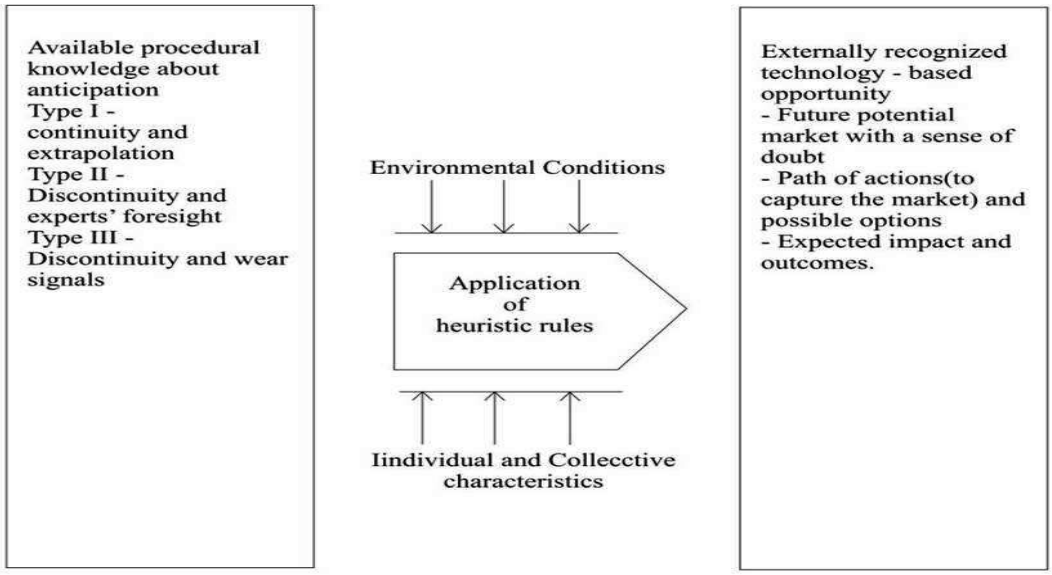


Fig. 1: Framework - Anticipation and Heuristic Rules for Opportunities Recognition (Source: Blanco, 2007)

The framework presents communal relationship between opportunities, heuristic rules and anticipation approaches in techno-entrepreneurship by multiplying the cases through case-based learning methodology, research, development, creativity and innovation. On the whole, Blanco (2007) stressed the ability to recognize business opportunities as one of the first and major skills that techno-entrepreneurs should acquire as it will dramatically shape the future of a given venture. This is made possible by opposing traditional capitalists (who exploit existing resources, fields and activities, engages in new activities) and or ventures that did not exist before.The process of opportunity recognition is therefore a necessary skill in techno-entrepreneurship, so also are information gathering. This is necessary in order to match Science, Technology, Engineering, Arts and Mathematics (STEAM) education opportunities with market opportunities throughout the technology development process. Another skill is in identifying embedded procedural knowledge about anticipation- to act before an event occurs. This position can be envisioned from the quote of Steve Job (1550-2010) the Co-founder of Apple and Pixer, as impacted by the theory of Effectuation (Sarasvathy, 2001). Don't let the noise of others opinions" drawn out your own inner vice. And mostly importantly, have the courage to follow your heart and intuition. They somehow already know what you truly want to become. Everything else is secondary (Bailetti, 2012). Since techno-entrepreneurship is teachable as a vocation. Monica and Cristian (2012) require teachers to possess qualities and skills on empathy, communication, scientific culture, democratic principles, good classroom management and to be a model with well-defined moral values. In fact, different types of education and training programmes for entrepreneurial communities have a common base, the emphasis on skills that entrepreneurs need. However, Marques and Albuquerque (2012) acknowledge that lack of knowledge on the impact of personal and initiative characteristics on entrepreneurial educators don't generate necessarily entrepreneurs, but can promote, or potentiate with learned pedagogical goals and tools, the possibilities, or capacities to be one involved in entrepreneurial pedagogy. Similarly, Bulsara, Gandhi and Porey (2014) connect techno-entrepreneurship to the entrepreneurship in technology area of STEAM education to the person who undertakes techno-entrepreneurship as a techno-entrepreneur.

Techno-entrepreneur is one who organizes, manages and assumes the risk of technology based business enterprises. Therefore, techno-entrepreneur also needs technical management skills, business management skills and motivation.Techno-entrepreneurship basically has its roots in the field of entrepreneurship. Techno-entrepreneurship is thus STEAM education related through interdisciplinary and multi-level as modelled by Therin (2007). Techno-entrepreneurs are a key catalyst in the process of industrial formation and sustainable community development with sufficient technical knowledge. From the highlights on techno-entrepreneurship so far, Prodan also contributed in Therin (2007) that techno-entrepreneurship is a style of business leadership that involves the identification of high-potential technology-intensive commercial opportunities, gathering resources such as talent and capital and managing rapid growth and significant risk using principled decision-making skills. It is aimed at the study of entrepreneurial activities in technology-intensive environments. This is based on the importance that techno-entrepreneurship combines the factors associated with entrepreneurship and the ones due to the highly uncertain nature STEAM education development. Blanco's contribution in Therin (2007) captured techno-entrepreneurship as one of the most important sources of economic values creation and development in Europe and, that techno-entrepreneurs aim at creating and capturing economic value through the exploration of new technology-based solutions.This provision varies from the models of entrepreneurship education and training programs in which future technical entrepreneurs are not identified, as illustrated by Valerio, Parton and Robb (2014).

The model shows that the education and training programs focus on building general knowledge and skills about or for the purpose of starting or operating an enterprise devoid of scientific and technical qualification and STEAM education. The contribution also identified seven levels or key elements of techno-entrepreneurship that are linked to a new technological entrepreneur, universities, corporations, capital, market or customers, government and advisors.Such development requires entrepreneurship capital, entrepreneurial knowledge and entrepreneurial capacity as significant implications for entrepreneurial performance (Sebikari, 2014). Principal entrants for techno-entrepreneurship are scientifically qualified workers in the higher institutions of learning or research or industrial firms.Practicing and emerging technological entrepreneurs are commonly required to possess different knowledge, skills and other characteristics than non-technological entrepreneurs. Others are the ones who started their new technology-based firm on their individual research and development, not within the institutions of learning or existing companies.Bulsara, Gandhi and Porey (2014) have therefore advocated teaching entrepreneurship to engineering students as an independent academic discipline which is distinctive and unique component of the free enterprise system. It is in this light that Okpara (2007) describes the experience of enterprises the world-over as a revolution in terms of new technologies, increase use of automation and computers as a revolutionary challenge for entrepreneurs to manage with appropriate creative skills and methods.

Mehodology

A Perception Questionnaire on the Techno-enterprise Potentials of *Canarium*-crete for rural housing (PERTECH) was developed, based on the relevant building requirements of the study in a rural setting. The instrument was in Sections A and B. Section A was used to find out the perception of respondents on the availability of *canarium* seeds in the area of study, while section B supplied responses on the usage of *canarium*-crete for rural housing. Mean ($\bar{x}$) was used to analyze data from the questionnaire, while standard deviation (SD) was employed to represent the dispersion of mean scores to obtain homogeneity or otherwise while analysis of variance (ANOVA), Sphericity and Pairwise Comparisons tested the hypotheses. Each item in both sections of the instrument was rated on a five point Likert scale of Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (D) and Strongly Disagree (SD) valued at 5, 4, 3, 2 and 1 respectively. The lower and upper class limit values of real or whole number range from; 4.50 to 5.49, 3.50 to 4.49, 2.50 to 3.49, 1.50 to 2.49 and 0.50 to 1.49. The instrument was subjected to face and content validation in order to determine the acceptability and justification of the items by (Uzoagulu 2011).

Draft copies of the instrument were validated by six professional teachers of vocational and technical education in the Federal College of Education, Pankshin, four from the Department of Technical Education, one from Department of Business education and one from Home Economics Education Department. Upon application of reliability statistics on the multiple response type instrument as suggested in Deji (2014) cited by Lidima (2017). Based on cluster administration, the reliability coefficient of 0.942 was obtained by Group A, 0.943 by Group B and 0.935 by Group C, while the overall Cronbach's Alpha coefficient value of 0.954 was obtained for the whole instrument.Thereafter the instrument was administered to members of Kwalla community. The population of respondents in the rural area of study were 79, made up of 41 youths (18-24), adults (25-32) and elders (32 and above). Data from respondents and laboratory test results were used for analysis, using mean and standard deviation, Analysis of Variance (ANOVA) was employed to test the null hypothesis at 0.05 level of significance while. The decision rule was based on the Likert decision scale of strongly agreed to strongly disagreed and vice versa. In deciding on the hypotheses tested, the hypothesis without significant difference was accepted, where the P-value was greater than 0.05 level of significance, thereby indicating that there was no significant difference in the mean value of the responses by the three groups of respondents on any item.

Results

Table 1: Mean Responses of Youths, Adults and the Elderly on Techno-enterprise Potentials of *Canarium*-crete for Rural Educational Housing (N=79)

S/N	Potentials of *Canarium* seeds	$\bar{x}_A$	$\bar{x}_B$	$\bar{x}_C$	$\bar{x}_G$	S D	Rem
1.	*Canarium* trees and seeds are in abundance at Kwalla for commerce.	4.51	4.22	4.61	4.45	0.203	A
2.	*Canarium* trees can be multiplied into business forests.	4.40	4.15	4.17	4.24	0.139	A
3.	*Canarium* seeds can be used to produce building materials because the shells or carnels are hard.	4.00	3.50	4.08	3.86	0.314	A
4.	*Canarium* seeds can be concerted from refuse to aggregates in Kwalla.	4.24	4.16	4.23	4.21	0.044	A
5.	The *canarium*-crete beam model construction in Kwalla can be commercialized.	4.82	4.89	4.84	4.85	0.036	A
	Usage of *canarium* seeds for techno-enterprise in housing						
6.	Masons in Kwalla have the basic skills for producing sand-crete blocks and concretes for commercial purposes.	4.12	4.12	4.03	4.09	0.052	A
7.	Houses in Kwalla will be cheaper to construct with *canarium* seeds.	4.06	4.05	4.09	4.07	0.021	A
8.	*Canarium*-crete will create markets for the people if used as building material for flooring, casting beams and columns.	4.20	4.12	4.32	4.21	0.101	A
9.	Rural housing with *canarium*-crete will enhance techno-enterprise skills by using appropriate materials in Kwalla.	3.52	4.09	4.18	3.93	0.358	A
10.	More cost effective houses can be constructed if *canarium*-crete is used in rural areas.	4.21	4.12	4.22	4.18	0.055	A

$\bar{x}_A$,$\bar{x}_B$,$\bar{x}_C$and$\bar{x}_G$=Mean of Groups A, B and C and Grand mean; SD= Standard Deviation; Rem.= Remark; A= Agreed; N= Number of Respondents.

Section A of Table 1presents the mean and the standard deviation on the respondents' perception on the potentials of *canarium* seeds and usage of *canarium*-crete for rural housing in group A. The overall grand mean was 4.02 representing 80.4% with standard deviation of 0.287, it implied that the respondents' perception was high. Results in Table 1Section B reflect the mean perception of youths, adults and elders on the potentials of *canarium* seeds and usage of *canarium*-crete for techno-enterprise potentials toward rural housing.The mean responses and standard deviation are the expression of the respondents on items 1-5 (Availability of *canarium* seeds) ranging from grand mean of 3.86 to 4.85 and 0.036 to 0.314 in that order. While the mean and standard deviation of respondents on items number 6 to 10 (Usage of *canarium*-crete for techno-enterprise) range from 3.93 to 4.21 and 0.021 to 0.358 respectively. The mean values depict that since the mean responses are greater than 3.50, which is the value for decision making for each item, it shows that all the respondents agree with the items on the potentials and usage of *canarium* seeds and *canarium*-crete for techno-entrepreneurship.

Table 2: Analysis of Variance (ANOVA)of the Mean Responses of Youths, Adults and the Elderly on *Canarium* Seeds for Rural Housing

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	0.356[a]	2	0.178	19.793	0.048
Intercept	0.028	1	0.028	3.152	0.218
Group B	0.043	1	0.043	4.831	0.159
GroupC	0.011	1	0.011	1.265	0.378
Error	0.018	2	0.009		
Total	96.910	5			
Corrected Total	0.374	4			

The ANOVA result in Table 2, presents the significant difference in the responses of participants' perception on the usefulness of *canarium* seeds across the group A, B and C. The result shows there is no significant difference since the p-values of 0.218, 0.159 and 0.378 were greater than the 0.05 significance level. Hence the hypothesis was accepted and it was concluded that there is no significant difference in the perception based on the grouping of the respondents. The result also produced the ANOVA result in Table 3 on the significant difference on the responses of youths, adults and the elderly on the usefulness of *canarium* seeds and potentials of *canarium*-crete for techno-enterprise across the three groups of youths, adults and elders in the community.

Table 3: Analysis of Variance (ANOVA)of the Mean Responses of Youths, Adults and the Elderly on the Usage of *Canarium*-crete for Rural Educational Building

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	0.041[a]	2	0.020	0.140	0.877
Intercept	0.020	1	0.020	0.138	0.746
VAR00005	0.037	1	0.037	0.253	0.665
VAR00007	0.000	1	0.000	0.001	0.979
Error	0.289	2	0.145		
Total	81.213	5			
Corrected Total	0.330	4			

The result in Table 3 shows there is no significant difference since the p-values of 0.746, 0.665 and 0.979 were greater than the 0.05 significance level. Hence the hypothesis was accepted and it was concluded that there is no significant difference in the usage of canarium-crete for rural housing based on the mean values of perception of the respondents.

Findings and discussion

The findings of the research question which sought to find the techno-enterprise potentials of *canarium*-crete for rural housing in the study area shows that *canarium* seeds possess potentials useful for the manufacture of *canarium*-crete for techno-enterprise. Also revealed by the grand mean scores of 4.21 with standard deviation of 0.13, respondents agree on all the items in the questionnaire as those perceptions required for practicing techno-entrepreneurship with *canarium*-crete in the study area.

Generally, the values of standard deviation reveal that the mean responses of the respondents were not too dispersed from each other in the perceptions and that they were not far from the mean. In conclusion therefore, *canarium*-crete has been highly accepted as a source of techno-entrepreneurship in Kwalla community.

There was no significant difference in the perception of youths, adults and elders on the techno-enterprise potentials of *canarium*-crete for rural housing. The null hypothesis (H_{01}) was upheld because the p-value of 0.378 for availability of *canarium* seeds and 0.979 0n usage of *canarium*-crete were greater than the cut-off alpha value of 0.05 level of significance. The findings of this study confirmed the opinion of Stulz (1986), supporting the successful application of agro industrial waste for construction and Bailetti (2012) on the process as a specific technological knowledge used to create and capture added values for a firm, being one of the most important sources of economic value creation (Therin, 2007). Basic technical and vocational skills are however required to be possessed for practicing techno-entrepreneurship (Sebikari 2014; Valerio, Parton & Robb 2004; Bulsara, Gandhi & Porey 2014; Umunadi 2014; Kwami 2013; Mafwalai 2011; Doyle 2017). Mavridou and Banti (2016).

Result of ANOVA on H_{01} obtained p-values of 0.218, 0.159 and 0.378 for *canarium* seeds and 0.746, 0.655 and 0.979 for the usage of *canarium*-crete to be greater than 0.05 alpha level of significance. Therefore, the null hypothesis stands accepted or not rejected.

Conclusion

Members of Kwalla community participated in the construction of a lightweight reinforced *canarium*-crete beam to exhibit skill for the in the techno-enterprise potentials of *canarium*-crete. There was no significant difference (H_{O1}) in the perception of youths, adults and elders of the community on the techno-enterprise potentials of *canarium*-crete for rural educational housing delivery. The perception of youths, adults and the elderly on the availability of canarium-seeds was greater than the perception value of application of the seeds. The null hypothesis on no significant difference in the perception of youths, adults was rejected. Based on the analysis of statistical data of the study, it was concluded that the potentials of *canarium*-crete for rural housing was accepted for implementation if approved.

Recommendations

1. The suitable and quality *canarium*-crete should be approved by the enforcing authority of building regulations as an appropriate material for rural housing delivery.
2. The building materials research institutes should collaborate with relevant ministries, departments and agencies to explore the discovered potentials of *canarium*-crete as a building material for rural housing delivery.
3. Training institutions and skill acquisition centres, affiliated professionals and agencies should emphasize the application of techno-entrepreneurship in research development and innovation on agro industrial waste for producing biocrete building materials.
4. NGOs and faith base organizations should establish training outfits in rural areas for the techno-entrepreneurial training in the production of appropriate building materials for rural housing delivery through technical vocational education and training.

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PRIVATE - PUBLIC PARTNERSHIP FOR SUSTAINABLE ENVIRONMENTAL PROTECTION IN MAKURDI METROPOLIS, BENUE STATE, NIGERIA

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Abstract: *The study was on private-public partnership for sustainable environmental protection in Makurdi metropolis, Benue State, Nigeria. The study adopted a survey design. The area for the study covered the entire Makurdi metropolis of Benue State. The population of the study comprised of people who were working in public and private places in Makurdi metropolis where wastes were generated and disposed into the environment. Six research questions and hypotheses were formulated for the study. The sample size of the study was 200 people which comprised of 100 people (men and women) from public places such as schools, hospitals, markets, motor parks. And 100 people (men and women) from private places such as homes, craft workshops and business ventures that were generating wastes as a result of their services. The instrument for data collection was private-public partnership for sustainable environmental protection in Nigeria questionnaire (PPSEPQ). The Mean and the standard deviation of the research questions revealed that private and public sectors were ensuring sustainable environmental protection, private sectors do not use finance to ensure sustainable environmental protection, public sectors use finance to ensure sustainable environmental protection, private and public sectors did not use technology to ensure sustainable environmental protection in Makurdi metropolis. The study revealed that private and public sectors were ensuring sustainable environmental protection, private sectors did not use finance to ensure sustainable environmental protection, public sectors use finance to ensure sustainable environmental protection and private and public sectors did not use technology to ensure sustainable environmental protection in Makurdi metropolis. The study recommended that private sectors should use their finance to ensure sustainable environmental protection and private and public sectors should embark on the use of technology to ensure sustainable environmental protection in Makurdi metropolis.*

Keywords: *Private Public Partnership, Sustainability, Environmental Protection*

Introduction

The reality of the environment pollution has seriously affected people's production and life, and even threaten people's life and living environment, it is urgent that we should curb environment pollution increasing trend. Sustainable environmental protection means meeting our own needs without compromising the ability of future generations to meet their own needs. In order words, sustainable environmental protection is the one that meets the needs of the present without compromising the ability of future generations to meet their own needs. The concept has been focused on the issues of ecological degradation. Nigeria, the most populous country in Africa and the 7th most populous in the world **(**Central Intelligence Agency, 2015), has been ranked among the countries with worst environmental record in the world (Butler 2008). The major environmental problems in Nigeria are deforestation, drought and desertification, soil and coastal erosion, water pollution, oil pollution, water hyacinth invasion, loss of biodiversity, flooding, urban decay, industrial pollution and climate change. The increasing rate of environmental degradation taking place around the world and particularly in Nigeria has generated great concern for the sustainability of the future environment (Ogunkan, 2010**;** Morelli, 2011**;** Abolade and Adeboyejo 2013). The emerging environmental sustainability questions have produced different perspectives on the preservation of the environment and about how to make it sustainable for the future generation (Ogunkan, 2010; Ojomo, 2011**;** Abolade & Adeboyejo 2013). However, the dominant perspective suggests that having a clean and neat environment free of littered solid wastes is a signal of good environmental sustainability. With the development, the pollution situations of domestic and public environments are becoming more and more serious (Rong and Yalong 2018). Cities need to adopt an integrated approach for improvement of city services in order to adapt to climate change and reduce their greenhouse emissions.

Cities in Nigeria need to be free of indiscriminate refuse dumps to respond to extreme events of environmental pollution. In most cases, private parties in PPP, focus on the project economics only though they have the potential to provide innovative technical, financial and managerial solutions for sustainable environmental protection (Tharun and Laishram, 2017). We need technology to use natural resources without compromising the ability of future generations to meet their own needs. But it has been increasingly recognised that technical solutions to environmental problems are not sufficient to obtain sustainable development. Instead, there is a growing attention to the importance of governance to manage the wide range of environmental challenges and impacts. Public-private partnerships for sustainable environmental protection involved one or more of the different steps or parts of policy-making: agenda-setting, use of resources and disposal of wastes. Public-private partnerships are sometimes mentioned as a potential vehicle for achieving sustainability goals (Lenferink, Tillema & Arts, 2013). Sustainable environmental protection will not be possible without the involvement of private sector and public-private partnerships. The effectiveness of these public-private partnerships is crucial to achieve sustainable environmental protection for future generation. There is a recognised need to incorporate public-private partnerships (PPPs) for sustainable environmental protection in Nigeria in order to use and make environment safe for future generation.

Aim and objectives of the study

The aim of this study was to explore how such incorporation can be encouraged through financial incentives and technological approach.The specific objectives of the study were to:

1. Find out whether private sectors are ensuring sustainable environmental protection in Makurdi metropolis.
2. Find out whether public sectors are ensuring sustainable environmental protection in Makurdi metropolis.
3. Find out whether private sectors are using financial incentives to ensure sustainable environmental protection in Makurdi metropolis.
4. Find out whether public sectors are using financial incentives to ensure sustainable environmental protection in Makurdi metropolis.
5. Find out whether private sectors are using technology to ensure sustainable environmental protection in Makurdi metropolis.
6. Find out whether public sectors are using technology to ensure sustainable environmental protection in Makurdi metropolis.

Research questions

1. How does private sectors ensure sustainable environmental protection in Makurdi metropolis?
2. How does public sector ensure sustainable environmental protection in Makurdi metropolis?
3. How does private sectors use financial incentives to ensure sustainable environmental protection in Makurdi metropolis?
4. How does public sectors use financial incentives to ensure sustainable environmental protection in Makurdi metropolis?
5. How does private sectors use technology to ensure sustainable environmental protection in Makurdi metropolis?
6. How does public sectors use technology to ensure sustainable environmental protection in Makurdi metropolis?

Research hypotheses

H_{O1}: The private sectors do not significantly ensure sustainable environmental protection in Makurdi metropolis.

H_{O2}: The public sectors do not significantly ensure sustainable environmental protection in Makurdi metropolis.

H_{O3}: Private sectors do not significantly use financial incentives to ensure sustainable environmental protection in Makurdi metropolis.

H_{O4}: Public sectors do not significantly use financial incentives to ensure sustainable environmental protection in Makurdi metropolis.

H_{O5}: Private sectors do not significantly use technology to ensure sustainable environmental protection in Makurdi metropolis.

H_{O6}: Public sectors do not significantly use technology to ensure sustainable environmental protection in Makurdi metropolis.

Materials and methods

1. ***Research Design:*** This study adopted survey research design in which a group of people or item is studied by collecting and analysing data from a people considered to be a representative sample of the entire population. This design was suitable because the study used questionnaire for collection of data from a representative sample of the population on the private public partnership for sustainable environmental protection in Nigeria.
2. ***Area of the Study:***The area for this study covers the entire Makurdi metropolis of Benue State. This is because Makurdi is the state capital where many people are living and are disposing a lot of wastes on daily basis. Makurdi metropolis which is the focus of this study is dominated by three main tribes, the Tiv, Idoma and Igede. Observation has shown that these different tribes come to stay in Makurdi metropolis for various economic and social activities. In addition, the study area has markets where business transactions can take place. The markets around the Makurdi metropolis and its environs where business activities are found to be taken place include; Wurukum, Modern, North Bank, International, Yakyôr, Wadata, High level, Airport, Akpehe, Kanshio and Railway markets. Different type of goods and services are been sold in these markets and wastes are commonly seen littered around this markets. More so, the study area has private and public hospitals such as; Benue State University Teaching Hospital, Federal Medical Centre, General Hospital and many other private Hospitals. These hospitals too use and dispose waste materials that could be harmful in the environment. Again, primary, post primary and tertiary institutions are located in the metropolis. This in turn, tends to attract business activities such as selling of books, school wears and other equipment and materials needed in the operation of schools. And when these materials are used by the school authorities, pupils and students they are sometimes not disposed correctly in the environment. In addition, observation has shown that craft works such as welding and fabrication, carpentry and joinery and many others are observed to be highly patronized by people in the metropolis. Hence, these damaged craft materials too are seen littered around the environment in the metropolis. Furthermore, festive activities are celebrated in the metropolis almost on daily basis. Observation has shown that the celebrations of these activities have been observed to correlate with high patronage in the buying of food and drinks that are either package in polythene or plastic materials. Hence, after used a lot of plastic materials are commonly seen disposed indiscriminately in the metropolis. The study area is characterized by indiscriminate disposal of wastes around public and private places. These wastes are capable of affecting the environment negatively in the state capital both at present and in the future. The study area is therefore a fertile ground suitable for the conduct of a study of this nature.

3. ***Population of the Study:*** The population of the study comprised of people who are working in public and private places in Makurdi metropolis where wastes were generated and disposed into the environment.

4. ***Sample and Sampling:*** The sample size of the study was 200 people which comprised of 100 people (men and women) from public places such as schools, hospitals, markets, motor parks. And 100 people (men and women) from private places such as homes, craft workshops and business ventures that were generating wastes as a result of their services. This sample size was arrived at by using table of sample size by Krejeleand Morgan in Emaikwu (2013). The sampling technique used was stratified and proportionate random sampling technique, a technique that used more than one sampling technique. This was so because purposive sampling technique was used to select only public and private places. Then in each of the selected places, simple random sampling technique of balloting was used to select only the required number. The selected sub-samples were added together as the sample for the study.

5. ***Method of Data Collection:*** Private public partnership for sustainable environmental protection in Nigeria questionnaire (PPSEPQ) was used. The researcher who was familiar with the study area administered and retrieved copies of the questionnaire from the respondents. The researcher visited the subjects in their places to administer the questionnaire on face to face bases. This was to ensure that the actual people, for whom the questionnaire is meant, were indeed the ones who completed it. Also, the researcher was available to explain any point that the respondents did not understand very well. The questionnaire was filled on the spot and given back to the researchers.

6. ***Method of Data Analysis:*** Data was collected and analysed using mean and standard deviations to answer the research questions. The choice of mean and standard deviation to answer research questions was because data collected was on interval scale. Benchmark of 2.50 was established to accept any item with a mean rating of 2.50 or above as agreed while any item with a mean rating less than 2.50 was regarded as disagreed for research questions. Hypotheses were tested using chi-square (χ^2) at 0.05 level of significance. This was achieved by degenerating the data using 2.50 as a bench mark to know those who have agreed on a concept and those who disagree with the concept been tested. The majority of the opinion on the concept was detected in the direction and when the difference was tested and it was found significant decision was taken in favour of the majority opinion in each hypotheses. The decision rule for rejection or otherwise of the hypotheses was based on the p-value (associated probability). A hypothesis of no significant difference was not rejected for any cluster of item whose p-value was equal to or greater than p-value of 0.05($P \geq 0.05$) while it was rejected for any cluster of item whose p-value was less than p-value of 0.05 ($P < 0.05$).

Results

Table 1: Mean Ratings of Private Sectors Ensuring Sustainable Environmental Protection in Makurdi Metropolis

S/N	Description	N	Mean	Std. Deviation	Decision
1	I make sure that wastes generated in the home are separated from the ones that can decay and the ones that cannot decay	200	3.1000	1.08438	Agreed
2	I make sure that wastes generated in the home are kept in waste bins before disposing them	200	3.4400	1.04492	Agreed
3	I ensure that generated waste materials are dispose in designated places	200	3.6800	0.46765	Agreed

S/N	Description	N	Mean	Std. Deviation	Decision
4	I make sure that wastes generated in the home to be burnt are burn in closed incinerators so that the environment is not polluted	200	2.6200	1.23419	Agreed
5	I ensure that harmful waste materials that cannot be burnt in a controlled way are proper dispose by burying them in designated places	200	3.3800	0.69137	Agreed
6	I always make sure that heap of waste materials are not found around my home	200	3.3600	0.71622	Agreed
	Grand Mean	200	3.2633	0.65916	Agreed

From Table 1, it can be seen that all the items captured on private sectors ensure sustainable environmental protection in Makurdi metropolis had their mean rating above 2.50. The grand mean of 3.2633 with standard deviation of .65916 can be used to answer the question that private sectors were ensuring sustainable environmental protection in Makurdi metropolis.

Table 2: Public Sector Ensure Sustainable Environmental Protection in Makurdi Metropolis

S/N	Description	N	Mean	Std. Deviation	Decision
7	We generate wastes and that they are separated into renewable and non-renewable ones	200	2.3400	1.10930	Disagreed
8	We always ensure that wastes to be disposed by burning are burnt in a controlled way	200	2.9600	0.89577	Agreed
9	We make sure that wastes in the premises are taken to the waste site for proper disposal	200	3.6200	0.48660	Agreed
10	We always ensure that all generated wastes are properly evacuated by the contractor who is in charge of disposing our wastes	200	2.7200	0.98307	Agreed
11	We make sure that wastes generated are not littered and left around the premises	200	3.7600	0.42815	Agreed
12	We always ensure that our surrounding is free of generated wastes and is kept neat	200	3.6200	0.48660	Agreed
	Grand Mean	200	3.1700	0.58788	Agreed

From Table 2, it can be seen that all the items captured on public sectors ensure sustainable environmental protection in Makurdi metropolis had their mean rating above 2.50 except item 7. This means that public sectors generate wastes and did not make sure that they were separated into renewable and non-renewable ones. The grand mean of 3.1700 with standard deviation of .58788 can be used to answer the question that public sectors were ensuring sustainable environmental protection in Makurdi metropolis.

Table 3: Private Sectors Use Finance to Ensure Sustainable Environmental Protection

S/N	Descriptions	N	Mean	Std. Deviation	Decision
13	I pay sanitation workers to evacuate generated wastes drop in the bins in order to keep the home clean	200	1.7800	1.00831	Disagreed
14	I pay some money to people to evacuate heaps of wastes materials around my premises and the surroundings to the waste dump site	200	1.7600	0.68171	Disagreed
15	I always purchase waste handling equipment of all kind for easy handling of wastes in the home	200	2.7400	1.21647	Agreed

S/N	Descriptions	N	Mean	Std. Deviation	Decision
16	I always procure waste bin for proper disposal of waste in the home	200	3.3400	1.03429	Agreed
17	I do pay money to repair damage wastes bin immediately so that wastes should not be dispose on the ground at home	200	2.4000	1.11635	Disagreed
18	I always pay medical bill of any sanitation worker that have accident in the cause of performing duty during waste disposal in my home	200	2.0400	0.72181	Disagreed
	Grand Mean	200	2.3433	0.63616	Disagreed

From Table 3, it can be seen that all the items captured on private sectors use finance to ensure sustainable environmental protection have their rating mean below 2.50 except items 15 and 16. This means that private sectors do always purchase waste handling equipment of all kind for easy handling of wastes in the home and also, always procure waste bin for proper disposal of waste in the home. The grand mean of 2.3433 with a standard deviation of .63616 can be used to answer the question that private sectors do not use finance to ensure sustainable environmental protection in Makurdi metropolis.

Table 4: Public Sectors Use Finance to Ensure Sustainable Environmental Protection

S/N	Description	N	Mean	Std. Deviation	Decision
19	We pay sanitation workers to evacuate all generated wastes drop in the bins in our premises to the designated dump sites	200	2.1000	0.78298	Disagreed
20	We used to pay some money to people to evacuate heaps of wastes materials around our premises and the surroundings to the waste dump site	200	2.5000	0.85654	Agreed
21	We always purchase waste handling equipment of all kind for easy handling of wastes in the premises	200	2.9000	1.04665	Agreed
22	We always procure waste bin for proper disposal of waste in our premises	200	3.1200	0.79293	Agreed
23	We do pay money to repair damage wastes bin immediately so that wastes should not be dispose on the ground in our premises	200	3.1000	0.60980	Agreed
24	We always budget for medical bill of any sanitation worker that have accident in the cause of performing duty during waste disposal in the premises	200	2.2000	1.09819	Disagreed
	Grand Mean	200	2.6533	0.65128	Agreed

From Table 4, it can be seen that items 19 and 24 captured on public sectors use finance to ensure sustainable environmental protection had their mean rating below 2.50 except item 20, 21, 22 and 23. This means that public sectors do not contract and paid sanitation workers some money to be evacuating all generated wastes drop in the bins in their our premises to the designated dump sites and they do not always budget for medical bill of any sanitation worker that have accident in the cause of performing duty during waste disposal in the premises. The grand mean of 2.5633 with standard deviation of .65128 can be used to answer the question that public sectors use finance to ensure sustainable environmental protection in Makurdi metropolis.

Table 5: Private Sectors Use Technology to Ensure Sustainable Environmental Protection

S/N	Descriptions	N	Mean	Std. Deviation	Decision
25	I recycle my generated wastes to produce other useful products in the home	200	1.8800	0.79293	Disagreed
26	I have monitoring cameras to capture and expose those that do not dispose wastes in waste bins in my home or surroundings	200	1.1200	0.32578	Disagreed
27	I use technology to clean up waste bin in order to make the toxic compounds from my home and surroundings environment harmless	200	1.24000	0.42815	Disagreed
28	I monitored and track wastes generated using cameras or drones until they are dispose to the designated waste dumping site	200	1.1200	0.32578	Disagreed
29	I use digital sniffer like Geo-Spatial Measurement to detect possible health risks pollutants around my surroundings	200	1.2400	0.42815	Disagreed
30	Wastes generated in my home are taken use by a waste management company to reuse it to produce new products	200	1.7200	0.96241	Disagreed
	Grand Mean	200	1.3867	0.29971	Disagreed

From Table 5, it can be seen that all the items captured on private sectors use technology to ensure sustainable environmental protection in Makurdi metropolis had their mean rating below 2.50. The grand mean of 1.3867 with standard deviation of .29971 can be used to answer the question that private sectors did not use technology to ensure sustainable environmental protection in Makurdi metropolis.

Table 6: Public Sectors Use Technology to Ensure Sustainable Environmental Protection

S/N	Descriptions	N	Mean	Std. Deviation	Decision
31	We recycle our generated wastes to produce other useful products in the premises	200	2.2400	0.97321	Disagreed
32	We have monitoring cameras to capture and expose those that do not dispose wastes in waste bins in our premises or surroundings	200	1.1200	0.32578	Disagreed
33	We use technology to clean up our waste bin in order to get rid of toxic compounds	200	1.2400	0.42815	Disagreed
34	We monitored and track wastes generated in our premises using cameras or drones until they are dispose to the designated waste dumping site	200	1.3600	0.48120	Disagreed
35	We use digital sniffer like Geo-Spatial Measurement to detect possible health risks pollutants around our premises or surroundings	200	1.2400	0.42815	Disagreed
36	Wastes generated in our premises are taken to a waste management company to reuse it	200	1.7400	0.65922	Disagreed
	Grand Mean	200	1.7767	0.38044	Disagreed

From Table 5, it can be seen that all the items captured on public sectors use technology to ensure sustainable environmental protection in Makurdi metropolis had their mean rating below 2.50. The grand mean of 1.7767 with standard deviation of .38044 can be used to answer the question that public sectors did not use technology to ensure sustainable environmental protection in Makurdi metropolis.

Table 7: Private sectors ensure sustainable environmental protection

	Observed N	Expected N	Chi-Square	df	Asymp. Sig
Did not ensure sustainable environmental protection	28	100.0	103.680[a]	1	0.000
Ensure sustainable environmental protection	172	100.0			
Total	200				

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 100.0.

From Table 7, it can be seen that 28 respondents were of the opinion that private sectors did not ensure sustainable environmental protection while 172 respondents said that they ensure sustainable environmental protection. Chi square =103.168, df=1, Asymp. Sig=.000=p. Since p was less than 0.05, the difference was significant.

Table 8: Public Ensure Sustainable Environmental Protection

	Observed N	Expected N	Chi-Square	df	Asymp. Sig
Did not ensure environmental protection	28	100.0	103.680[a]	1	0.000
Ensure environmental protection	172	100.0			
Total	200				

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 100.0.

From Table 8, it can be seen that 28 respondents were of the opinion that public sectors did not ensure sustainable environmental protection while 172 respondents said that they ensure sustainable environmental protection. Chi square =103.680, df=1, Asymp. Sig=.000=p. Since p was less than 0.05, the difference was significant.

Table 9: Private Use Finance to Ensure Environmental Protection

	Observed N	Expected N	Chi-Square	df	Asymp. Sig.
Did not use finance to ensure environmental protection	124	100.0	11.520[a]	1	0.001
Use finance to ensure environmental protection	76	100.0			
Total	200				

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 100.0.

From Table 9, it can be seen that 124 respondents were of the opinion that private sectors did not use finance to ensure sustainable environmental protection while 76 respondents said that they use finance to ensure sustainable environmental protection. Chi square =11.520, df=1, Asymp. Sig=.001=p. Since p was less than 0.05, the difference was significant.

Table 10: Public Use Finance to Ensure Sustainable Environmental Protection

	Observed N	Expected N	Chi-Square	df	Asymp. Sig.
Did not use finance to ensure environmental protection	100	100.0	.000[a]	1	1.000
Use finance to ensure environmental protection	100	100.0			
Total	200				

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 100.0.

From Table 10, it can be seen that 100 respondents were of the opinion that public sectors did not use finance to ensure sustainable environmental protection while 100 respondents said that they use finance to ensure sustainable environmental protection. Analyzing whether there was no significant difference between these groups, Chi square =.000, df=1, Asymp. Sig=1.000=p. Since p was greater than 0.05, the difference was not significant.

Table 11: Private Use Technology to Ensure Environmental Protection

	Observed N	Expected N	Chi-Square	df	Asymp. Sig.
Did not use technology to ensure environmental protection	197	100.0	188.180[a]	1	.000
Use technology to ensure environmental protection	3	100.0			
Total	200				

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 100.0.

From Table 11, it can be seen that 197 respondents were of the opinion that private sectors did not use technology to ensure sustainable environmental protection while 3 respondents said that they use technology to ensure sustainable environmental protection. Analyzing whether there was no significant difference between these groups, Chi square =.188.180, df=1, Asymp. Sig=.000=p. Since p was less than 0.05, the difference was significant.

Table 12: Public Use Technology to Ensure Sustainable Environmental Protection

	Observed N	Expected N	Chi-Square	df	Asymp. Sig.
Did not use technology to ensure environmental protection	196	100.0	184.320[a]	1	.000
Use technology to ensure environmental protection	4	100.0			
Total	200				

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 100.0.

From Table 12, it can be seen that 196 respondents were of the opinion that public sectors did not use technology to ensure sustainable environmental protection while 4 respondents said that they use technology to ensure sustainable environmental protection. Analyzing whether there was no significant difference between these groups, Chi square =.184.320, df=1, Asymp. Sig=.000=p. Since p was less than 0.05, the difference was significant.

Findings and discussion

The finding of research question one revealed that private sectors were ensuring sustainable environmental protection in Makurdi metropolis (Table 1). There was a significant difference between the mean ratings of responses of private sectors that did not ensure sustainable environmental protection with those that ensure sustainable environmental protection (Table 7). This finding was similar with Osei-Kyei, Chan Yao Yu, Chen, Ke and Bashir (2019) who reported that environmental protection was maintained in China, however, it was ranked lower by the Chinese respondents compared to their Ghanaian counterparts.

The result of this study with respect to research question two on Table 2 revealed that public sectors were ensuring sustainable environmental protection in Makurdi metropolis. There was a significant difference between the mean ratings of responses of public sectors that did not ensure sustainable environmental protection with those that ensure sustainable environmental protection (Table 8). This finding was in disagreement with Ali ´ nska, Filipiak and Kosztowniak (2018) who stated that public sector entities were not able to meet the adopted sustainable development objectives to ensure environmental sustainability on their own and required the support of private sector partners.

The finding of research question three (Table 3) revealed that private sectors do not use finance to ensure sustainable environmental protection in Makurdi metropolis. There was a significant difference between the mean ratings of responses of private sectors that did not use finance to ensure sustainable environmental protection with those that use finance to ensure sustainable environmental protection (Table 9). This could be attributed to the level of poverty in the state. This finding is similar to Samans (2016) stated that private sector should use their incentives, finance and make sure that appropriate resources are in place to ensure sustainable environmental protection.

The finding of research question four (Table 4) revealed that public sectors use finance to ensure sustainable environmental protection in Makurdi metropolis. This could be attributed to strict compliance of sanitation laws by some government establishment in the state capital. There was no significant difference between the mean ratings of responses of public sectors that did not use finance to ensure sustainable environmental protection with those that use finance to ensure sustainable environmental protection (Table 10). This finding agrees with Osei-Kyei *et al.*, (2019) who reported that environmental protection was maintained in China among the public sectors by the use of finance.

The finding of research question five (Table 5) revealed that private sectors did not use technology to ensure sustainable environmental protection in Makurdi metropolis. This could be attributed to high cost of such equipment and inadequate awareness on their use to ensure sustainable environment. There was a significant difference between the mean ratings of responses of private sectors that did not use technology to ensure sustainable environmental protection with those that use technology to ensure sustainable environmental protection (Table 11). This finding agrees with Ashford and Hall (2011) who stated that both private and public sectors were not using technology to ensure environmental sustainability. They suggested that sustainable environmental development requires stimulating revolutionary technological innovation, structural interventions by both private and public sectors to foster breakthrough technological innovations.

Finally, the finding of research question six (Table 6) revealed that public sectors did not use technology to ensure sustainable environmental protection in Makurdi metropolis. There was a significant difference between the mean ratings of responses of private sectors that did not use technology to ensure sustainable environmental protection with those that use technology to ensure sustainable environmental protection (Table 12). This could be attributed to inadequate awareness on their use to ensure sustainable environment. This finding agrees with Ashford and Hall (2011).

Conclusion

The results of the study showed that private and public sectors were ensuring sustainable environmental protection in Makurdi metropolis, private sectors did not use finance to ensure sustainable environmental protection in Makurdi metropolis, public sectors use finance to ensure sustainable environmental protection in Makurdi metropolis, private and public sectors did not use technology to ensure sustainable environmental protection in Makurdi metropolis.

Recommendations

1. Private sectors should use their finance to ensure sustainable environmental protection in Makurdi metropolis.
2. Private and public sectors should embark on the use of technology to ensure sustainable environmental protection in Makurdi metropolis.

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CONCEPTUAL MODEL ON PERCEIVED ROLE OF INTERNET FOR THE MANAGEMENT OF STUDENTS' INDUSTRIAL WORK EXPERIENCE SCHEME IN HIGHER INSTITUTIONS OFFERING TECHNOLOGY EDUCATION IN NIGERIA

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Abstract: *Among the objectives of Technical Vocational Education and Training(TVET) isto enrich students with sound and transferable employability skills for industrial and economic growth and development.The implication of this is for the programs to effectively operate in pace with the learning technologies; using internet tools. With the current developments on the internet connectivity,the management of Students Industrial Work Experience Scheme (SIWES) would be done. To integrate internet tools for SIWES management, a conceptual model to address questions on 'where' and on 'what' was developed from qualitative approach (interview) with Lecturers of Technical Education having background knowledgein ICT purposefully selected from Universities, Polytechnics and Colleges of Education considering their characteristics in admission and graduation requirements. After data analysis procedures, five major categories (subscription to job information providers websites, development of online SIWES management system, online link to public and private organizations, Collaboration with funding agencies; UNESCO, UNDP, UNICEF etc, and development of online allowances payment system) emerged. These were conceptualized and collapsed into a model of internet integration for the management of SIWES in Technical Education programs. A model was recommended for adoption in higher technical education programs in Nigeria.*

Keywords: *Internet, Higher Technical Education and SIWES*

Introduction

Internet is fast becoming a bedrock on which "global digital infrastructure" is resting.The tool is now seen as one of the breakthrough toward a total conversion of teaching and learning materials into online materials that can be easily accessible anywhere anytime (Leu, O'Byrne, Zawilinski, McVerry, & Everett-Cacopardo, 2009), ithas been found to assists students in collaborative learning activities (Gao, 2013) and students assessment capabilities using "wikis" (Lai & Ng, 2011). Consequently, therapid developmentof internet connectivityintomost of the Nigerian higherinstitutions of learningis to simplify academic and administrative operations to a greater extent(Agbatogun, 2013). However, a higher cross section of these institutions are yet to take the advantagesthesetoolscould bring into basicmanagerial operations e.g.,Students Industrial WorkExperience Scheme (SIWES).The current trend in the management of SIWES placementin most of the Nigerian higher institutions of learning, especially those offering Technical Education is manually done; planning, orientation, placement, supervision and payment of allowances were handled without the use of internet tools.

Author's experience has shown thatstudent usually link upto training agencies/organizations to secure placement before they proceed on SIWES training, the function ought to be solely a responsibility of their various departments, faculties or institutions they are domiciled.(Ugwuanyi & Ezema, 2010). This contributes to high number of students'rejection; in fact, some students are shuttling to and fro seeking for placement throughout the period of the exercise, or ended up securingplacement in organizations that are not equipped withup-to-date facilities (Olugbenga, 2009). In addition, supervision that is central to the SIWES exercisewould not be properly executed as stipulated within the training period (Akintola, Aderounmu, & Owolarafe, 2002).

Despite observation by different scholars on unstableand slowinternet connectivity(Bankole, 2013; Salaam, Ajiboye, & Bankole, 2013) around higher institutions in Nigeria, universities, faculties, departmental SIWES offices, and bursary offices are not supposed to be left out in harnessing internet tools toward the management of SIWES and payment of training allowances.In that, theuse of internet and by extension web 2.0 in higher education for academic and

nonacademicactivitiesis gaining popularity, e.g., virtual work placement of students(Bennett, Bishop, Dalgarno, Waycott, & Kennedy, 2012; Irwin, Ellis, & Graham, 2012)and in"Online Industrial Training Attachment System; a system that enable students apply for industrial attachment online and at the same time allow employers seeking to attach students in their companies declare attachment vacancies through the internet" (Mutua, 2012).While this is taking place in some part of the third world countries, e.g. Kenya, in Nigeria (giant of Africa);teachers and students mostlyexploit internet and social networksfor chatting and instant messaging (Bankole, 2013);purely for personal other than academicpurposes. Although, this is the current situation in our higher technical education programs, qualitative graduates remain the expectationoflabour employers (Chinien & Kotsik, 2003). Therefore, to meet the expected labour market requirements and minimize problems encountered during SIWES managementinHTE programs, integration ofinternet tools becomes highly inevitable.

From the matters arising about internet tools and their coherent applicability into the management of higher education especially their inclination toward creating a convenient atmosphere for management of industrial training (Mutua, 2012), the need to integrate it for management of SIWES in HTE programs cannot be overemphasized. In view of the foregone and in the interest of improving current position of Nigerian HTE programs, experts in TE and ICT in Nigeria were interviewed to explore the relevant of internet tools and procedures for their subsequent integration in HTE programs SIWES management. It was aspired thataconceptual model thatemergefrom interview responses willhelpfaculties, departmental and institutional SIWES offices, in Nigerian HTE programsconvert their planning, organization, supervision and payment in SIWES activities online.

SIWES in Nigerian context

Student Industrial Work Experience Scheme (SIWES) was developed totransform student's theoretical knowledge into real life practical skills needed for employment. The programme was introduced in tertiary institutions by the Federal Government of Nigeria through Industrial Training Fund (ITF); a body established underDecree 47 of 1971 as amended in 2011 as 'ITF Act'. As part of its responsibilities, the ITF provides Direct Training, Vocational and Apprentice Training, Research and Consultancy Service, Reimbursement of up to 50% Levy paid by employers of labour registered with it, and administers the Students Industrial Work Experience Scheme (SIWES). It also provides human resource development information and training technology service to industry and commerce to enhance their manpower capacity and in-house training delivery effort. (http://www.itf-nigeria.com/about_itf.html)**.** Therefore, SIWES serves as a bridge that connects theory and practice, thereby exposing students in "specialized engineering, technical, business, applied sciences and applied arts to realities in the world of work and in turn fulfils manpower requirement of the host organizations(ITF, 2004). SIWES or industrial training (IT) isorganized to further enrich students with practical employability skills (Izueke & Nzekwe, 2013). It is compulsory on all students enrolled into higher learning institutions pursuing National Diploma (ND), Higher National Diploma (HND), Nigeria Certificate in Education (NCE) and Bachelor Degree (B. Ed/B. Tech) in various fields of specializations. However, due to the training time frame and logistics involved in organizing supervision, remunerations and so on, the training is not yielding an encouraging end result (Akintola, et al., 2002), hence, the need of this research.

Objectives of the research

The purpose of this research was to develop a conceptual model of the perceived transformation using relevantinternet toolsfor the management of SIWES at higher institutions in Nigeria. The research was specifically to;

1. Determine the lecturers' perception on the relevant internet tools for SIWES management.
2. Develop a conceptual model for SIWES management using relevant areas identified by the lecturers.

Research questions

1. What is the opinion of lecturers on relevance of internet tools for SIWES management?
2. What is the nature of conceptual modelfor SIWES management?

Methodology

This qualitative research was aimed at developing a conceptual model from the interview responses held with lecturers in Higher Institutions offering Technology Education Programme in North-East, Nigeria. The purpose of an the interview was toexplore from theexperts experiences toward addressing a problem at hand (Seidman, 2012). Relationship was established with the experts prior to period scheduled for the interview because of its distinguished importance (Seidman, 2012); they were contacted via emailsaddresses provided on their institutional address directories. Their positive responses showed willingness to participate in the interview despite tight schedules. Interview places, duration and other logistics procedures were discussed and agreed at individual levels. Other procedures involved in qualitative study to finally realized themes and categories have been followed (Merriam, 1998)**.** The research was conducted in North-East Geopolitical Zone of Nigeria. The zone comprises of 6 states; Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe states (Fig. 1). Nigeria it lies between latitudes 4°16' and 13°53' to the north of the equator and longitudes 2°40' and 14°41' to the east of the Greenwich Meridian. The country is in the West African sub-region and borders Niger in the north, Chad in the northeast, Cameroon in the east, and the Republic of Benin in the west. To the south, Nigeria is bordered by approximately 800 kilometers of the Atlantic Ocean. With a total land area of 923,768 square kilometers, the country is the fourth largest in Africa.



Fig. 1: Map of Nigeria showing 36 States (Macro, 2004, p1)

Educationally, the country practice 6-3-3-4 system of education, that is 6 years of primary school, 3 years of junior secondary school, 3 years of senior secondary school and 4 years of tertiary education. Though, the 6-3-3-4 system has not changed, 9 year basic education was launched in 1999 to emphasize free and compulsory basic education to all citizens of Nigeria (Aluede, 2006). Federal Universities, Polytechnics and Colleges of Education offering Technology Education, constituted schools from which participants (interviewees) were drawn using purposeful sampling technique. Only participants that fulfilled selection criteria:

(a) Must be at the rank of Associate Professor or Chief Lecturer;
(b) Must have certificate in ICT related courses and
(c) Must have been involved into SIWES management at departmental or at faculty levels.

The choice of only federal higher institution was done with the understanding that all federal higher institutions were control by specific boards and commissions under the central supervision of the Federal Ministry of Education; National Universities Commission (NUC), National Board for Technical Education (NBTE) and Federal Commission for Colleges of Education (NCCE) are responsible for supervision of activities in Universities, Polytechnics and Colleges of Education respectively. In addition, to the above reason, all schools selected admit students from diverse cultural backgrounds and from the six geo-political zones in Nigeria (Fig. 1).

Table 1: List of Participants and Institutions offering TE in North-East, Nigeria

Abbreviation	Name of Institution	Location	Participant(s)	Rank
ATBU	AbubakarTafawaBalewa University	Bauchi State	1	Associate Professor
MAUTECH	ModibboAdama University of Technology Yola	Adamawa State	1	Professor
FCE (T)	Federal College of Education (Tech), Potiskum, Yobe State	Yobe State	1	Chief Lecturer
FCE (T)	Federal College of Education (Technical), Gombe, Gombe, Gombe State.	Gombe State	1	Chief Lecturer
FPB	Federal Polytechnic Bauchi, Bauchi State.	Bauchi State	1	Chief Lecturer

Table format adopted with modification from (Gikas & Grant, 2013)

1. ***Data Collection:*** Interview was administeredby the researcherguided bya semi-structured interview protocol/guide (Seidman, 2012). The interview guide was developed in conformity with specific objectives of the research and literature review. The questions in the guidewere derived from two main research questions. The content of the interview guide was criticized by the researchers from UniversitiTeknologi Malaysia (UTM).The reliability of qualitative instruments was ascertained together with the reliability of the qualitative result after data analysis procedures. Face-to-face interview (Lichtman, 2012)precisely lasted about one hour and audio-recorded using mobile phone. Audio transcript was played back to each participant immediately after the interview session.
2. ***Data Analysis:*** After transcription, interview data was analyzed using inductive analysis approach (J. Creswell, 2009), in order to find out experiences that were later summarized into components of a conceptual model. This approach is suitable in type of researches aimed at developing a model or theory (Thomas, 2003). Themes and categories generated during the process of data analysis (reading, coding, themes generation and categorization) were conceptualized to a model of internet tools integration for the management of SIWES in Nigeria.
3. ***Result Reliability:*** Reliability of the result was determined using two procedures; member checks and peer debriefing. Peer debriefing was carried out by presenting the raw data to colleagues (authors of this manuscript), they assisted to critically analyze the research methodology, hypotheses and raw data for consistency with the result (Davis, 1992). Member checking was also done by handing the analyzed result to informants for checking. This method issuitable for establishing the reliability of qualitative result(J. Creswell, 2009).

Table 2: Qualitative Results on Internet Tools integration in SIWES Management

Subscription to Directories of Business Organizations	Create Online SIWES Management System	Direct link to Public and Private Organizations	Collaborates with Funding Agencies	Creat Payme
Means for access to information about organizations and industries	Internet connectivity makes it possible to control students' training activities	Should be used as avenue for communicating to organizations about their products and services	Used toretrieve and contact funding agencies like, UNDP and others	Ease disl allowances electronica
An avenue to locate addresses of companies available in different localities	With internet tools institutions convert SIWES management to interactive online	Assists students and lecturers explore training opportunities offered by various companies	Tools help to make contact with funding agencies easily	E-payment allowances tools
A link that can enable access to possible locations for students to conduct training	Help monitor/supervise students on IT without physical visits	Serves as an environment for contacting agencies to book places for students trainees ahead of time	To apply the use of internet secure funds from international donor agencies	Electronic payment s developed
Online link to locate industries via address, map, directions and contact information	Internet enable SIWES management; planning, orientation, posting, supervision to be carried out electronically	Used for exchange of information, rules, guidelines on requirements of student trainees expectations	Could be relevant as collaborative tools to secure interventionfrom ITF, and other donor agencies	Students c be encou bank acco allowances
Channel through which a link to training places for student's placement can be established.	Internet creates environment for college collaboration by receiving confidential information on students commitments during IT.	Tools that will enable graduates prepare CV, make contact, and even attend interview/aptitude test prior to graduation.	Agencies such as UNICEF, UNESCO can easily be contacted using internet tool	Online pa can be de internet too

evealed five major categories (subscription to job information providers, development of online SIWES management syste private organizations, online collaboration with funding agencies; UNESCO, UNDP, UNICEF etc, and develop ment system). These categories were later conceptualized to form a model of internet tools integration for SIWES r cation programs in Nigeria. As presented under each category,respondent statements extracted verbatimwas reported a v (Table 2). Pseudonyms (RU1, RU2, RP1, RP2 and RF1) were chosen to identify respondents from Universities, Po of Education respectively.

Findings

The main purpose of this research was to explore important areas of internet tools use in the management of SIWES and consequently develop a conceptual model. After data analysis procedures, resultsrevealed the relevance of using internet tools for SIWES management and highlighted important areas to be given priority forinternet toolsintegration. Findings were organized into five major categories followed by sub categories and"eye-catching" (J. W. Creswell, 2012) quotations summaries of each of the respondent (Table 2).



Fig. 2: In ternet Tools Integration Model for SIWES Management

1. ***Subscription to Directories of Business Organizations:*** Respondents have unanimously reflected in their responses need to integrate internet tools for creating access to directories of businesses organizations. Summaries from their responses show that internet tools can be used for management of SIWES. The outlined advantage mostly highlighted by the respondents is that internet tools can serve as means to have access to information about business organizations. They accorded internet tools a credibility to reduce suffering students normally go through while searching for organization they could be accepted to conduct their training. According **RU1** internet tools provides "means for access to information about organizations and industries", in the same vein **RU2** think internet tool if used for SIWES management will serve as "an avenue to locate addresses of companies available in different localities", **RP1** observe that using internet tools for SIWES management helps create "a link that can enable access to possible locations for students to conduct training", for **RP2**, the use of internet tools for SIWES management helps in "locating industries via addresses, map, directions and contact information provided online" and **RF1** sees internet tools to serve as "channel through which a link to training places for students placement can be established". It can thus be observed from the responsesthat internet tools are capable of making it possible to get access to information regarding addresses, location, maps and telephone numbers of organizations that may likely be contacted for placement of students that will be posted out for SIWES. In that online version of these directories enhances advertisement process, showing full addresses, maps and directions(Leal, 2001).

2. ***Developing an Online SIWES Management System:*** Online SIWES management system was another major category revealed by qualitative data analysis of the interview responses.Experts (interviewees) suggested for developing an online SIWES management system that will be used to monitor operations and processes of SIWES. This system according to them will have the flexibility of enabling staff and students interact, provide collaboration between schools and various organizations offering training placements to students and by extension help establish link to various funding operations including connectivity with banks for payment of allowances. Analysis further revealed that**RU1** holds the opinion that "internet connectivity makes it possible to developing strong database controlling all aspect of students training activities", this shows that with internet tools all activities relating to SIWES can be handled and process through database that is centrally controlled. In their separate responses **RU2** observed that "with internet tools institutions convert SIWES management to interactive online", while **RP1** considers using internet tools to achieve proper monitoring of student, he states that it "help monitor/supervise students on IT without physical visit". For **RP2** internet tools "enable SIWES management; planning, orientation, posting, supervision to be carried out electronically" and **RF1** holds the opinion that "Internet creates environment for college collaboration by receiving confidential information on students commitments during training". However, with the critical observation of their responses, we concluded that it revolves around the need to develop SIWES management system. The needto develop SIWES management system as revealed by expert responses may not be unconnected to the level of satisfaction recorded, interactivity nature and collaborative flexibilitiesof various management systems in use at different institutions in developed economies of the world e.g. use of learning management system at university level (Naveh, Tubin, & Pliskin, 2010) and interactivity of course management system (Malikowski, 2008)
3. ***Direct link to Public and Private Organizations:*** Another advantage accorded to internet tools integration for SIWES management is through its ability to give institutions direct access to websites, weblogs, and web pages etc of various organizations. In this perspective, participants feel that internet integration for SIWES management will give institutions opportunity for training officers and students as well to visit and even linked up with organizations through websites, weblog and web pages. One of the participants **RU1**, states that internet "should be used as avenue for communicating to organizations about their products and services", another participants **RU2**observed that internet tools "assists students and lecturers explore training opportunities offered by various companies". To further describe relevance of internet tools for institutions-organizational link ups, **RP1** and **RP2** sees internet to "serves as an environment for contacting public agencies to book places for students trainees ahead of time" and be "used for exchange of information, rules, guidelines on requirements of student trainees expectations", but for **RF1**, internet tools has far reaching implications as the "tools will enable graduates prepare CV, make contact, and even attend interview/aptitude test prior to graduation".
4. ***Collaborates with Funding Agencies:*** Participants have unanimously identified possibility of collaboration with funding agencies as internet tools have become integrated for the management of SIWES. According to **RU1**, internet tools will be "used to retrieve and contact funding agencies like, UNDP and others", for **RU2** and **RP1**, internet are "tools that helps make contact with funding agencies easily" and "secure funds from international donor agencies" respectively. Although with the integration of internet tools, collaboration can be achieved and at the end funding opportunities will be further explored. While **RP2** state that internet tools "could be relevant as collaborative tools to secure intervention from ITF and other donor agencies", **RF1** feels that "agencies such as UNICEF, UNESCO can easily be contacted with the integration of internet tools". This can further strengthen technical education based programs perform effectively toward provision of required manpower for national development (Akintola, et al., 2002).

5. ***Creates Online Allowances Payment System:*** Additional area emphasized by experts from the interview is on creation of an online allowance payment system that according to them will assist in processing students' allowances payment without hitch. Experts opined that internet tools integration for SIWES management will enable students receive their allowances as at when due. The traditional method of allowances payment in which students spend the whole day queuing up, filling documents and receiving cash in hand will no longer be experienced if internet tools are embraced in SIWES management. Internet tools "ease disbursement of allowances to trainees electronically"as extracted from **RU1** response. **RU2**,opined that internet tools "allow e-payment of student's allowances via internet tools", for **RP1**, using the toolsenable "electronic allowances payment system to be developed for schools", **RP2** looks at it from the perspective that "students on training will be encourage to open bank accounts for their allowances payment", while **RF1** maintained that "online payment system is possible using internet tools".This observable factis realizable considering the current trend in electronic payments systems that are becoming more popular in financial transaction because of security situation in Nigeria (Ayo & Ukpere, 2010). Figure 2, shows a conceptual model of internet tools integration for SIWES management in HTE programs in Nigeria

Discussion

Internet tools have been identified to make significant contributions in various operations in higher institutions globally; in teaching and learning as well as in other activities that are not part of the core curriculum. The present research found out the relevance of these tools as they are integrated into SIWES management. Several studies were recently conducted to explore the impact of internet in higher education; e.g. implementation of web 2.0 in higher education (Bennett, et al., 2012; Laru, Näykki, & Järvelä, 2012). The present study in line with the previous ones has also established that internet tools would bring enormous changes in the way SIWES management is currently being conducted in Nigeria. One of the advantages of internet tools identified ison the opportunity of online subscription to directories of business organizations; in that the impact of internet is making business organization details open for public consumption (Schroeder, 2013).

Online SIWES management system identified and advocated in this research could be of relevant to HTE programs, in that similar industrial attachment training management system was recently developed and advertizedin Kenya (Mutua, 2012).This IATMS provide a platform for students, industries and schools to collaborate in industrial attachment training matters. The system enable industries to advertize training opportunities, it equallyallow students gain access to information about industries willing to accept him/her for attachment period, teachers also conducts their duty online and the system provide a collaborative platform between schools and industries.

Direct link to public and private organizationsvia internet tools in SIWES managementis another important area identified in this research. This finding may likely improveupon inadequacies observed in the curriculum of vocational and technical education department in a university at West African country toward creating linkages between students in industries(Amu & Offei-Ansah, 2011). Consequently, internet tools integration in SIWES management makes it simple and convenient for students in TVE or TE departments to get in touch with current happenings in organizations and world of work in general (Amu & Offei-Ansah, 2011).

One of the finding of this research is geared toward gaining collaboration to funding agencies; e.g. UNESCO, UNDP and UNICEF, as internet tools get integrated in SIWES management.This coincides with the UNESCO mission to realize global peace and eradicate poverty through the use of educationand by extension to include support in technical and vocational education and training (TVET), through UNEVOC (http://en.unesco.org/themes/education-21st-century). In addition, UNICEF also supports education activities, though is categorical on"Basic Education", but under its mission on "Adolescence and Youth" in developing economies like Nigeria, HTE programs training activities may likely be supported. Therefore, online collaboration via internet is highly important.

Conclusion

Internet tools integration in HTE programs for SIWES management cannot be over emphasized despite slow and unstable internet connectivity in various higher institutions in Nigeria. The tools are found to be relevant and necessary for smooth management of SIWES from the interview responses analyzed. Students' problems in terms of placement and honorarium are equally addresses, in which alternative areas that will bring changes were outlined. Lecturers/supervisor will also have an alternative means of making their work easier. Training offices at departmental, faculty or administrative levels were equally touched by this research. Although, the findings may have some limitations due to sample size, the criteria used in the selection of sample have some implications. The five themes/categories conceptualized into a model of internet integration in HTE for SIWES management will have some implications in both theory and practice, as theneed of TE graduatesthat fulfills labour market requirements is on the increase.This research also form a basis of further research on the development of SIWES management system and SIWES allowances payment systems for HTE and other similar programs that offer SIWES as minimum requirement for graduation.

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THE NEED FOR PUBLIC/PRIVATE PARTICIPATION (PPP) IN HOME ECONOMICS FOR SUSTAINABLE ENVIRONMENTAL PROTECTION

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Abstract: *Home economic plays a very important role in sustaining a clean environment in every society. In Nigeria there seem to be little awareness of what home economics really offers as benefits to individuals, families, communities and the society at large. It is in view of this that this paper discusses the need for public/private participation (PPP) in home economics for a sustainable environmental protection. The paper discussed what is home economics in a broad term, it benefits and its contribution towards protection of the environment. The paper also discusses the concept of PPP which gives room for public awareness and contributions to home economics in order to have a sustainable environment protection PPP can make home economics more relevant to the society. The paper also discusses what sustainable environmental protection stands for and what benefits Nigeria can get from it. The paper further recommends among others. That, home economic curriculum should always be reviewed together with stakeholders in order to make it more relevant to each in Nigeria.*

Keywords: *Home Economics, Public Private Participation, Sustainable Environmental Protection.*

Introduction

In the Nigerian policy on education the federal government owns and funds all the federal secondary schools, technical colleges, colleges of education, polytechnics and universities. In all the 36 states of the country, the state government also owns and funds a number of secondary schools, other tertiary institutions and universities. Communities and private individuals /organizations also own and fund quite a number of institution from primary to tertiary level (FRN, 2004). It is obvious that the Nigerian education policy gives room for public/private participation (PPP) generally and in terms of establishment and development of sustainable environment. Looking at the nature of Home Economics Education, the participation of government in funding is always enormous. Home Economics Education is very costly to establish and maintain bearing in mind the cost of infrastructure, maintenance human and material resource and capacity building. The need for PPP in Home Economics Education for environmental protection can never be over emphasized. According to UNESCO – IBE (2011), government spending on education is often inadequate and is insufficiently and disproportionately allocated among educational inputs and across all levels including Home Economics.

Statement of problem

Throughout the century, Home Economics has provided its significance in increasing the quality of human life. From the beginning of the creation of the subject there is a close bond with the idea/beliefs of sustainable environmental protection. It is unfortunate that most people are not really aware of what home economics offers as benefits to individuals families communities and society at large. They thought home economics is mainly cooking and childrearing especially the Northerners. And therefore have negative effects on funding and training students.

Objectives of the study

The objectives of this study are as follows:

1. To find out the need for PPP in home economics for sustainable environmental protection.
2. To enlighten the public about the role and benefits of home economics in sustainable environmental protection.

Concept of home economics

Home economics as a vocational subject is very important to a developing nation like Nigeria as it has the potential of equipping the individuals and families with self-employment skills. International Federal of Home Economic (IFHE, 2012) asserted that Home Economics can improve skills and competences of individual's families and society in a challenging world. Home Economic as a field of endeavour is both a body of theoretical knowledge based on exact science and humanities and forms of practicals backed up by appropriate technologies. Its area of activity is the development, use and management of human material resources in the society. (IFHE 2003). Home Economics Education is concerned with the ways in which the quality and content of individual and family life can be enhanced through utilization of skills and material resources for efficiency of new economic for sustainable nation. Home Economics prepares individuals families and society for acquisition and development of competencies and attributes which necessary for environmental protection and sustaining it. The challenges of a changing world can be met by programmes that are skilled oriented and have economics is one such programmes that offers several opportunities. Usman (2017) Home economics exposes individuals, families and society to many occupational areas of skills in craft work, gardening, and flower planting outdoor decoration and soon for sustainable environmental protection.

Mission of home economics and its application

1. Odu (2012) stated the mission of Home Economics as response to the problems of individuals families and the society in general, that if the needs of individuals in the family are met, they would have the capacity to contribute justly to the effectiveness and efficiency in running their homes towards having peaceful environment that is of anomalous activities.
2. Home Economics addresses challenges related to family, society and environment for daily living Usoroh (2010).
3. Home Economics could be applied in management of environmental hazards and household wastes dispersal.
4. Home Economics is a solution in eradicating environmental waste in our society to have a cleaner and greener environment devoid of health hazards and promotes human lifespan.
5. Home Economic centered on controlling environmental degradation and reduces health hazards.

Roles of home economics in environment protection

1. Home Economics makes individuals, to develop an understanding about the physical, emotional, intellectual, economical and social needs of individuals families and society and to encourage an appreciation of the diversity of socio economic and cultural influence on family life.
2. It encourages skill development and application to manage the skills necessary for the effective organization and management of available resources to satisfy personal, family and environmental needs.

Benefits and Contribution of home economics towards environmental protection

1. Home Economics presently enjoys renewed attention in the movement epoch Azunwena, (2012). This is as a result of its libiquitous application in our daily livelihood, which makes it to be perceived as a resolution mechanism for redressing the socio-economic and environmental protection of the country (community)
2. Home Economics was referred to be a field of stud and a profession, poisoned in the human science that draws from variety of disciples to accomplish optimal and sustainable living environment for individual, families and communities (IFHE).

3. Home Economics is a field of study that dealt with economics and management of the home and community for sustainable environment protection.
4. Home Economics is a discipline that equips man with knowledge of how to adapt to his own environment by effectively making use of human and material resources.
5. Home Economics studies foster the critical thinking and problem solving skills needed to effectively manage resources for environmental protection.

The Concept of Public Private Participation (PPP)

Although PPP has many definition, in this context the definition by Organization for Economic Co-operation and Development (OECD) suits this paper PPP is defined as an arrangement between the government and one or more private partners according to which the private partners deliver the service in such a manner that the service delivery objectives of the government are aligned with the profit objectives of the private partner (OECD, 2008). In the same vein LMIP, (2017) defined PPP as a formal relationship with shared responsibilities between public and private sector, actors achieve mutual goals that may take the form of a joint business venture, a joint education and training agreement or a social partnership structured around a social agenda.

The need for private sector participation in home economics

There are several functions that for the partnership of the private sector to support the expansion of Home Economics. Glaring among these include the limited capacities of the public sector (government) to provide Home Economics and their low irresponsibleness to enterprises and trainees. Private home economics providers are expected to be more responsible because they have less bureaucratic restrictions than public institutions. The private sector is expected to help raise quality in the system as well as compliment government effort to add quantity in many developing countries Nigeria inclusive, government budgets constitute a vulnerable an unreliable source of financing for home economics. An important way to finance home economics system is by increasing the contribution of beneficiaries, most especially employers and trainees Marope, et al (2015). The apprenticeship program in the Nigeria have economics is an example of private partnership that increases the quantity of young people acquiring craftsmen home economics skills apart from other private formal and non-formal home economics providers. Machief (2019). It has been observed that private sector participation in home economics has become a significant and growing part of the system, most especially in the Sub-Saharan Africa, Nigeria inclusive.

Challenges of Public Private Participation (PPP)

Notwithstanding its well established advasntages, PPP poses potential disadvantages as follows as outlined in ETF and World Bank (2005), thus;

1. Public Private participation (PPP) courses have often been concentrated in professional areas that typical do not require large capital investment, permitting easy entry and exit by private providers from the sector.
2. Qualities issues have also emerged where market information about quality has been available.
3. Many times private providers ijn home economics lack capacity for maintaining human and material resources development and welfare in line with the laid down standards.

Concept of sustainable environment

Environment can be seen as an individual's surroundings such as human beings, animals of the lowest species, trees, mountains, rocks, and the seen and unseen things. It was also been regarded as the totality of things that in any way affects an organism or anything that is external to an organism Oderinde, (2010). Environmental adulation is aimed at developing a world population that is aware of and concerned about the total environment and its associated problems which has knowledge, understanding skills and attitude and environmental to work individually and

collectively towards solutions of current problems and prevention of new ones. Home Economist need to be understand, have awareness and consciousness towards biophysical environmental problems and it solution for sustainable living. Sustainability has been on the agenda of environmental education for several decades, climatic change and altered weather pattern, global wearing, exhaustion of fisheries, desertification and degradation of agricultural land and pollution are reported to be some of the main threats to our environment and inhabitants. Oskamp, (2000). Proper control and protection of the environment are only matters of economics and politics because they are about personal, emotional and survival of individuals, families, societies and our planets as well. The politician and policy makers do not seem to take life threatening of environment very serious. Oderide et al, (2010). The relevance of public private participation (PPP) and home economics for sustainable environmental protection cannot be over emphasized.

PPP in home economics for sustainable environmental protection

Home Economics is a broad field of knowledge involving education and research in many areas home management and the environment (Anyakoha & Eluwa 2010 in Onuigbo et al 2010). Based on this one can conveniently say that home economics can play vital role in the control and management of environment hazards for sustainable living. To enlighten the public on the proper control of environment as a bid to prevent environment hazards, home economics being the study of human and material resources affecting home, family and society, utilization of the knowledge for the benefit of man. This could be very possible with the participation of public private participation (PPP). Proper environmental control is also an aspect of home economics, but improper disposal of waste, can pollute the environment and pose a threat to human health, when wastes are properly disposed, the incidence of ill health and hazards are minimized. This could be achieved through collaborating with PPP.

Home economics can help in advising the government through research and publication on the need for PPP for provision and continual prompt maintenance of disposal facilities for the populace because it is believed that if incinerators are placed at strategic points, people will dispose their refuse thereby having a clean and sustainable environment. Home economics may not be well informed on the issues relating to the need of proper wastes disposal as a guide to preventing environmental hazard. They might not there be fully aware of their roles in controlling improper waste disposal and unless the home economics bearers aware of their roles I n this issue, they cannot act effectively. So it is important to involve PPP to facilitate the role if home economics. Home economics has close link with the environment. However women's activities could pose problem. Oderinde et al, (2010) stated that about 30% of urban dwellers own gas cookers and kerosene stove. 70%-90% of the rural dwellers use fire wood and fire wood merchant. This lives on degrading the environment. There is also the menace of bush burning which affect our environment as accentuate desertification of trees and grasses and unending hunting process leading to the extinction of different species of animals. Hence, PPP with home economics provides facilities that could substitute the tree cutting, and bush burning.

Conclusion

The population of Nigeria and the world at large is ever increasing each rate. The issue of environmental degradation and its hazardous to man can be solve and controlled when the individuals and society are educated and enlightened through home economics programmes so that they can understand the effects of living in hazardous environment. The implication of being destroyed is enormous. Animals and plants provide a vulnerable services to mankind. Environmental protection touches every aspect of our lives being ecological, biological, biotechnical, economic, social-cultural and morals. Home Economics development and environmental interest should not be ignored; its interest, skills and perceptions in environmental management should be given recognition. This should be done in a more holistic why and integrative manner. That is to say government alone cannot meet up with the challenges of home environmental protection thus, the need for private participation.

Recommendations

1. Government should make clear strategic policies to set up an agency that will ensure a dynamic public private participation (PPP) in home economics for sustainable environmental protection.
2. Home Economics curriculum should always be reviewed together with stakeholders in order to make it more relevant to each home in Nigeria.
3. Enlightenment programmes be embarked on by government on the importance of home economics.
4. Government should set laws to be strictly followed on adequate environmental control.
5. Individual, family's communities and society at large should come together and put hands on deck for proper environmental protections.

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SUB-THEME 5

SCIENCE, TECHNOLOGY AND FOR SUSTAINABLE ENVIRONMENTAL PROTECTION

THE ROLE OF TECHNICAL VOCATIONAL EDUCATION AND TRAINING IN ACHIEVING SUSTAINABLE ENVIRONMENTAL PROTECTION IN NIGERIA

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Abstract:

The paper explores the role of technical and vocational education and training in achieving sustainable environmental protection in Nigeria. The paper provides the needed information about the contemporary environmental challenges, its effects and consequences. in the country, it reviews the environmental policy and enforcement for sustainable environmental protection in Nigeria. Furthermore, the paper highlights the concept of environmental sustainability. The paper concluded that, TVET is a major stakeholder in achieving sustainable environmental protection in Nigeria by providing trained individuals in the field of agricultural production, renewable energy technologies, efficient use of energy and resources in industrial production and sustainable craft/business and product development.

Keywords: *Technical Vocational Education and Training, Sustainability, Environmental Protection*

Introduction

The term Environment is originated from the French word 'Environ' which means "Surrounding". Environment consist of four interlinking systems, namely,

1. *the Atmosphere:* the cover of the air, envelopes the earth;
2. *the Biosphere*: otherwise known as the life layer, it refers to all organisms, on the earth's surface and their interaction with water and air. It consists of plants, animals and micro-organism, ranging from the tiniest microscopic to the largest whales in the sea;
3. *the Hydrosphere*: this includes all water bodies such as lakes, ponds, rivers, streams, oceans etc; and
4. *the Lithosphere*: mainly, it contains soil, earth, rocks, mountains etc.

These four systems are in constant change and such changes are affected by human activities and vice versa (Kumaraswamy et al., 2004). Environment has been serving mankind since the beginning of the time, and continues to do so. Good Environment is a pre-requisite for the survival of life on Earth. Industries or factories, commuting via fuel driven vehicles using air conditioners etc. have become an essential part of our lives. The amount of energy that we are using in is essential and there is no other alternative to it. Many parts of our planet are being over populated by human population. Over population means more demands and less supply. This increases the fossil fuel consumption and the harmful impacts of it on the environment it also leads to increased waste to make the supplies reach the required rate. This wastes rate level leads to air and water pollution. The increased rate of burning of fossil fuels has led to increase in earth's temperature which leads to melting of glaciers and increased in ocean level rise. The need for creating land space for making roads and homes or humans leads to destructions of the habitat of wild animals and birds. It also leads to constant increase of level of CO since there are no trees to absorb this gas so it remains in the atmosphere leading to global warming. The practice of protecting the natural environment from unwanted changes and where possible to repair damage and reverse trends is called environmental protection. Rao (2006) explained that environmental protection has been a serious concern which has been steadily growing in the last 50 years with the increasing intensity of industrial activity in most countries. The consequences of the environmental challenges in Nigeria include people displacement, damage of infrastructure, decline in soil fertility, outbreak of diseases, injury as well as loss of life. Likewise, Nigeria has faced flooding in recent years, with hundreds killed and thousands displaced.

Contemporary environmental challenges in Nigeria

Petters (1995) described environmental challenge as any form of harm, danger, peril or any risk of loss in the environment. Mary (1995) noted that environmental challenge can be said to be 'an unexpected accident resulting from natural or man-made factors (or combination of both) that has a negative impact on the daily lives and living conditions of humans, flora and fauna'. In Nigeria, there are natural and anthropogenic calamities of different types, magnitudes and frequencies (Ibimilua & Ibimilua, 2014). According to them, the most common natural disasters in the country are desertification, landslides, flood and erosion. These problems are distributed across country based mainly on the prevailing geological, vegetal, hydrological or climatic condition. For instance, desert encroachment is a major problem in the Sahel vegetation , widespread in places like Birnin-Kebbi, Damaturu, Maiduguri and Sokoto. The problem is equally noticeable in the North-Eastern part of the country. Related problems of drought and vegetation loss are noticeable in Borno, Jigawa, Kano, Katsina, Kebbi, Sokoto, and Yobe States. Likewise, coastal erosion is peculiar to some states in the southern parts of the country. It is common in states like Akwa-Ibom, Bayelsa, Cross Rivers, Delta, Imo, Lagos, and Rivers. Similarly, gullies are prominent in Anambra, Imo, Adamawa, Ogun, Akwa Ibom, Cross Rivers, Benue, Abia, Bayelsa, and Ekiti States (Siyanbade, 2006). Likewise, Nigeria has faced flooding in recent years, with hundreds killed and thousands displaced. On October 6, 2018, the National Emergency Management Agency (NEMA) declared 12 states along the River Niger and Benue as worst affected by flood disaster, while other states were being monitored. Nigeria's climate has witnessed significant spatial and temporal changes with extreme weather and climate conditions with ocean surges and floods becoming more regular (Udegbunam, 2019). Premium Times reported that no fewer than 74 Local Government Areas in 30 states in Nigeria would experience severe flooding in June, July, and August and September, another 270 Local Government Areas would experience minimum flooding across the country in the period (Udegbunam, 2019).

Anthropogenic challenges are caused mainly by human interference with the environment. Human activities in Nigeria have also resulted into environmental challenges like oil spillage, mining, deforestation, bush burning, pollution (water, soil, air, noise, thermal, radioactive, thermal and vehicular) as well as use of pesticide and herbicides. The oil producing areas like Akwa Ibom, Cross Rivers, Rivers, Abia, Bayelsa, Ondo, Delta, Edo and Anambra are characterized by the problems of oil spillage, situation of water bodies, over fishing, land degradation, biodiversity loss, increased watershed instability, as well as extinction of rare species of flora and fauna (Ibimilua & Ibimilua, 2014). They further observed that in the mining region of Jos, Enugu, Itakpe, Nkalagun and Ijero, loss of soil fertility, bad land and dereliction are the major challenges. Deforestation has negative implication on the environment in terms of soil erosion, loss of biodiversity ecosystems, loss of wildlife and increased desertification among many other reasons. As of late 2012 nearly half of Nigeria is forested, but the country's rain forests are fast declining. According to the United Nations Nigeria lost nearly 80% of its old-growing forest between 1990 and 2005, giving the dubious distinction of having the highest deforestation rate of natural forest on the planet during that period. Global report on pollution affirming the country is one of those with the worst indices are frightening. First the World Health Organization revealed that Onitsha, the hub of the South-East, was the most polluted city in the world. Then this report says that three of our rivers are among the 20 most polluted globally. The affected rivers are: Imo, Akwa Ibom and Cross Rivers (World Health Organization, 2017). Cement companies located in many Nigerian territories lead to acid rains. Many Nigerian firms pollute ozone level of the atmosphere by their toxic wastes (Tersoo, 2008). Shockingly a new study reveals that environmental pollution accounts for increasing child mortality rates in the Niger Delta region (Punch, December, 2017). In all, the current environmental challenges in Nigeria is are natural forces, as well as uncontrolled human interference with the environment.

Environmental policy and enforcement in Nigeria

Environmental policy can be defined as a government's chosen course of action or plan to address issues such as pollution, wildlife protection, land use, energy production and use, waste generation, and waste disposal. Atsegbua in Ogbodo (2009) defined enforcement as the application of a set of tools both formal and informal, designed to impose legal sanctions or penalties to ensure that a defined set of requirements is complied with. The basis of environmental policy in Nigeria is contained in the 1999 constitution of the Federal Republic of Nigeria. Pursuant to Section 20 of the constitution, the State is empowered to protect and improve the environment and safeguard the water, air and land, forest and wildlife of Nigeria. In addition to this, section 2 of the Environmental Impact Assessment Act of 1992 (EIA Act) provides that the public or private sector of the economy shall not undertake or embark on or authorise projects or activities without prior consideration of the effect on the environment. In this regard, the Federal Government of Nigeria has promulgated various laws and regulations to safeguard the Nigerian environment. These include:

1. Federal Environmental Protection Agency Act of 1988 (FEPA Act) repealed by the National Environmental Standards and Regulations Enforcement Agency (NESREA) Act 2007. The following regulations were made pursuant to the FEPA Acts:
   (a) National Environmental Protection (Efficient Limitation) Regulation;
   (b) National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulation; and
   (c) National Environmental Protection (Management of Solid and Hazardous wastes) Regulation.
2. Environmental Impact Assessment Act of 1992 (EIA Act).
3. Harmful Wastes (Special Criminal Provisions etc.) Act of 1988 (Harmful Wastes Act).

The National Environmental Standards and Regulations Enforcement Agency (NESREA) has the responsibility for the protection and development of environment, biodiversity, conservation and sustainable development of Nigeria's natural resources, environmental technology, including coordination and liaison with relevant stake holders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies and guidelines. Other regulatory agencies with oversight functions and responsibility over specific industries have also issued guidelines to regulate the impact of such industries on the environment such as Environmental Guidelines and Standards for Petroleum Industry in Nigeria (EGASPIN) 2002, published by the Department of Petroleum Resources (DPR). The NESREA Act allows each State and Local Government in the country to set up its own agency for the protection and improvement of the environment within the state. Each state is also empowered to make laws to protect the environment with its jurisdiction. All states have environmental agencies and state laws.

Concept of environmental sustainability

To define environmental sustainability, we must first define sustainability. Sustainability can be defined as the ability of to continue a defined behaviour indefinitely. To define what environmental sustainability is we turn to the experts. Daly (1990), one of the early pioneers of ecological sustainability, looked at the problem from a maintenance of natural capital view. In 1990 he proposed that:

1. ***For Renewable Resources***: the rate of harvest should not exceed the rate of regeneration;
2. ***For Pollution:*** the rates of waste generation from projects should not exceed the assimilative capacity of the environment (sustainable waste disposal); and
3. ***For Non-Renewable Resources:*** the deflection of non-renewable resources should require comparable development of renewable substitutes for that resources.

According to Pettinger (2018) environmental sustainability is concern with whether environmental resources will be protected and maintained for future generation. He further states that environmental sustainability is concerned with issues such as:

1. ***Long-Term Health of Ecosystems:*** Protecting the long-term production and health of resources to meet future economic and social needs e.g. protecting food suppliers, farmland and fishing stocks.
2. ***Intergenerational Decision Making:*** When taking decisions, we should focus on implications for future generations, and not just the present moment. For example, burning coal gives a short-term benefit of cheaper energy, but the extra pollution imposes costs on future generations.
3. ***Renewable Resources:*** Diversifying into energy sources that do not rely on non-renewable sources for example, solar and wind power.
4. ***Prevent the Consequences of Man-made Global Warmings:*** Policies to ensure the environment of the planet does not deteriorate to a point where future generations face water shortages, extreme whether events, excess temperature. - All factors that could make living in parts of the world very difficult if not possible.
5. ***Protection of Species Diversity and Ecological Structure:*** Sometimes medicines require elements within specific plant species. If some species go extinct, it limits future technological innovation.
6. ***Treating Environmental Resources as if they have Extrinsic Rights and Value:*** Other words, we shouldn't just rely a monetary value, i.e. we should protect rainforests because they deserve to be protected rather than using a cost benefit analysis of whether we gain financially from protecting rainforests.
7. ***Targeting Social Welfare/Happiness:*** Environmental sustainability above crude measures of progress such as GDP.

Therefore, environmental sustainability can be defined as responsible interaction with the environment to avoid deflection or degradation of natural resources and allow for long-term environment quality. The practice of environmental sustainability helps to ensure that the needs of today's population are met without jeopardizing the ability of future generations to meet their needs.

Role of TVET in achieving sustainable environmental protection in Nigeria

The Federal Ministry of Environment was established in June 1999 to ensure effective coordination of all environmental matters. The Ministry was excised from the Housing and Urban development in September 2008. The mission of the Ministry is to ensure environmental protection, natural resources conservation and sustainable development. An educational programme that has the mandate of producing a competent workforce capable of achieving the goals of the ministry is the Technical Vocational Education and Training (TVET). Obierika (2018) maintained that the standing mandate of TVET is to provide individuals with learning experiences and training that equip them with skills to manipulate their natural environment and nurture development for their immediate community and the nation in general. The goals of technical and vocational education and training as specified in the National Policy on Education (2013) shall be to:

(a) provide trained manpower in the applied science, technology and business particularly at craft, advance craft and technical levels;

(b) provide the technical knowledge and vocational skills necessary for agricultural, industrial, commercial and economic development; and

(c) give training and impart the necessary skills to individual for self-reliance economically.

Conclusion

In Nigeria, the effects of environmental challenges are multifaceted. They differ from place to place and from time to time. For instance, oil spillage, coastal erosion, pollution and flooding are widespread in oil producing areas of the country, In the mining region of Jos, Enugu, Itakpe, Nkalagun and Ijero, loss of soil fertility, bad land and dereliction are the major challenges. TVET is a major stakeholder in achieving sustainable environmental protection in Nigeria by providing trained individuals in the field of agricultural production, renewable energy technologies, efficient use of energy and resources in industrial production and sustainable craft/business and product development.

Recommendations

In many countries TVET remain the major supplier of skilled labour to industries. Thus, TVET is a major stakeholder in achieving sustainable environmental protection in Nigeria by providing trained:

1. Individuals in the field of agricultural production to provide technical knowledge for the new practice like organic farming, agroforestry, application of energy-efficient technologies, efficient use of water and irrigation technologies and use of information technology (ICT) in agriculture.
2. Individuals in the application of energy-efficiency measures, renewable energy technologies, and upgrading skills for emergent energy markets.
3. Technicians and professionals on the established code of practice or adjustments in the environmental standards and job sector regulations over a period of time, in: efficient use of energy and resources in industrial production, controlling the material cycle and energy-efficient applied technologies.
4. Workforce needed with the knowledge and skills required to enforce the highest environmental standards and practice throughout the value chain, including: raw material collection, pre-processing, production, trade (marketing), sustainable craft/business and product development.
5. Workforce needed with the knowledge and skills required to enforce the highest environmental standards and practice throughout the sustainable construction process including: sustainable building design, building technologies and construction materials, water supply and sanitation, energy efficiency in building, solid waste treatment, reuse of materials and controlled demolitions.
6. Qualified workforce to support process of advanced wastewater treatment practice, improved packaging, improved sensors and process control (to reduce waste and improve productivity), food irradiation, water and wastewater reduction using closed loop/zero emission systems.

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INFLUENCE OF AGRICULTURAL EDUCATION ON STUDENTS' ENTREPRENEURIAL DEVELOPMENT IN COLLEGES OF EDUCATION IN BAUCHI STATE

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Abstract: *The study investigated the influence of Agricultural Education on Students' Entrepreneurship Development in Colleges of Education in Bauchi State. Four objectives and four research questions were formulated to guide the study. The study adopted descriptive survey research design. The target population were students of Colleges of Education in Bauchi State and only two Colleges of Education were randomly selected in the study (Colleges of Education Azare and Kangere). A total of 144 respondents from the colleges of education were selected for the study using simple random sampling technique. The instrument used in data collection was questionnaire developed by the researcher and validated by three experts. The instrument was administered by the researcher with help of the two research assistants. The data collected was analyzed using mean decision. The findings revealed that most NCE III students of agricultural education in Colleges of Education in Bauchi state have not developed entrepreneurship in agriculture and also the result shows that if the concept of agricultural education would be properly explained to the students, they would appreciate the concept and present them in most entrepreneurship in life. Recommendations were made among others include students should be made to realize that agricultural education is more than just producing agricultural science teachers but rather a way of life and agricultural science education curriculum should be modified to reflect the current situation of the country.*

Keywords: *Agricultural Education, Entrepreneurial Development, Innovative Skills, Curriculum Relevance*

Introduction

Entrepreneurship Development refers to the process of enhancing entrepreneurial skills and knowledge through structural training and institution building programmes. It is basically aims to enlarge the base of entrepreneurs in order to hasten the pace at which new ventures are created. This accelerates employment generation and economic development. Entrepreneurship is promoted to overcome the problem of stagnation and to increase the competitiveness and growth of business and industries. Various attempts have been made to promote and develop entrepreneurship by giving specific assistance to improve the competence of the entrepreneurs and his enterprise so as to enhance his entrepreneurial objective and accommodate more people to become entrepreneurs as well (Odeigah, 2012). Career is the sequence of occupation, job or position occupied by a person during his entire life (Janick, 2014). Therefore, it is an accepted fact that one should choose and prepare for a career easily enough in life. Hence, agricultural education students should be exposed to entrepreneurial opportunities in agriculture.

Agricultural science education according to Egbe (2014) is an art, a science, a business, profession, occupation and industry for production of food and fibre for man's use. It is very extensive in scope and has many career opportunities. He further listed the careers open for students of agriculture in the areas of (i) self-reliance in production of various crops, fishery, poultry, piggery, rabbitary, or distribution of farm produce; (ii) Civil service work in ministry of agriculture, national directorate of employment, agricultural agencies etc; (iii) research station; and (iv) agro-allied industries like detergents, processing, supplies, textiles, feed meal etc (Egbe, 2014). Agricultural education as a discipline is relatively young with legislation that established the study of agriculture in colleges and public schools come the need for educators who knew agriculture and the art and science of teaching. Pioneers such as Rufus Stemsons (Moore, 2008) established the marriage between agricultural teachings. Cracken (2016) wrote; it is increasingly essential that agricultural education be further developed as a profession. We need leaders in our profession who will work together in charting a new course for the future. We need intellectual discussion and debate will require that we become academicians and philosophers.

Statement of the problem

It has been observed through interaction with graduates from the study area that, many students could not pursue on entrepreneurship in vocational agriculture such as fattening, bee keeping, fisheries, forestry, poultry production to mention a few. Some of these students ended up in studying other education related subjects aside from agriculture. Students in the study area have general idea that, agricultural science education is all about producing agricultural science teachers. This not so as in the work of Amadi, (2012); which gave entrepreneurship paths in vocational agriculture to include: soil conservationist, vocational teacher, extension agent, farmer/manager agricultural scientist, sale representative, commercial loan officer and others. Like also, agricultural education has expanded beyond the initial 'teaching function' to include research, extension education, international education and the like (Carnick, 2013). Many researches shown that it is difficult for student to pursue vocational agriculture after graduation in the study area (Jones, 2011).

Research questions

1. What is the extent of entrepreneurial development by the students of agricultural education in the colleges of education?
2. What is the extent of students' awareness of entrepreneurial components of agricultural education?
3. What is the extent of entrepreneurial ambition among the students of agricultural education in the colleges of education?

Methodology

The study adopted descriptive survey research design. The target population were students of Colleges of Education in Bauchi State and two Colleges of Education were randomly selected in the study (Colleges of Education Azare and Kangere). The population comprises all 234 (NCE III) students of Agricultural Education in the two colleges of Education. A total of 144 students were used as the sample, using simple random sampling technique (Krejcie and Morgan, 2017). The instrument used for data collection was questionnaire developed by the researcher and validated three experts. Data was collected by the researcher with the help of three trained research assistants. 144 copies of questionnaires were distributed to NCE III agricultural education students in the colleges selected and the researcher recorded 98% returned rate. The data collected was analyzed using descriptive statistics of mean.

Results

Table 1: Extent of Entrepreneurial Development by the Students of Agricultural Education in the Colleges Of Education

S/N	Questionnaire Items	Mean	Decision
1.	Most NCE III students of agricultural science education have developed entrepreneurship in agriculture.	2.62	Rejected
2.	You intend to take a vocation in agricultural science	3.48	Accepted
3.	Difficulties have prevent you from taking up on entrepreneurship in agricultural science education	3.47	Accepted
4.	Most students of agricultural science education earn from agriculture.	3.46	Accepted
5.	No agriculture, no life.	4.20	Accepted
6.	With agriculture, one can become job provider rather than job seeker.	4.35	Accepted
7.	About 80 – 85% of the Nigeria population are directly or indirectly engaged in agricultural activities.	3.67	Accepted
	Total:	**25.25**	**Accepted**

Table 1 revealed that the respondents rejected that, most NCE III students of agricultural education have developed entrepreneurship in agriculture with a mean of 2.62. While all others items were accepted by the respondents, such as livestock production as a vocation in agricultural education with a calculated mean value of 3.48. Difficulties have prevent you from taking up on entrepreneurship in agricultural education with a calculated mean value of 3.47. Most NCE III students of agricultural education earn from agriculture with a calculated mean of 3.46, no agriculture, no life. with a calculated mean value of 4.20. with agriculture, one can become job seeker rather than job provider with a calculated mean value of 4.35. about 80 – 85% of the Nigerian population are directly or indirectly engaged in agricultural activities. with a calculated mean value of 3.67.

Table 2: Extent of Students' Awareness of Entrepreneurial Components of Agricultural Education

S/N	Questionnaire Items	Mean	Decision
1.	Agriculture encompasses many entrepreneurial opportunities.	4.14	Accepted
2.	Most of our communities practice agriculture as a profession.	4.30	Accepted
3.	Agriculture is more than farming but rather a profession.	4.73	Accepted
4.	Agricultural education has very wide entrepreneurial prospects.	4.05	Accepted
5.	Agricultural education has better employment prospects than ND.	3.55	Accepted
6.	You perform better in agriculture than those in ND programs.	3.67	Accepted
7.	You can take up an agricultural entrepreneurship after graduation	2.63	Rejected
	Total:	**27.07**	**Accepted**

Table 2 above, shows the responses on what is the extent of students' awareness of agricultural science education in entrepreneurship. The first item states that, agriculture encompasses many entrepreneurial opportunities, is accepted with 4.14 calculated mean values. This reveals that agriculture encompasses many entrepreneurial opportunities. The second item states that most of our communities practice agriculture as a profession. This statement is accepted with a mean value of 4.30 indicating that, agriculture is a profession to most of our communities. The third item in the below table stated that, agriculture is more than farming but rather a profession. This item is agreed by the respondents with a calculated mean value of 3.73 indicating that agriculture is not just farming but also a profession. With agricultural education, one can be involved in many choice of entrepreneurship is the fourth item and is also accepted with a calculated mean value of 4.05 which shows that agricultural education provide one with many choice of entrepreneurship. The fifth item in the table states that with agricultural science education, one can be employed in many places than with any other science qualification. The item was accepted by the respondent with the calculated mean value of 3.55 indicating that agricultural science education provides job opportunities than any other science qualification. The respondents whose were the students of colleges of education agreed with item six with a calculated mean value of 3.67 which stated that students in colleges of education performed better in agricultural science than any other colleges. The last but not the least item in the table below states that, you will take any of the agricultural science entrepreneurship after your NCE programme. It was rejected with a mean value of 2.63.

Table 3: **Extent of Entrepreneurial Ambition Among the Students of Agricultural Education in the Colleges of Education**

S/N	Questionnaire Items	Mean	Decision
1.	I would take career in agriculture after NCE programme.	1.97	Rejected
2.	I like agricultural science courses very much	4.23	Accepted
3.	Agricultural science course is the number one course to me	4.14	Accepted
4.	I offer entrepreneurial courses in NCE programme	4.72	Accepted

S/N	Questionnaire Items	Mean	Decision
5.	Students in colleges of education have higher interest in entrepreneurial development	3.63	Accepted
6.	Would you agree to retain your choice of career if agricultural science is made compulsory for entry into university?	4.06	Accepted
7.	You will take any of the agricultural science entrepreneurship after your NCE programme	2.66	Rejected
	Total:	**25.41**	**Accepted**

Table 3, shows the responses on what is the entrepreneurial ambition of colleges of education students in agricultural science education. The first item stated that I would take career in agriculture after NCE programme. This item was rejected by the respondents with the calculated mean value of 1.97. This shows that most of the students of agriculture would not take career in agriculture after their NCE programme. The respondents agreed with the second item with calculated mean value of 4.23 which states that I like agricultural science courses very much. This indicated that most of the students in colleges of education like agriculture very much. The third item states that an agricultural science course is the number one course to me. This item was agreed with the calculated mean value of 4.14 which indicated that agricultural science courses is the best courses to most of the agricultural science education students in colleges of education. I after entrepreneurial course in NCE programme is the fourth item and was also accepted by the respondents with the calculated mean value of 4.72. This shows that respondents were exposed entrepreneurial courses. The fifth item said students in colleges of education have higher interest in entrepreneurial development. This item was accepted with the calculated mean value of 3.63 indicating that students of agricultural science education in colleges of education have interest in entrepreneurial development. The sixth item states that would you agree to retain your choice of career if agricultural science is made compulsory for entry into university? This item was accepted with calculated mean value of 4.06 which reveals that most of the students would retain their choice of career, if made compulsory for entry into university. Finally, the last item in the above table states that you will take any of the agricultural science entrepreneurship after NCE programme. However, this item was rejected by the respondents with the calculated mean value of 2.66. This clearly indicated that most of the respondents are not willing to take any of the agricultural entrepreneurship after their NCE graduation.

Findings of the study

1. It was found that most NCE III students of agricultural science education in Colleges of Education in Bauchi state have not developed entrepreneurship in agriculture.
2. The study shows that if agricultural science education properly taught to the students, they would appreciate the concept and present them in most entrepreneurship in life.
3. The study shows that most of the students did not have interest in taking entrepreneurship in agriculture after their NCE graduation.

Discussion of the findings

The first finding shows that despite the fact that agriculture provides solid ground in which about 80–85% of the Nigerian population are directly or indirectly engaged in its activities however, most of the NCE III students of agricultural science education in colleges of education in Bauchi state have not developed entrepreneurship in agriculture. This finding is in agreement with the explanation of (Green and Pryde, 2010) that about 70% of Finns University students would prefer to be 'employed' than self-employed and only 27% would prefer to be self-employed. Also, in Canada, almost of the youth would like to start their own business someday, but only half think they will and the biggest barrier being fear of financial rule and lack of knowledge about the first step to take (Green and Pryde, 2010). It is also in agreement with the explanation of Ugwu (2011)

that when there is proper motivation, it leads to good performance and higher productivity to the sustenance of the national growth and development and also welfare of the citizens. Hence, the impact of motivation on students' academic performance cannot be over emphasized. More also, Harzberg (2011) stated that motivation energies the behaviour of the students and arouses them for action. Not only the motivation energies the behaviour, it also sustain their interest and motivated state helps to increase efficiency and adequacy of behaviour. This also agreed with the explanation of Igbeka (2008) that there is a lack of entrepreneurial spirit and culture, confidence and determination and fear of competition and failure. They may have arisen out of the lack of basic entrepreneurial training which would enable them to identify and harness the abundant opportunities available in their environment. Also, Brijlal (2010) stated that revitalizing the students' industrial work experience scheme which has been distorted by a multiplicity of problems is another strategy for students to acquire practical industrial training through industrial attachment. Although, they know the importance of agricultural science education and yet many of them fails to recognize it involvement in many entrepreneurship in life, which might be result from the inability of the school to provide adequate materials to prepare students against knowing the subject better. This problem is in agreement with the explanation of researcher such as (Britton, Huntlay, Jacobs and Weinber, 2011). Our school is too "abstract" frequently; it is accused of lacking the sufficient real world 'connection' and relevant 'context' necessary for many students to learn concepts and principles. Moreover, investigators like (Balschwesd, 2011) have concluded that it is very important to provide students with sufficient context while they learn and appreciate the concept. This is also in agreement with the explanation Global Entrepreneurship Monitor GEM (2011) reported that there is an overall lack of entrepreneurial elements in the education systems of most of the countries in Africa. Some of the factors in the education system contribute towards entrepreneurship, business role models, negative mindset in terms of confidence, initiative and creativity and negative perception towards entrepreneurship as a career choice (Brijlal, 2010). Entrepreneurial ambition in agricultural science education by students in colleges of education is geared towards Romantism as shown in Table 3 as this agrees with the report of Ipaye (2013) who stated that, the trend of most students is that they want to get into high ranking jobs and professions and failure to get that will lead to sign of failure in life.

Conclusion

The students are aware of the importance of agricultural education. Also, most of the students know of it place in their entrepreneurial aspiration. They also know some jobs that need the knowledge of agricultural science. Therefore, it is not surprising that students realize the varieties of entrepreneurship in vocational agriculture such as fattening, fisheries, poultry production, bee keeping, rabbitary to mention but a few. The students have poor attitude towards agricultural science education although, they knows it relevance.

Recommendations

1. The students from their first year should be made to understand that choice of vocational agricultural as an entrepreneurship beyond NCE level is the best thing that could happen to students of agricultural education.
2. Students should be made to realize that agricultural science education is more than just producing agricultural science teachers but rather a way of life.
3. Students should be given opportunities to carryout agricultural related tasks that reveal the relevance of agricultural science to life.

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GREENING TECHNICAL VOCATIONAL EDUCATION AND TRAINING: AN IMPERATIVE FOR SUSTAINABLE ENVIRONMENT PROTECTION IN NIGERIA

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Abstract: *Green paradigm is emerging world over. In order to achieve an eco-friendly environment, greening TVET (GTVET) is critical. Technical vocational education and training (TVET) play an important role in equipping individuals with the skills required for employment, decent work, entrepreneurship and lifelong learning. In recent decades, environmental problems have increased as a result of human activities and unplanned management of the technological development that interfere with the ecosystem. It is, therefore, necessary to strike a balance between the importance of conservation and preservation of ecosystems that protect environment and the necessity to satisfy human desires in their daily activities. This paper focused on GTVET as an essential tool for sustainable environmental protection. It examined the concepts of GTVET, sustainability, environment and sustainable environmental protection. If further looked at GTVET for sustainable environmental protection, factors that could influence GTVET as well as its constraints. It was concluded that in order to ensure sustainable environmental protection GTVET should be pursued vigorously. This paper recommended among others, that awareness on GTVET should be created among Nigerian and that green technology should be emphasized in order to have an eco-friendly environment.*

Keywords: *Greening Technology, TVET, Environmental Protection, Sustainability*

Introduction

In recent years, mankind's consciousness has been aroused very strongly about the need for environmental protection and ecological preservation. It is of utmost importance that the people should be aware, not only of the problems involved but also of the role to be played in protecting the environment (Singh, 2015). The components of the natural environment are used as a resource, however, it is also exploited by human beings in order to fulfill some basic physical needs and purposes of life. In order to achieve a resilient, low carbon and eco-friendly environment that leads to higher quality of life, many countries in recent times have put their focus on green growth. Furthermore, environmental pollution and climate change are negatively affecting the sustainability of various economical activities across the world, Nigeria inclusive. To mitigate these environmental problems, greening TVET is imperative. This is because green technology (GT) aspires to tackle these problems. Jahonga, Ngore and Muramba (2015) stated that globally, cities account for about 70% of carbondioxide emissions, which comprises a significant share of global greenhouse.

Mustapha (2015) stressed that education and training play an important role in the success of transmitting the economy to the development of green economy and clean environment conducive for the overall economic growth. In the same vein, Majumdar (2010) stated that since education is considered the key to effective development strategies, technical vocational education and training (TVET) must be the master key that can alleviate poverty, promote peace, conserve the environment, improve the quality of life for all and help achieve sustainable development. Onele, Imakwu & Nwofe (2017) described technical vocational education and training (TVET) as a comprehensive term referring to those aspects of the educational process involving, in addition to general education, the study of technologies and related sciences as well as the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life. TVET is the strategic entry point for ensuring a world of work that contributes to social cohesion and promotes environmentally sound, sustainable development (Kamis, Alwi, Ismail, Zakaria & Yunus, 2017). In addition, the changes in our physical environmental such as global warming, changing weather pattern, floods, drought, rising sea levels and scarcity of natural resources require responsive adjustment measures. These changes are being felt all over the world especially where sustainable environmental protection is compromised.

Sustainable environment which meets the needs of the present generations without compromising the ability of the future generations to meet their own needs. The human population is bond to change their production patterns to cope with changes in their physical environment of planet earth. A green technology transformation greater in scale and achievable in a short time is needed. Green technology (GT) is a method of practical application of knowledge from environmental science to conserve the natural environment and resources in harmony with mother nature and ecology (Jahonga, Ngore & Muramba, 2015). Greening TVET is considered as one of the holistic frameworks for smooth transition to sustainable environmental protection (Agus, 2017) Greening TVET seeks to address technological and societal development and growing concerns about climate change, environmental degradation and scarcity of resources that are changing the nature of work. These developments demand that TVET develop skills and provide knowledge to ease transition to green economies and societies. Adam, Jibrin, Shuaibu, Dahiru & Jaja (2018) opined that greening TVET enhances problem-solving skill in the daily lives (skills manage life), education in sustainable development in life and entrepreneurship education. Thus greening TVET for sustainable environmental protection in Nigeria is crucial in the face increasing environmental degradation and climate change.

Greening technical vocational education and training

Greening is the process of pursuing knowledge and practices with the intention of becoming more environmentally friendly, enhancing decision-making and lifestyle in more ecologically responsible manner, that can lead to environmental protection and sustainability of natural resources for current and future generations (UNESCO, 2014). Technological and societal developments and growing concerns about climate change, environmental and scarcity of resources are changing the nature of work. These developments demand that TVET develop skills and provide knowledge to ease transitions to green economies and societies. In the light of the above greening TVET is essential. Majumdar (2010) asserted that greening TVET (G TVET) is an essential and cross cutting theme for sustainable development. He further stated that greening TVET refers to the effort to reorient and reinforce existing TVET institutions and policies in order to reinforce achievement of sustainable development. Thus, greening TVET acknowledges the relationship between sustainable development and green development and clarifies different definitions of green jobs and green skills as well. Furthermore, green TVET comprises economic, ecological and social aspects and this contributes to sustainable development. It is a cross-cutting issue that plays a role in any occupational sector: industry, handicraft, agriculture, forestry, fisheries, services and administration. Green TVET contributes to the transition to green economies and green societies by providing green competencies in a holistic approach including formal, non-formal and informal learning environment (UNESCO, 2014). The global climate change that we face can be prevented using multidimensional approach including education and training.

Sustainable environmental protection

Simply put, sustainability can be referred to a long term human and material sustenance. It ensures the continued existence of programmes long after their establishment. In a similar vein, UCLA (2017) described it as the physical development and institutional operating practices that meet the needs of present users without compromising the ability of future generations to meet their own needs, particularly with regard to use and waste of natural resource. Sustainable practices support ecological, human and economic health and vitality. Sustainability presumes that resources are finite, and should be used conservatively and wisely with a view of long term priorities and consequences of the ways in which resources are used. In simplest terms, sustainability is about our children and our grandchildren, and the world we will leave them with.

Nigeria has a total land space of 983214km^2 occupied by about 200 million people. The interaction of these millions of people with their environment has left indelible mark on the landscape. Omofonmwan and Osa-Eboh (2017) stated that urbanization, deforestation, desertification, overpopulation and all kinds of pollution are some of the resultant effects of man's interaction with

his environment. The changes occur as the people attempt to acquire their seemingly endless desire for food, shelter, recreation and infrastructural facilities. Though these wants and desires contribute to the development of the country, the unwise use of the land and its resources produce negative impacts on the environment. In addition, Singh (2015) described environment as all natural surroundings such as land, air, water, plants, animals, solid material, wastes, sunlight, forests and many other things. He stated that healthy environment maintains the nature's balance as well as helps in growing, nourishing and developing all the living things on the earth. There is therefore the need to protect this environment so that our lives as well as our existence of life in the future on this planet is not in danger.

Environmental protection is viewed as policies and procedures aimed at conserving the natural resources, preserving the current state of natural environment and where possible, reversing its degradation(Business Dictionary, n.d.). In the same vein Celikyay and Uzun (2007) described environmental protection as the practice of protecting the natural environment by individuals, organizations and government for the benefit of both the natural environment and humans. Additionally, Hamilton and Bastianoni (2009) viewed environmental protection as the prevention of unwanted changes to ecosystem and their constituent parts. This includes:

(a) the protection of ecosystems and their constituent parts from changes associated with human activities; and
(b) the prevention of unwanted natural changes to the ecosystems and their constituent parts.

Hamilton and Bastianoni (2009) further opined that environmental protection is concerned with the relationship between people and the natural environment rather than the relationship between people and communities. Environmental protection is now generally used to refer to measures that have traditionally been associated with preservation as well as conservation and natural resource management initiatives. The critical aspect of environmental protection is that it is driven by the values of human attribute to different aspects of the environment.

Greening TVET for sustainable environmental protection

A lot of human activities pose great threats to the environment. These include threats from the energy sector, iron and steel sector, manufacturing sector, agricultural sector and food sector. Thus, there is the need for human activities as well as occupations in the workplace to be carried out in a way that is sustainable and environmental friendly. Bonnett (2010) asserted that sustainable environmental protection has many specific benefits, which are positive processes in solving the global problems, both individually and as a community. In addition, a major component in achieving sustainable environmental protection is the creation of more sustainable production and consumption patterns. Kamis, et al. (2017) maintained that TVET can be a tool to minimize the effect of global warming by providing an environmental conscious culture.

Furthermore, greening of TVET requires TVET to engage more systematically in response to the changing job opportunities and skills needs that a green development agenda brings about (UNESCO, 2014). Majumdar (2010) explained that greening TVET for sustainable environmental protection can be achieved through five key areas which include green campus, green curriculum, green community and workplace, green research and technology and green culture.

1. *Green Campus:* Green campus is based on that philosophy of practicing what is being preached in managing campus resources such as energy, water, and waste resources. This area intends to reduce the carbon footprint of students, teachers and staff within the TVET institutions.
2. *Green Curriculum:* Green curriculum aims at integrating sustainability into the existing curriculum and training. It seeks to embed environment-related contents and green skills in the curriculum and training. In the process, teachers and trainers are progressively equipped with competencies they need to deliver relevant contents across disciplines or in a specific area of competence.

3. *Green Community and Workplace:* Green community involves extending sustainability principles and practices to create a sustainable impact on the community and workplace such that sustainable lifestyles become a norm.
4. *Green Research and Technology:* Green research and technology aims at fostering green technologies and innovations that promote sustainability as well as the development of research culture within institutions. It is in this approach that institutions can engage in collecting and disseminating data that are useful for the learning community. Actors in the institution seek to investigate applications of sustainability practices and develop solutions together.
5. *Green Culture:* Green culture involves embedding sustainability into all aspects of the institution, by focusing on strengthening green values in education, green ethical standards, green attitudes and behaviours that respect ecological resources and value the requirement of the future generation.

Factors that could influence greening of TVET

Pavlova (2015) identified factors influencing GTVET which include the following:

1. Generic green skills will be different for low, medium and high levels. Generic skills can be included in anticipation of industry demands.
2. It is important to pay attention to capacity building for industry, so companies can think in terms of skills requirements and can predict skill requirements and convey this to TVET.
3. All key stakeholders should be involved in the process of greening skills development.
4. There should be a significant potential for improving TVET responses to greening through a targeted effort across different ministries and different levels of education and skill training.
5. Transformation of the mindset of Nigerians towards the importance of green technology.

Constraint to greening TVET for sustainable environmental protection

1. Lack of awareness among TVET instructors and the Nigerian general populace.
2. Lack of adequate skill development of TVET instructors in the area of greening.
3. Inadequate policies that will promote green technology.
4. A small number of TVET institutions are equipped to address the needs of the industry with regard to the emerging green economy.
5. TVET institutions lack close links with the industry in order to minimize the gap between TVET outcomes and green job outcomes.
6. Slow responsiveness of training institutions in creating futuristic curricula for green jobs.

Conclusion

Greening TVET (GTVET) is crucial to the enhancement of sustainable environmental protection. This is because by greening TVET in Nigeria, we will be able to contribute in building a robust green Nigeria as a country and this will make it sustainable and environmentally friendly. This GTVET campaign has gone far in developed countries of the world like Germany, United States of America, United Kingdom, Australia etc. Some developing countries too are picking up on GTVET, however green practices are not part of Nigerian lifestyle today. We need to change our thinking so that we will be able to enjoy the quality of life now and in the future. We should also be aware that the choices made by us today will determine the quality of environment for our children in the future. A clarion call to all Nigerians here is that greening TVET for sustainable environmental protection should be pursued vigorously. appropriate and relevant policies on greening TVET should be introduced followed by coordinated implementation.

Recommendations

1. Awareness on greening TVET and its importance in environmental sustainability should be created among Nigerians.
2. Greening TVET should be pursued vigorously in order to ensure sustainable environmental protection.
3. Green technology should be emphasized in order to have an environmentally friendly society.
4. Appropriate and relevant policies on greening TVET should be introduced and there should be coordinated implementation of education and training for environmental sustainability.

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EVOLUTION OF TECHNOLOGY EDUCATION ON PRESENT ERA

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Abstract: *The use of technology in education has come along way since the earliest times to human civilization. With the evolution of technology, students achieved competence and interested in interactive learning. The paper discuses the benefits of using technology in today's education which includes; making learning interesting and engaging younger generations on the latest techniques of technology, reduction in the use of textbooks and other printed materials, allowing more efficient and faster delivery of lessons both at home and in the class rooms and communication between school administrators, students, teachers and parents are also discussed. It emphasizes that learning can take place without teacher's intervention once the learning resource has been constructed. The article has also discussed the innovative application of technology which include the use of mobile technology in the classroom, robot technology, and learning with 3D games, different theories of teaching and learning were also discussed. Limitation such as immense expenditure insufficient methods of teaching and transforming learners into inefficient learners were discussed. Conclusion was drawn and recommendations made among others.*

Keywords: *Technology Education, Educational Technologies, Teacher Competence, Innovation*

Introduction

Technology has always been at the forefront of human education from the stone age to-date. Technology continuous to push educational capabilitieis to new levels, when students and teacher equipped with several technological devices. The use of technological devices to send materials and information to students and parents. Technology refers to all tools and procedures. It is the state of knowledge and development at any given time of our control of our surroundings, and includes all tolls (utensils, devices, machinery, inventions and structures), all methods (skills, processes and techniques) and all applied materials (both raw and manufactured). In the most general sense, technology is man's ability to control nature. The term can be applied generally or specific areas such as in "construction technology, computer technology" and medical technology generally advances overtime, as people improve upon or replace the technologiess that came before the most advanced technology in any specific area is referred to as state of the art technology (Wikipedia, 2006). Technology education is the study of technology in which students learn about the process and knowledge related to technology as a field of study, it covers the human ability to shape and change the physical word to meet needs by manipulating materials and tools with techniques. According to Muttappallymyalil (2006) with the evolution of technology, students achieved competence and interested in interactive learning. Thus the newer educational technology can be effective tools of teaching and learning in this rapidly changing technological world and be part of a comprehensive system for lifelong education.

Benefits of using technology in today's education

When technology is used in the right way, it help students to learn. For students to survive in today's "tough completion" use to understand technology. Student's use technology devices in doing home work and term papers online and to access other educational applications and programs to further assist their learning.

(a) Technology makes learning interesting and engaging especially for younger generations raised on the latest technology.
(b) It reduces the need of using textbooks and other printed materials, this has lower the cost of procuring books by teachers and students.
(c) It allows more efficient and faster delivery of lessons, both in the class room and at home.
(d) It allows students, teachers and parents to collaborate and communicate more efficiently.

The work of Seymour (1980) concerns the constructivist approach. His vision of computers being used in education has proved very influential. Papert view of the importance of the motivational engagement of the learner contrasts sharply with skinner who although recognized. This influence considered it necessary for instruction. In the constructivist view the learner as an active participant is involved in structuring their own learning experiences. Papert worked with Piaget who emphasized the way in which knowledge is structured and organized as well as how the learners own perceptions of their prior experiences to existing knowledge becomes paramount. However neither approach takes fully into consideration the teacher and the relationship between teacher and learner. Both emphasize the role of the educator for setting up learning experience but both see learning as all to take place without teacher intervention once the learning resource has been constructed.

Innovation application of technology

According tto Kanter (2006) innovation is a generation, administration and realization of new ideas, products, services and processes. OECD (2014) innovation is production or adoption, assimilation of value-added novelty in economic and social spheres, renewal and enlargement of products, services and markets development of new management system. It is both a process and an outcome. There are several innovative ways to use technology for teaching and learning. Some of the ways are:

1. ***The Use of Mobile Technology in the Classroom:*** Mobile technology are increasing day by day in education. In today's modern world, it influence will continue to grow with mobile devices occupying the role of a teacher in the classroom. The role of the teacher will remain to direct and guide the learner to achieve the stated objectives. Mobile applications also help teachers and school administrators conducts digital polls, presentation skills, in corporate technology skills with core competency lessons and verbal enhancement. Mobile learning technologies offer teachers and students a more flexible approach to learning. Prensky (2001) warned that students have changed radically. According to him students of nowadays are no longer the people our educational curriculum was designed for. He went further in describing how these digital natives are being exposed to more gadgets and technology than ever before. This has more effect on the ways in which children learn. They have more interest when learning with the latest Technological gadgets because it is what they are most used to students don't just want mobile learning they need it.
2. ***Robots in the Classroom:*** The use of robots in education is rapidly becoming more commonplace all round us. In our offices our homes and even in our schools. The use of robots is quite new to education, some researchers predict that within the next ten years robots will be rapidly use in the classroom around the globe. Research has shown that south Koreaan schools have experimented with robot teachers. This makes lessons more interesting and entertaining for kids and enables teachers from anywhere in the world to be "present" in the classroom. Educational robotics strengthen and support students to develop skills and knowledge through creation, design, assembly and operation of robots because they feel free to interact directly with both electrical and mechanical processes and procedures. Educational robotics can also help those students who cannot attend school. As the technological world evolves daily, the educational world will continue to benefit from the opportunities offered by its new innovations, tools and discoveries.
3. ***Learning with 3D Games:*** Jumpstart (2008) launched jumpstart.com, transporting young learners to a virtual world characterized by an enjoyable educational experience. Through its innovative approach to bridging the gap between fun and academics, jumpstart.com has not only encouraged its players to prioritize education, but become excite to learn as well. Kids enjoy 3D games and movies so thus technology will help students to learn faster. Educational games allow kids to practice and develop physical skills like hand and eye coordination. Games-based learning allows kids to develop cognitive, social and physical skills simultaneously. Edward Tolman has contributed significantly to the cognitive learning theory.

According to him, individuals not only responds to stimuli but also act on beliefs, thoughts, attitudes, feelings ad strive towards goals. Tolman was the first behaviourist who challenged the conditional theory on the belief that stimulus response-theory is unacceptable as reinforcement was not necessary for the learning to happen and asserted that bahaviour was mainly cognitive.

Limitations

Despite the benefits of technology in education, there are some shortcomings which include:

1. ***Immense Expenditure:*** The expenditure incurred to acquire those devices for learning, such as mobile phone, computers and even the subscription to access the internet are rocketed as compare to the traditional use of paper and pen.
2. ***Insufficient Method of Teaching:*** With the advancement of mechanizes, teachers and not equally trained with it proper implementation. Thus, learners are just using technology instead of getting knowledge from it.
3. ***Transforming Learners into Inefficient Learners:*** Relying completing on computers are creating poor studying habits. Many students keep browsing the website to find the shortest possible ways of solving problems instead of solving them in a traditional way which actually help them to gain in-depth knowledge of the subject.

Conclusion

As we embrace the fourth industrial revolution, its clear that technology will play a central role in nearly all aspects of our lives. Research by the world economic forum estimates that 65% of children entering primary school will find themselves in occupations that today, do not exist. Its estimated that by 2020 there will be 1.5 million new digitized jobs across the globe, while 75% of educator and students feel there is a gap in their ability to meet the skilled needs of the IT workforce. To prepare the talent needed for digital economy, Technology education must adapt as fast as the demand for technology skills is growing and evolving. Technology is important but its really just the means to an end. The real magic is in giving great educators freedom and license into how school works.

Recommendations

1. Staff training and training of staff on new technology devices should be considered by both government and school administrators.
2. The implementation of information and communication technology in all level of education should be considered by curriculum developers.
3. Steady power supply and purchase of new technology devices should be taken into consideration by school administrators and government.

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TEACHERS' APPLICATION OF HIGHER ORDER THINKING SKILLS IN TEACHING BUILDING TECHNOLOGY IN TECHNICAL COLLEGES IN NIGER STATE, NIGERIA

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Abstract: *The study assessed teachers' application of higher order thinking skills in teaching building technology in technical colleges in Niger State. Two research questions were raised to guide the study and two hypotheses were formulated and tested at .5 level of significant. The research design used for this study was the descriptive survey research design. The population of the study consisted of 10 Federal and 40 State technical college building technology teachers. No sampling was used. The instrument for data collection was a structured questionnaire designed on five points rating scale. Cronbach Alpha method was used to determine the reliability of the instrument and found to be .88 and .90 respectively. Mean was used to answer the research questions and z-test to test the hypotheses. It was found that, engaging practices lead students through the process of how to connect one concept to another and providing students with problems from easy to difficult level are the only higher order thinking skills applied by teachers in teaching building technology among others. The study recommended among others that, teachers should embrace the application of higher order thinking skills in teaching so as produce craftsmen with skills capable of solving complex problems.*

Keywords: *Technical Colleges, Building Technology, Technical Skills, Higher Order Thinking Skills*

Introduction

Technical college is an organized institution where specialized type of education aimed at providing skills and knowledge required for employment in an occupation is provided. According to Abdulkadir (2011), the responsibilities of technical college education in Nigeria include the provision of full time courses in the areas of technology, applied science and commerce relevant to the needs of the development of Nigeria. According to Federal Republic of Nigeria (2004), the aim of technical colleges is to produce craftsmen with saleable skills, knowledge and attitude necessary for effective employment and who can actually function well in various disciplines such as Building technology. Building technology is one of the trade obtainable in technical colleges in Nigeria. The trade is generally obtainable at different levels leading to the award of National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC) for craftsmen and master craftsmen. According to the National Board for Technical Education (NBTE, 2001), the goal of building technology is to produce skilled craftsmen with high-quality knowledge and skills on the application of right or appropriate blocks, tools and concrete as applicable in the construction industry. The attainment of the goal of building technology largely depend on the quality of the teachers. Teacher could be seen as a professional person in the classroom situation who is highly knowledgeable in the subject matter. Umunadi (2009) described a teacher as a leader who is always dynamic and believes in change and have the capacity to prepare future leaders and develop in them the skills required to succeed. The teacher in relation to this study is a professional who has acquired professional training in teaching the subject matter of building technology. Adewumi (2009) disclosed that, education quality is not only determined by the plan and the development of education but by the quality of its implementation which depends on teachers skills. To ensure the realization of the objectives of teaching building technology, teachers need to equip themselves with new knowledge and skills as well as new teaching and learning practices relevant to 21st century developments and needs, thinking skills across all disciplines especially in the context of higher-order thinking skills. Higher Order Thinking Skills (HOTS) is a concept of education reform based on learning taxonomies that can be described as the ability to use information to solve problems, analyze arguments, negotiate issues, innovate and create something. Zohar (2013) defined HOTS as the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/ or evaluating information gathered from, or generated by observation, experience, reflection, reasoning or communication.

HOTS involves the transformation of information and ideas. This transformation occurs when students analyze, combine facts and ideas and synthesize, generalize, explain, or arrive of some conclusion or interpretation. Tomei (2005) noted that, manipulating information and ideas through these processes allows students to solve problems, gain understanding and discover new meaning. HOTS is essential and relevant to educate students of the 21st century who face complex real-life problem, which often deem complex solution. Jailani and Retnawati (2016) revealed that, information learned and processed through HOT processes is remembered longer and more clearly than information that is processed through lower order rote memorization. Zulkpli *et al.* (2017) further revealed that, knowledge obtained through HOT processes is more easily transferable, so that student with a deep conceptual understanding of an idea will be much more likely to be able to apply that knowledge to solve new problems in different situations. To realize these importance, teachers need to apply HOTS in teaching and also enhance it use among students. Based on the importance of HOTS in teaching, there is need to assess teachers' application of higher order thinking skills in teaching building technology in technical colleges in Niger State.

Statement of the problem

The goal of building technology is to produce skilled craftsmen with high-quality knowledge and skills on the application of right or appropriate blocks, tools and concrete as applicable in the construction industry. Building technology graduates of technical college have the prospect of either being employed in industries or becoming self-employed. However, these graduates prove to be ill equipped as most of them remain unemployed due to the lack of requisite and saleable skills to make them self-employed. The situation pose a great trait to the socio-economic status of Nigeria and Niger State in particular. Based on the fore mentioned problem, there is need to ascertain the skills used by teachers in teaching building technology to enhance students' performance. Hence, the study intends to assess teachers' application of higher order thinking skills in teaching building technology in technical colleges in Niger State.

Research questions

1. What are the higher order thinking skills applied by teachers in teaching building technology?
2. What are the Challenges faced by teachers in the application of higher order thinking skills in teaching building technology?

Hypotheses

H_{O1}: There is no significant difference between the mean responses of teachers from Federal and State technical colleges on the application of higher order thinking skills in teaching building technology.

H_{O2}: There is no significant difference between the mean responses of teachers from Federal and State technical colleges on the challenges faced in the application of higher order thinking skills in teaching building technology.

Methodology

The research design used for this study was the descriptive survey research design. Mulki *et al.* (2016) defined descriptive survey research design as design aimed at casting light on current issues or problem through a process of data collection. The study was carried out in Niger State, Nigeria. The population of the study was 50 building technology teachers that consisted of 40 from the six State own technical colleges and 10 from the only Federal technical college in the study area. Total population sampling technique was used to select sample for the study. The instrument for data collection was a structured questionnaire developed by the researcher titled: Teachers' Application and Challenges in Using Higher Order Thinking Skills Questionnaire (TACUHOTSQ). The instrument was designed on five points rating scale of Always Applied (AA)/Strongly Agree (SA), Applied (A)/Agreed (A), Not Applied (NA)/Disagreed (DA), Always Not Applied

(ANA)/Strongly Disagreed (SD) and Undecided (UD) with numerical values of 5, 4, 3, 2, and 1, respectively. The instrument contained two sections, A, and B. Section A comprises of higher order thinking skills applied by teachers in teaching building technology and section B comprises of challenges faced by teachers in the application of higher order thinking skills in teaching building technology. Cronbach Alpha method was used to determine the reliability of the instrument and found to be .88 and .90 using five building technology teachers from Federal Science and Technical College (FSTC), Orozo, Abuja, Nigeria. The study employed the use of mean to answer the research questions and z-test to test the hypotheses at .05 level of significant. Mean scores above 3.00 was considered as Applied/Agreed and P-value above .05 was considered not significant difference in the mean responses.

Results

Table 1: Mean Responses of Teachers on the Application of Higher Order Thinking Skills in Teaching Building Technology (N1=10, N2=40)

S/N	Items	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_A$	Remark
1.	Engaging practice by asking questions	4.40	3.97	4.06	Applied
2.	Creating discussion groups	2.10	2.07	2.08	Not Applied
3.	Asking questions that contain HOT processes	2.40	2.07	2.14	Not Applied
4.	Adopting teaching techniques that improve HOTS	2.10	2.02	2.04	Not Applied
5.	Leading students through the process of how to connect one concept to another	4.00	3.87	3.90	Applied
6.	Presenting problems from easy to difficult level	4.30	3.90	3.98	Applied
7.	Assigning students to read more HOTS literature	2.20	2.30	2.28	Not Applied
8.	Asking students to think critically	2.30	2.30	2.30	Not Applied
9.	Making games in increasing the level of thinking	2.10	2.05	2.06	Not Applied
10.	Applying problem-solving approach	2.10	2.00	2.02	Not Applied
	Grand Mean	**2.80**	**2.66**	**2.69**	**Not Applied**

Key: N_1 = Federal technical college teachers, N_2 = State technical college teachers, $\bar{X}_1$ = Mean of Federal technical college teachers, $\bar{X}_2$ = Mean of State technical college teachers, $\bar{X}_t$=Average mean of teachers from Federal and State technical colleges.

Table 1 revealed that three items had average mean value above 3.00 and 7 items had average mean value less than 3.00. This indicates that the three items are the higher order thinking skills applied by teachers in teaching building technology in Niger State, Nigeria.

Table 2: Mean Responses of Teachers on the Challenges Faced by Teachers in the Application of Higher Order Thinking Skills in Teaching Building Technology (N1=10, N2=40)

S/N	Items	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_A$	Remark
1.	Lack of knowledge of HOTS	3.70	3.82	3.80	Agreed
2.	Lack of competencies in the application of HOTS	3.40	3.82	3.74	Agreed
3.	Lack of competencies in designing teaching and learning environment that supports HOTS	2.50	3.90	3.62	Agreed
4.	Lack of adequate time to teach for HOTS	2.40	3.75	3.48	Agreed
5.	Teaching for HOTS distracts the process of learning	2.70	3.52	3.36	Agreed
6.	Heavy content of building technology made it difficult to apply HOTS	2.10	2.07	2.08	Disagreed

S/N	Items	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_A$	Remark
7.	Lack of conducive environment for students HOTS	3.40	3.70	3.64	Agreed
8.	Challenge of controlling the various characteristics and attitudes of students in the classroom	2.10	2.05	2.06	Disagreed
9.	Inability of building technology students in learning HOTS is a challenge for teachers	2.80	3.70	3.52	Agreed
10.	Building technology students dependence on teachers	3.50	3.50	3.50	Agreed
	Grand Mean	**2.86**	**3.38**	**3.28**	**Agreed**

Key: N_1 = Federal technical college teachers, N_2 = State technical college teachers, $\bar{X}_1$ = Mean of Federal technical college teachers, $\bar{X}_2$ = Mean of State technical college teachers, $\bar{X}_t$=Average mean of teachers from Federal and State technical colleges.

Table 2 revealed that 8 items had average mean value above 3.00 and 2 items had average mean value less than 3.00. This indicate that the respondents were of the opinion that, the 8 items are the challenges faced by teachers in the application of higher order thinking skills in teaching building technology in Niger State, Nigeria**.**

Table 3: z-test Analysis for Difference between the Mean Responses of Teachers on the Application of Higher Order Thinking Skills in Teaching Building Technology

Respondents	N	$\bar{x}$	SD	df	z-value	p-value	Remark
Federal Technical Colleges' Teachers	10	2.80	0.84				
				48	0.056	0.956	Not Significant
State Technical Colleges' Teachers	40	2.66	0.93				

Table 3 revealed that the p-value > 0.5, which implies that there is no significant difference between the mean responses of both categories of teachers on the application of higher order thinking skills in teaching building technology. Hence, hypothesis one was retained.

Table 4: z-test Analysis for the Test of Significant Difference between the Mean Responses of Teachers on the **Challenges faced in the Application of Higher Order Thinking Skills in Teaching Building Technology**

Respondents	N	$\bar{x}$	SD	df	z-value	p-value	Remark
Federal Technical Colleges' Teachers	10	2.86	1.28				
				48	0.056	0.956	Not Significant
State Technical Colleges' Teachers	40	3.38	1.35				

Table 4 revealed that the p-value > 0.5, which implies that there is no significant difference between the mean responses of teachers from Federal and State technical colleges on the challenges faced in the application of higher order thinking skills in teaching building technology

Findings

1. Engaging practice by asking questions, leading students through the process of how to connect one concept to another and providing students with problems from easy to difficult level are the higher order thinking skills applied by teachers in teaching building technology.
2. Lack of: teachers' knowledge, competencies in the application and designing teaching and learning environment that supports HOTS, adequate time, conducive environment, inability of students and dependence on teachers are the challenges faced by teachers in the application of higher order thinking skills in teaching building technology.

3. There is no significant difference between the mean responses of teachers from Federal and State technical colleges on the application of higher order thinking skills in teaching building technology.
4. There is no significant difference between the mean responses of both teachers on the challenges faced in the application of HOTS in teaching building technology.

Discussion of findings

Findings on the higher order thinking skills applied by teachers in teaching building technology revealed engaging practice by asking questions, leading students through the process of how to connect one concept to another and providing students with problems from easy to difficult level. The findings is in agreement with the findings of Abdul-Talib *et al.* (2015) that revealed teachers gave little evidence of utilizing HOTS in history teaching, despite expressing positive claims on its utilization. This implies that teachers' implementation of innovation to enhancing students achievement is inadequate in the teaching building technology. Nevertheless, the z-test analysis for the test of significant difference between the mean responses of teachers from Federal and State technical colleges on the application of higher order thinking skills in teaching building technology revealed no significant. The findings is in agreement with the findings of Hu *et al.* (2017) that revealed no significant difference between the mean responses of Chinese male and female preschool teachers' knowledge and practice of higher order thinking skills in teaching.

Findings on the challenges faced by teachers in the application of higher order thinking skills in teaching building technology revealed lack of: teachers' knowledge, competencies in the application and designing teaching and learning environment that supports HOTS, adequate time, conducive environment, inability of students and dependence on teachers. The findings concords with the assumption of Retnawati *et al.* (2018) that, the challenges faced by teachers in the application of higher order thinking skills includes lack of teachers knowledge and competencies in designing teaching and learning environment that supports HOTS. Furthermore, the findings is similar to the findings of Jailani and Retnawati (2016) that revealed students' inability and dependence of students on teachers as a challenge in the application of higher order thinking skills in teaching. This implies that, teachers' are faced with several challenges in application of higher-order thinking skills in the teaching building technology. Nevertheless, the z-test analysis for the test of significant difference between the mean responses of teachers from Federal and State technical colleges on the challenges faced in the application of higher order thinking skills in teaching building technology. The findings is in agreement with the findings of Hu *et al.* (2017) that revealed no significant difference between the mean responses of Chinese male and female preschool teachers' knowledge and practice of higher order thinking skills in teaching.

Conclusions

Based on the findings from the study, it is concluded that insight into the phenomena of teachers' application of higher order thinking skills in teaching building technology in technical colleges in Niger State is provided. The study revealed that teachers do not adequately apply higher order thinking skills in teaching building technology and the level of teachers' application of higher order thinking skills in teaching building technology in technical colleges in Niger State is not significant. The results of this study are particularly important for the development of effective strategies for teachers development programme to foster a healthy transfer of knowledge, and thus enhance students' performance in building technology.

Recommendations

1. Teachers should embrace the application of HOTS in teaching building technology in technical colleges so as produce craftsmen with skills capable of solving complex problems.
2. Technical college administrators should endeavor to ensure a conducive learning environment that supports the application of HOTS.

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DIGITAL TECHNOLOGY IN CHILDREN EDUCATION: CHILDREN EDUCATORS PERSPECTIVES IN MINNA METROPOLIS, NIGER STATE, NIGERIA

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Abstract: *In the last decades, there has been a significant increase in the advocacy for the integration of digital technologies into classroom teaching and learning. Literature has indicated that digital technologies have the potentials to enhance learners' engagement, academic achievement, and critical thinking skills. These competencies and skills are essential skills for success in the 21st century. Nevertheless, there seems to be limited research that focused on children learning using digital technology. Therefore, this study determined Digital Technology in Children Education: Children Educators Perspectives in Minna Metropolis, Niger State, Nigeria. The research design was a descriptive survey. The population of the study involved all children teachers in Minna metropolis, Niger State. The sample size was made up of ninety-three (93) respondents who were selected using simple random sampling. The study was guided by three research questions and two hypotheses, which was tested at 0.05 significant level. Questionnaires on children teachers' awareness, attitudes and teachers' readiness to use digital technology for children education were adopted for data collection. The instrument was pilot tested and using Cronbach Alpha, and the instrument yielded a reliability coefficient of between 0.72 and 0.76. The findings of the study indicated that there is no significant difference between male and female teachers' perception on the use of digital technology for instruction. Hence, it was recommended that digital technologies be made available for children learning.*

Keywords: *Digital Technology, Children Learning, Teachers' perception, Teachers' Self-efficacy*

Introduction

Digital technologies have the potentials to create a learning environment that will enhance meaningful learning in the classroom. Studies have advocated for the integration of digital technologies for learning at all levels of education, especially among children (Fleer, 2011; Yelland, 2011). Effective early childhood education is vital for children success at other successive levels of education. To achieve this laudable objective, the teacher's perception of these digital technologies is a crucial factor to be considered. However, there seem to be no adequate guidelines to help teachers, and no policy in place to compel teachers, especially at the early childhood education to implement these devices. One of the critical ways technology integration can be achieved is by increasing teachers perception and training of teachers to integrate different technological tools into teaching and learning (Hammonds, Matherson, Wilson, & Wright, 2013). There is a need for teachers to focus on technology-enhanced learning to prepare students for academic success (Ertmer & Ottenbreit-Leftwich, 2013). Consequently, the best place to implement digital technologies for learning should be at the childhood level of education, this could form the necessary foundation for the children successful use of technology at the subsequent level of education. Given the importance to implement digital technology among children, it is imperative to consider teacher perspective of using digital tools to enhance learning. Because while some teachers integrate digital technologies in their classroom, others believe that children may abuse it and become addicted to it (Ibrahim, 2013). Despite the benefit of digital enhanced-learning devices among children, technology on its own cannot be guaranteed meaningful learning. Teachers are the facilitators and mediators of technology-enhanced learning (Blackwell, Lauricella, & Wartella, 2014). Perception is a vital construct that account for the level of engagement, and diverse opinion among individuals in a given phenomenon. It involves attaching meaning and experiences to a given context. Hence, perception or perspective in this study involves teachers' mental judgement resulting from experiences and awareness of the use of digital technologies among children in this study, the use of digital technology-enhanced learning among children. However, teachers' perceptions may vary, while some teachers rely on technology in their classrooms, others don't (Ibrahim, 2013).

Childhood educators that perceive that digital technology are vital for pupils learning are likely to integrate technology for teaching and learning. On the contrary, teachers who see technology negatively are less likely to use technology in their classrooms (Hammonds et al., 2013). Consequently, knowledge of teachers' perspective on digital technology in Children Education could contribute meaningful literature to this important subject matter. Digital technology in this study is broadly defined to include portable computers, electronic books, digital toys, mobile phones, portable computers, video games and desktop, among others. In other words, digital devices in this study refer to all products bought and integrated for children's learning. The literature on the use of digital technology at early childhood education is inconclusive; Alon and Fuentes 2014) advocated for technology-enhanced learning among children. While other researchers argue that technology-enhanced learning has a negative influence on children learning and underscore the importance of hands-on learning and exploratory experience among children (Davidson, Given, Danby, & Thorpe, 2014). Contrary to this, others opined that age should not be a barrier to the integration of technology for classroom instruction (Vandewater et al., 2005). The evolving landscape of the use of digital technology provides the need to assess teachers' perception on the use of technology. However, literature is replete on teachers of older children perspectives on technology use (Ertmer & Ottenbreit-Leftwich, 2013; Teo, 2014). Given how digital technology impacts children. Despite the benefit of digital technology in learning among children, technology on its own cannot generate meaningful learning. Teachers are mediators of technology-enhanced instruction. Nikolopoulou and Gialamas (2013) highlighted teachers negative perception and lack of training and development opportunities as some of the problems or barriers to the implementation of digital devices in early childhood education. Lindahl and Folkesson (2012) reported that children teachers attitudes have a significant influence on their adoption of technology for teaching and learning. Hermans, Tondeur, Van Braak, and Valcke (2008) reported teachers' positive attitudes towards digital devices in the classroom.

Statement of Problem

Digital natives are today young people in our school who are growing up in the world of digital devices such as computers, cell phone, internet, among others. Palfrey and Gasser (2008) prove that digital natives are those born in the digital age and who have access to digital technology. Therefore, technology is part of their lives both in school and out of school. However, teachers' perspectives on the integration of these digital technologies for instructions among children calls for concern. Lindahl and Folkesson (2012) reported that teachers' perception is one of the most common barriers to technology integration among children. However, researchers have highlighted that there is limited use of digital technologies in children's education (Blackwell, 2013; Vockley & Lang, 2011). Considering the critical role of digital technologies in children learning, it is essential to consider teachers perception and behavioural intentions to use of these devices in children instruction (Obielodan, Amosa, Ala, & Shehu, 2019). Perception refers to an individuals' sensory impression of an existing phenomenon. Obielodan et al. (2019) reported that male and female educators have a similar perception of the use of digital devices. Therefore, gender is considered as a moderating variable in this study to determine its effects of teachers' perception. Thus, children teachers' perception of digital technology and children instruction will contribute to the existing literature on the subject matter

Research questions

1. What is the perception of children-teachers on digital technology for children instruction?
2. What is the behavioural intention of children teacher to the use of digital technology for children instruction?

Hypothesis

H_{O1}: There is no significant difference in the behavioural intention of male and female children teachers towards the use of digital technology for children instruction

Methodology

The study adopted descriptive statistics on (cross-sectional) survey design. The descriptive design in this study involves the use of a quantitative approach to gathering data (Creswell, 2012). The population of the study is made up of all children teachers in Minna metropolis, Niger State. A multi-stage sampling procedure or approach was used in selecting the respondent for this study. First, the stratified sampling technique was employed to divide Minna Metropolis into two strata; Bosso local government and Chanchaga local government. Five schools were randomly selected from each local government and all the children teachers chosen from the schools were used for the study. The sample size was made up of 93 children-teachers; 31 of the children were from the private school, and 61 were from government institutions. The sample size was also made up of 51 female teachers, and 42 were male teachers. The instrument for data collection was adopted structured questionnaire. The questionnaire is a 5-point Likert- scale of Strongly agreed (5) Agreed (4) Undecided (3) Disagreed (2) and Strongly disagreed (1). The instrument was made up of section A, B and C. Section A is made up of respondent demographic data, Section B is made up of 10 items that sought to determine children teachers' perception towards digital technology for children instruction. Finally, Section C consists of 8 items that sought to determine children teachers' behavioural intention towards the use of digital technology for children instruction. The structured questionnaire was validated for face and content by two educational technology experts, two educational phycologists, 1 English language expert. The instrument yielded a relatively coefficient index of 0.72 and 0.75 using Cronbach alpha. This agrees with Hair, Black, Babin, and Anderson (2010) who reported that the Cronbach's Alpha reliability value of 0.60 and above is adequate for instruments developed in the field of education and social science. The researchers solicited the cooperation of the respondents to encourage objective responses the researchers promised them that the data would be strictly treated for this study and confidentially. Secondly, the respondents were advised not to write their names to encourage objectivity. The researchers administered the 100 Questionnaires, but only 93 respondent returned their responses. The data collected were analysed using descriptive and inferential statistics. Research questions were answered using mean and standard deviation while the formulated hypothesis was tested using t-test at 0.05 level of significance. The benchmark for agreeing and rejecting an item and the grant mean was 3.00 and above and less than 3.00 respectivelying. This was determined using the average mean of a 5-point Likert scale (3.00) (Owodunni, 2019).

Results

Table 1: Perception of the Respondents on the Use of Digital Technology for Children Instruction

S/N	ITEMS	N	Mean	SD	Decision
1.	Digital technology makes the students to develop creative skills	93	3.14	1.06	Agreed
2.	Using digital technology encourages student`s participation in achieving learning goals	93	3.26	1.30	Agreed
3.	Digital technologies enhance students' understanding	93	3.24	1.20	Agreed
4.	Digital technology provides instant feedback	93	3.80	2.63	Agreed
5.	Children concentration during learning is enhanced using digital technologies	93	3.48	1.43	Agreed
6.	Teaching and learning through digital technologies allow children and facilitators to brainstorm on the subject matter	93	3.24	1.35	Agreed
7.	I have the knowledge to employ digital technologies for children learning	93	3.36	1.41	Agreed

S/N	ITEMS	N	Mean	SD	Decision
8.	I can facilitate and monitor my children's learning process using digital technologies	93	3.62	2.24	Disagreed
9.	Digital technologies have negative effects on learning	93	2.12	1.12	Disagreed
10.	I feel digital technology is time-wasting and a distraction to the student	93	2.34	1.46	Disagreed
	Grand (Mean and Standard Deviation)		3.16	1.41	Agreed

Table 1 shows the findings of children teachers' perception of the usefulness of Digital technology for instructions. The children teachers from the population perceive Digital technology to be useful for children instruction. The average mean of 3.0 was used as the benchmark for agreeing and less than 3.0 for disagree on each item. Consequently, items 1-8 shows the mean of between 3.14 – 3.80, and the grand mean 3.16, indicating that digital technology is perceived as useful for children instruction. The finding of item 9 and 10, which are negative items show that the respondents did not agree that digital technologies have negative effects and are a distraction to children learning. The standard deviation of the respondents' perception was between 1.02-2.63, indicating that there is no significant deviation of respondents' perception and from the mean in their responses.

Table 2: Behavioural Intention of the Respondents to the Use of Digital Technology for Children Instruction

S/N	Items	N	Mean	SD	Decision
1.	I consider digital technologies as innovation, and I am ready to adopt them for children learning	93	3.20	1.26	Agreed
2.	I engage in technology-enhanced teaching with my skills	93	3.28	1.30	Agreed
3.	I am willing to serve as a facilitator for children learning using digital technologies	93	3.44	1.20	Agreed
4.	I am prepared to respond to children questions and inquires on learning with digital technology	93	3.60	1.83	Agreed
5.	With enabling environment, I am ready to engage in digital technology-enhanced learning	93	3.46	1.43	Agreed
	Grand (Mean and Standard Deviation)		3.40	1.40	Agreed

Table 2 shows the findings of children teachers' behavioural intention to the use of digital technology for children instruction. The average mean of 3.0 was used as the benchmark for agreeing and less than 3.0 for disagree on each item and the grand mean. Consequently, all items show the mean of between 3.20 – 3.60 and the grand mean is 3.40, indicating that all the respondents have the intention to integrate digital technology for children instruction. The standard deviation of the respondents' behavioural intention to the use of digital technology for children instruction was between 1.20-1.83 indicating that there is no significant deviation in the respondents' behavioural intention to the use of digital technology to enhanced children learning.

Table 3: t-test of Male and Female Responsents' Perception on the Use of Digital Technology for Children Learning

Gender	N	Mean	SD	df	t-value	p-value	Decision
Male	42	14.27	1.47	91	2.66	0.08	Not Significant
Female	51	11.63	2.24				

Table 3 shows there is no significant gender difference in the perception of digital technologies for children instruction $t(91)=2.66$, $p=0.08$ ($p>0.05$). Hence, the hypothesis H_{O1} is accepted.

Findings and discussion

The findings indicate that children teachers perceive digital technologies to have a critical role in meaningful teaching and learning among children. The findings corroborate with the earlier findings of (Teo, 2014) and (Hermans et al., 2008) who also reported teachers positive perception of digital technologies for effective teaching and learning among children. This also agrees with Lindahl and Folkesson (2012) who reported that digital technology is an important tool for instruction among children. However, this finding did not correspond with Nikolopoulou and Gialamas (2013) who reported teachers' negative attitudes towards digital technology for teaching which could be attributed to their negative perception The findings of the study could be attributed to the fact that digital technology has impacted every sector of human endeavours, the education system inclusive. The use of digital devices such as computers, handset and calculators, among others, could help to influence their perception of digitally enhanced learning among children.

The findings also show that gender does not influence teachers' perception of digital technologies for children instruction. These findings are supported by Obielodan et al. (2019), who reported no differences between male and female teachers perception of the use of digital technology (blended learning) for instruction. These findings could be attributed to the fact that both male and female teachers are digital natives and digital technologies have become an integral part of their lives (Palfrey & Gasser, 2008). Hence, they have similar perception and behavioural intention on the use of these devices.

Conclusion

Digital technology is viewed as a veritable tool that will enhance meaningful learning at all levels of education. Therefore, the quest to integrate digital technology for classroom instruction is at the forefront of educational discourse. Given the findings, it is logical to conclude that digital technology has infiltrated children educators, and this was demonstrated by the positive perception and behavioural intention to integrate digital technology for classroom instruction. The teachers of this population perceive that these devices have no negative effects on children education. Gender did not play a significant role in on respondents' perception, suggesting that irrespective of gender, children teachers have positive perception towards technology-enhanced learning. Hence, this study provided a theoretical understanding of children teachers perception of digital technology.

Recommendations

1. Digital technologies for children education should be provided for children teachers use in their classroom.
2. The conducive learning environment and motivation should be provided for children teachers to engage in digital technology-enhanced learning.

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RE-SKILLING NEEDS OF WOOD TECHNOLOGISTS TOWARDS SUSTAINABLE ENVIRONMENTAL PROTECTION IN NIGERIA

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Abstract: *Re-skilling boosts the morale of workers towards better performance in the organization. Re-skilling aids workers to improve their skills and knowledge which enhances their performance in their places of work. Failure in periodic re-skilling of technologists affects theirperformance across the globe. Hence, this paper explained extensively the needs for re-skilling wood technologists for sustainable environmental protection in Nigeria. The paper identified areas wood technologists need to be re-skilled in order to protect the environment. These area include roof design and construction (carpentry), joinery work, use of woodworking machines, tree planting, tree pest and disease control.*

Keywords: *Re-Skilling, Wood Technology, Sustainable Environmental Protection*

Introduction

Skill according to Hornby (2000),is theability, experience and knowledge to be able to do well. It can therefore be deduced from this expression that skill is an acquired knowledge associated with ability to perform in a practical term which may involve subjecting a material to manipulation to produce an item using hands and equipment. Technologists are laboratory workers in charge of tools, materials and equipment used forpracticals. They are also charged with the maintenance of tools and equipment. Turkman (2005) referred to technologist as a specialist who satisfy societal needs by exploiting modern technologies and environment conservationsand also works in a formal sector of the economy. Wood technologists are specialists that work to determine composition, properties, behaviour, utilization, development, treatment and processing of wood and wood products. They analyze physical, chemical and biological properties of wood, study method of curing wood to determine the best and most economical procedure, develop and treating methods (seasoning), preservation and resistance to wear, fire, fungi, insects and marine borers.They conduct tests to determine the ability of wood adhesives to withstand water, oil penetration, temperature extremes and ability, strength and hardness of wood under varieties of conditions (Tan, 2000). They were trained in polytechnics, monotechnics and other relevant tertiary institutions where they are made to take course in forestry studies, carpentry and other wood related courses during their course of study and obtain National Diploma and Higher National Diploma certificates. The contribution of wood technologists in national economy is of a great importance, they are involved in tree protection, research work into re-creational environment and environmental protection, construction of wood products and as well maintenance of tools, equipment and workshop management. However, the wood industry is undergoing a lot of transformation as a result of technological development in wood tools and equipment (Kareem &Okwori, 2018). Similarly, wood technologists are faced with various challenges in the performance of their duties and this calls for acquainting them with modern wood processing so as to keep them updated and be relevant in their jobs. Some of the areas where wood technologists need re-skilling are carpentry works, tree planting, harvesting, and re-planting skills towards sustainable environmental protection in Nigeria.

Concept of re-skilling need

The term skilling has been defined in various ways by several authors for example Jackson and Schuler (2003) defined skilling as improving competencies presently needed by individuals. Training is also described as acquisition of knowledge, skills and ability to enable individual function optimally in the performance of the careers and as well for development and growth of nation (Olumukoro&Marbel, 2012). However, skilling and re-skilling has always been discovered

and known to be a universal remedy that helps to improve performance of workers. Skilling and re-skilling are set of activities planned and arranged to assist individual in the industries or related field to acquire knowledge, skills, right attitude and services as enthusiasm to enhancing the effectiveness of the performance in a specific task (Imhabekhai, 2000). Every career requires skilling and re-skilling at all levels in the organizationsince it can be used to develop mental ability, dexterity, skills and renew or update of workers at all levels. Momoh (2012) did classified types of training and re – training (re-skilling) techniques into three categories, namely; on - the – job techniques, formal techniques and executive techniques. Also, in the context, the major forms of training and re - training for craftsmen are in - service training and formal training (Olomukoro&Marbel, 2012). In other words, retraining is a development encompasses the revitalization of workers' knowledge, attitude, skills, competences and work habits to enable them perform optimally to the expectation of their employers (Imhabekhai, 2000). Re-skilling can also be said to mean re- training and as a result changes occur during the process. The need to retrain or up-grade skill otherwise known as train again is an indication of occurrence of discrepancy (Needs). The reason for re-skilling is to bring about transformation in performance of the technologists which is planned based on needs (Kareem &Okwori 2018). This kind of re-skilling takes place in a formal settings which include, tertiary institutions, UNESCO Nigeria Technical Vocational Education project North Central Nigeria, National Agency for Science and Engineering Infrastructure (NASENI), the National Directorate of Employment (NDE), Federal Ministry of Labour and Productivity and industries among others.

Re-skilling needs of wood technologists for sustainable environmental protection

Technologically, re-skilling needs should be related to the technological problems and should provide answer to technological problems. The only way to achieve this is to re-trainwood technologists in allthe wood technology courses taken during their course of studyingespecially in the area of sustainable environmental protection. These areas of retraining needs include re-training in carpentry and joinery work, tree planning and re-planting, seed selection and dressing, bed preparation, maintenance of trees, and harvesting among others (Okwori, 2012). The professional areas of wood that need re-skilling by wood technologists includes carpentry works, design of various roof to aid in breaking wind to protect the environment. These includes gable or pitch roof, hipped roof, shed roof and mansard roof for residential houses, market store, bus parks shed. Other areas are shopping complex, stadium, recreational environment and public places. High roof is essential for breaking wind and if properly constructed it cannot easily be blown by wind. In the light of the above, the technologists will need re-skilling in selection of appropriate timber, appropriate joints for rafters, beams, king posts, nailing skills, application of preservative and finishing on interior works and skill in trimming the roofing sheets.Wood technologists also need re-skilling in tree planting, this includes bed preparation Skills such as tilling of the soil, fertilizer application (Natural or Artificial) that is, the use of manureand fertilizer using manual mechanical application, skills in planting or transplanting. They also need re-skilling in maintenance of tree, pest and disease control. Pests and diseases affect the proper growth and health of trees.

Re-skilling needs in tree planting towards sustainable environmental protection

Trees are infested with diseases as a result of some reasons emanated from lack of proper skill in planting and nurturing of the tree. When trees are planted very close to each other without enough space, the branches of trees or shrubs touching each other allow spreading of diseases (Okwori, 2012). Controlling insects and pests infesting forest trees is very important. The following are outlined for controlling tree insects and pests in the forest. All residues in the forest need to be cleared as this will prevent attraction of insects and pests. Also,all branches and leaves cut from the plants should be removed from the forest.Note that once trees are infested, it is only chemical that is effective in bring them back to life.This is because infested trees need applications of

insecticide whichneedsknowledge and skill for effectiveapplication by wood technologists for sustainable environmental protection.

Re-skilling needs in carpentry and joinery towards sustainable environmental protection

A study was conducted on Evaluation of practical skills possessed by woodwork graduates of technical colleges in Niger State, Nigeria by Okwori,Adamu and Odo *(*2013)and objectives of the study was to determine the level of skills possessed and the extent in the use of woodworking hand tools by graduates produced by the technical colleges. The finding of the study showed that woodwork graduates of Niger State technical colleges possess skills in the use of some powered mechinesexcept band saw machines, tenonning machine, mortiser and thicknesserand mortiser. However, the graduates need re-skilling in the use of an identified machines such as modern lathe machine and Computer Numeric Control (CNC) machine that they cannot put into use to enable them function effectively in environmental protection projects. The study recommended that Government should intensity efforts in the provision of modern tools and equipment for improving practical skills of woodwork students.

Study focus

A research was conducted on up-skilling needs of woodwork technologists in tertiary institution in North central, Nigeria by Kareem &Okwori (2018). The study determined the skills required, the skill possessed and up-skilling needs of technologists in Colleges of Education, Polytechnic, Mono-technic and Universities with NCE, B.Tech/B.Sc and HND qualifications within the study of area. The finding of the study showed that fifteen (15) items out of forty-two (42) showed a level of significant difference which indicates areas of skill improvement needs by technologists. The finding also shows that technologists with degree and NCE needed more skills in various items than those with H.N. D qualification, this finding was due to the fact that the H.N.D holder had more practical experience than NCE &B.Sc/B.Tech holders during their course of study. The result of the study is in Table 1.

Table 1: Mean and z-test of Skill Required and Possessed by the Woodwork Technologists for Optimal Performance in Woodwork Technology in Tertiary Institutions in the North Central Nigeria

S/N	ITEMS	$\bar{x}_1$ N=101	$\bar{x}_2$ N=101	SD_1	SD_2	Sig.	Remark
	Skills in General Woodworking						
1.	Classifying of wood into hard and soft wood.	3.62	2.96	1.35	1.44	0.01	**S**
2.	Identification of both physical and mechanical properties of timber and its characteristics	3.60	2.76	1.13	1.30	0.01	**S**
3.	State technical names for marketing wood.	3.71	2.59	1.13	1.39	0.09	**NS**
4.	Identification of wood defects both natural and artificial.	3.62	2.62	1.26	1.24	0.38	**NS**
5.	Identification of types of wood preservative.	3.62	2.62	1.27	1.16	0.11	**NS**
6.	Treat wood with relevant preservative.	3.83	2.50	1.18	1.27	0.37	**NS**
7.	State the process of manufacturing board and its application.	3.62	2.35	1.27	1.15	0.07	**NS**
8.	Produce a detailed drawing and transfer details to a full size set out	3.86	2.65	1.13	1.14	0.01	**S**
9.	Utilization of factors of a good design.	3.81	2.73	1.18	1.36	0.07	**NS**
10.	Design works with emphasis on	3.80	2.54	1.04	1.15	0.00	**S**

S/N	ITEMS	$\bar{x}_1$ N=101	$\bar{x}_2$ N=101	SD_1	SD_2	Sig.	Remark
	construction techniques.						
11.	Sharpen saws and other cutting tools	3.71	2.74	1.28	1.35	0.09	**NS**
12.	Prepare bill of materials	3.61	2.43	1.36	1.24	0.23	**NS**
13.	Read and interpret drawings to determine materials required for construction.	3.74	2.51	1.15	1.19	0.11	**NS**
14.	Restores a structure to a former state in all aspect of woodwork.	3.78	2.51	1.03	1.17	0.01	**S**
15.	design based on elements and principles of good design	3.66	2.35	1.10	1.09	0.02	**S**
16.	Mix pigments, oils and other ingredients to obtain the required colour	3.69	2.53	1.14	1.30	0.32	**NS**
	Skills in Joinery Work						
17.	Mark off and produce the joint commonly used in the profession, such as mortise and tenon joints, halving joints, cut housings; bridle joints; and angle bridle joint	3.65	2.71	1.27	1.22	0.03	**S**
18.	Set off and construct framed; ledged and braced doors, and framed for transparent roof sheets in buildings	3.72	2.82	1.21	1.20	0.00	**S**
19.	Identification of various types of wood adhesives, abrasives and wood finishes.	3.69	2.67	1.10	1.20	0.00	**S**
20.	Apply preservatives to joints and frames	3.57	2.52	1.17	1.33	0.38	**NS**
21.	Carryout trial assembling of joints	3.65	2.43	1.33	1.28	0.96	**NS**
22.	Apply adhesives to joints	3.83	2.57	1.10	1.22	0.06	**NS**
23.	Nailing of joints together perfectly joints	3.67	2.50	1.17	1.08	0.01	**S**
24.	Cleaning of excess glue from the joints	3.76	3.13	1.16	1.45	0.00	**S**
	Skills In Carpentry Work						
25.	Construct roof that are high to serve as wind breaker	3.56	2.54	1.27	1.34	0.11	**NS**
26.	Construct facial board and fixed to the rafters	3.71	2.73	1.26	1.30	0.02	**S**
27.	Nail roofing sheets to rafters	3.72	2.54	1.13	1.25	0.21	**NS**
28.	Trim roofing sheets	3.44	2.47	1.24	1.25	0.13	**NS**
29.	Erect a free standing scanfold in a safe manner	3.90	2.62	1.13	1.17	0.01	**S**
30.	Locate and construct building geometry (roofs, centre for archies, beams and others).	3.70	2.60	1.20	1.19	0.11	**NS**
31.	Ability to set out for big and small building	3.82	2.42	1.17	1.21	0.53	**NS**
	Skills in Machine Woodworking						
32.	Identification of modern woodworking tools.	3.70	2.62	1.21	1.31	0.33	**NS**
33.	Observe simple rules in the use of machine and equipment	3.50	2.79	1.37	1.31	0.13	**NS**
34.	Carryout various types of maintenances of wood.	3.47	2.51	1.27	1.25	0.50	**NS**
35.	Use modern powered methods of finishing	3.66	2.41	1.22	1.17	0.57	**NS**

S/N	ITEMS	$\bar{x}_1$ N=101	$\bar{x}_2$ N=101	SD_1	SD_2	Sig.	Remark
	wood.						
36.	Service and repair tools and equipment used in wood laboratory or workshops.	3.71	2.61	1.13	1.26	0.02	**S**
37.	Take inventories, replacements, installation and dismantling of equipment.	3.65	2.47	1.23	1.19	0.23	**NS**
38.	Install machinery and equipment according to lay out plans, blueprints, and other drawing in Industrial establishment or schools	3.89	2.45	1.25	1.20	0.26	**NS**
39.	Operate CNC lathe, router, drill machines to perform operations such as turning, facing and many other	4.30	1.70	1.11	1.08	0.08	**NS**
40.	Operate glue-size machines	3.72	2.71	1.26	1.30	0.00	**S**
41.	Operate one or more manual or power-fed woodworking machines for surfacing, sizing, joint construction, cutting tongues, groves, bevels, beads or molding patterns.	3.74	2.32	1.21	1.18	0.74	**NS**
42.	Operate band saw machines, circular saws, thickness and mortise	3.63	3.02	1.28	1.40	0.02	**S**

Key: N = Number of Respondents, $\bar{x}_1$= Mean of Skill Required, $\bar{x}_2$ = Mean of Skill Possessed, SD_1 = Standard Deviation of Skill Required SD_2 = Standard Deviation of Skill Possessed, Sig. = Level of Significance, S = Significant, NS = Not Significant.

The table above presents the analyzed the outcome on the skill required, skill possessed and the up-skilling needs by woodwork technologists in tertiary institutions in north central, Nigeria.

The skill required shows that the respondents required up-skilling in all 42items with an average mean of 3.10. However, the mean result ranging from 3.44 to 4.30 as displayed in the table, is an indication that all the presented items are required skills by woodwork technologists and are within the range of moderately required at required levels. Also, the standard deviation outcome ranged from 1.03 to 1.35 indicated that the technologists have closer opinion in their responses to the items. In other words, the technologists have similar view on the woodwork skills required for optimal performance in their tasks.

The skill possessed by woodwork technologists showed that the respondents possessed skill slightly and moderately with mean range of 1.70 to 2.96. The average mean of skill possessed by the technologists is 2.33 (moderately posessed). This implies that the respondents possessed some level of skills in woodwork technology that actually made them employable but the skills possessed are very low. The standard deviation on skill possessed ranged from 1.03 to 1.35 which shows that the respondents share similar view on the skill possessed in woodwork technology, this is noted in the closeness of their responses as indicated by the standard deviation.

The z-test of the mean contrast between the skill required and skill possessed showed that there are significant differences in 16 items. This implies that the respondents have different opinions in their ratings of the items in terms of needs which is an indication that technologists need up-skilling at different levels in 15 items which are 1,2,8,10,14,15,17,18,19,23,24,26, 29,36, 40 and 42.

Federal environmental protection (FEPA) in Nigeria

Federal environmental protection agency (FEPA) act of 1988 was established by decree 55 of Dec 30th 1988. FEPA was vested with the statuary responsibility for overall protection of the environment. The FEPA decree covers all sectors that deals with environmental issues. The decree

contains penal provisions against offenders discharging hazards substances in harmful quantities into the air, land and water. The decree requires FEPA to issue environmental guidance and standards for the abatement and control of all forms of waste management. This guideline was launched in 1990. In 1991, FEPA established an inspectorate and enforcement department with division for standard regulation, chemical tracking and compliance monitoring waste management. All these were directed by exercising control and preventing hazard towards environmental protection in Nigeria (FEPA, 1988). Environmental protection law was recently put in place by some states. These are laws or Edicts which make provision for the control of certain environmental issues (Gasali, 2017). These issues includes Tree planting, cleaning gutters, enchanting the aesthetic quality of the environment nutshell.The purpose of these legislations is to make provisions towards the improvement of environmental quality of the states in line with the objective of the policy on Environmental and FEPA act. Cross River State for example legislated an edict on Environmental protection Agency Edict No 4 of 1996 as well as Enugu State Environmental project Agency Edict, No 2 of 1996. It was enacted by these states in order to provide law for the sustainable environmental management in terms of monitoring control of gaseous and other wastes discharged into the state environment so as to manage them towards environmental protection.

Conclusion

There is no doubt about the fact that technologists across the globe needs to be updated in their skill performance. This is because technological changes and advancement is evident in the society. This paper addressed the re-skilling needs of wood technologists for sustainable environmental protection in Nigeria. The paper identified areas of re-skilling by wood technologists which includes carpentry work, tree planting and its maintenance among others.

Recommendations

1. The education stake holders such as federal and state Ministry of Education should give needed attention to technology education by away of providing adequate funding for the skilling and re-skilling of wood technologists towards sustainable environmental protection.
2. The organization should partner with NGO and industries for the re-skilling of technologists towards environmental protection.
3. Educational institutions and other organizations should organize a periodical re-skilling programme for technologists in order to protect the environment effectively.
4. The practical period in technical institutions should be adequate, so as to enable the learners acquire necessary practical experience during the course of study in order to protect the environment effectively after graduation.

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ASSESSMENT OF THE IMPACT OF MOTOR VEHICLE EMISSION ON THE ENVIRONMENTAL HEALTH OF PEOPLE LIVING IN SULEJA METROPOLIS

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Abstract: *This study assessed the impact of motor vehicle emission on the environmental health of people living in Suleja metropolis. Three research questions were raised and three hypotheses were formulated to guide the study. The research questions assessed the status of motor vehicle emission and health-related problems in the study area. The study employed a descriptive survey design. A thirty (30) item questionnaire was used to collect data from (150) respondents located in Suleja metropolis. All the one hundred and fifty respondents were used for the study. Findings revealed among others, is that motor vehicle emissions are the major causes of health problems affecting the population. Based on the findings of the study, recommendations were made which among others include; Developing effective Control of automobile emissions quality management programmes; improvement of motor traffic flow and control which requires good city road network; provision of reliable mass transport system which will reduce the number of vehicles and motorcycles on Suleja metropolis road and therefore reduce emissions; and strengthening of the vehicle inspections and maintenance department.*

Keywords:*Motor Vehicle, Emission, Climate Change, Transportation, Environmental Pollution*

Introduction

The effect of Climate change as a result of environmental pollution from gases leading to global warming is a thing of global concern which must be continually addressed. This affects more than half of the world's population is urban, and cities emitting 75% of all carbon dioxide from energy use (Bai, 2018), cities and satellite towns such like Suleja are increasingly feeling the effects of extreme weather, and floodplains. Chu and Pan (2017) observed thatClimate change is a crucial issue that concerns about the survival and development of human beings. As asserted by Bai, (2018), more than 1,000 people died and 45 million people lost homes, livelihoods and services when severe floods hit Southeast Asian cities, including Dhaka in Bangladesh and Mumbai in India. The case is the same in Nigeria with those living in the riverside areas in some parts of Nigeria including Niger State.

According to Ritchie and Roser (2019), carbon dioxide is not the only greenhouse gas which contributes to climate change—nitrous oxide and methane are also greenhouse gases. It comes to a consensus gradually that carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and hydrogen fluoride (HFCs) eventually led to global climate change that we produced during all production and life activities. Carbon dioxide is the most important factors in greenhouse gases. From a global perspective, highway transportation is one of the three main carbon sources of greenhouse gas emissions. It has been classified into various categories that include air pollution, water pollution, soil pollution, noise pollution and electromagnetic radiation pollution among others.All these are dangerous to public health. Presently, exposure to a high level of emission over a long period has a negative resultant effect on human health.Air pollution can be caused by the release of small particles or noxious gases being released into the atmosphere, whether by natural or artificial sources. If left unchecked, the chemical aspect of air pollution could become the largest contributor to premature death in the world, higher than the rate of cancer, HIV/AIDS, automobile accidents, or any other cause of unnatural or premature death. Bai (2018) observed that, by 2030, millions of people and US$4 trillion of assets will be at risk from such events (Bai, 2018). Most people make the assumption that the greatest single cause of air pollution is the big factories, especially in the big cities; however, the greatest single contributor to the pollution problem facing not only the United States but also the entire world is automobile emissions which come mainly from cars and

other types of automobiles, as well as off-road vehicles (Heinke, 2004). Transportation mostly from automobiles caused over half of the carbon monoxide, over a third of the nitrogen oxides, and almost a quarter of the hydrocarbons in ouratmosphere in 2006, (Lage, 2008). With the number of vehicles on the road and the number of vehicle miles travelled escalating rapidly, we are on the fast road to uncontrollable air pollution. These substances have been shown to produce harmful effects on the blood, bone marrow, spleen, and lymph nodes. The tars and other organic compounds released in the smoke from automobiles also pollute the atmosphere, and, when they land on the ground, pollute the soil and can potentially enter the groundwater and drinking supply. This problem of this study is therefore to assess the impact of motor vehicle emission on the people living in Suleja metropolis as regards to guide on environmental protection.Environmental pollution is the contamination of the earth's environment that has interference with the environment which is hazardous to human health.

Research questions

1. What are the statuses of motor vehicles emission in Suleja metropolis?
2. What are the health problems resulting from motor vehicle emission?
3. What are the strategies for effective management of emission from the motor vehicle?

Hypotheses

H_{O1}: There is no significant difference between the mean response of motor vehicle owners and residential occupants on the statuses of motor vehicles emission in Suleja metropolis**.**

H_{O2}: There is no significant difference between the mean response of motor vehicle owners and residential occupants on health problems resulting from motor vehicle emission.

H_{O3}: There is no significant difference between the mean response of motor vehicle owners and residential occupants on the strategies for effective management of motor vehicle emission.

Methodology

The research design was a survey method with the use of a structured questionnaire to collect the required information from the respondent adopted.The study was carried out inSuleja metropolis, Niger state, Nigeria. An accessible of 50 motor vehicle owners and 100 residential occupants of Suleja metropolis was used for the study. The total population of one hundred and fifty (150) respondents were used for the study. The questionnaire used to gather information was developed based on four-point Likert's rating scale by the researchers. The questionnaire was administered to the respondents by the researchers personally. The data analysis techniques employed in this study are descriptive and inferential statistics. Descriptive statistics which includesmean and standard deviation while the inferential statistic involves the use of t-test. Mean score above 2.50 was considered agreed and mean scores below 2.50 was considered disagreed. T calculated value above the t-critical ±1.96 was accepted and calculated value below the t-critical ±1.96 was rejected.

Table 1: Mean Response of Residential Occupants and Motor Vehicle Owners on the Status of Motor Vehicle Emission in Suleja Metropolis (N_1= 50; N_2= 100)

S/N	Item	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_t$	Remarks
1	Motor vehicle traffic has increased tremendously	3.42	2.39	2.91	Agreed
2	Increased urbanization and industrialization are accelerating the use of motor vehicles	3.76	3.82	3.79	Agreed
3	Enhanced concentrations of emission in Suleja has greatly exacerbated	3.30	2.39	2.85	Agreed
4	A fleet of diesel-powered trucks strongly influences air quality	2.56	2.26	2.59	Agreed

S/N	Item	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_t$	Remarks
5	Smog is becoming a serious issue in Suleja	2.52	2.62	2.57	Agreed
6	The level of motorization has increased vastly	2.62	2.21	2.42	Disagreed
7	Serious air quality deterioration	2.70	2.79	2.75	Agreed
8	People are exposed to motor vehicle emissions	2.62	2.69	2.66	Agreed
9	Motor vehicles emissions are the major source of health problems affecting the populations	2.70	3.83	3.27	Agreed
10	Motor vehicles emission are the major source of air pollutants	2.29	3.12	2.02	Agreed

KEY: $\bar{X}_1$ = Mean score of residential occupants, $\bar{X}_2$ =Mean score of motor vehicle owners, $\bar{X}_t$ = Average mean score of residential occupants and motor vehicle owners, N_1 =Number of the residential occupant, N_2 = Number of motor vehicle owners.

The result presented in Table 1 above shows that the respondents in two groups (residential occupants and motor vehicle owners) agreed with all the items with the mean score above 2.50 except item6 with the mean score below 2.5.

Table 2: Mean Response of Residential Occupants and Motor Vehicle Owners on the Health Problems Resulting From Motor Vehicle Emission (N_1= 50; N_2= 100)

S/N	Items	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_t$	Remarks
11	It causes cancer in humans	3.64	3.73	3.69	Agreed
12	It has a direct effect on the ozone layer	3.34	3.32	3.33	Agreed
13	It has toxic impacts on natural environments	3.93	3.91	3.92	Agreed
14	Air pollution can restrict processes enabling vegetation and crops to grow	3.26	3.32	3.29	Agreed
15	It can cause dizziness, confusion, headaches and in high concentrations lead to death	3.92	3.95	3.94	Agreed
16	It causes widespread damage to crops and forests	3.92	3.90	3.91	Agreed
17	Contributes to the formation of acid rain and global warming	2.30	2.82	2.01	Disagreed
18	Damages lung tissues	2.58	2.53	3.01	Agreed
19	Aggravates respiratory disease	3.76	3.82	3.79	Agreed
20	it may shorten the lifespan of exposed people	3.82	3.89	3.86	Agreed

KEY: $\bar{X}_1$ = Mean score of residential occupants, $\bar{X}_2$ =Mean score of motor vehicle owners, $\bar{X}_t$ = Average mean score of residential occupants and motor vehicle owners, N_1 =Number of the residential occupant, N_2 = Number of motor vehicle owners.

The result presented in Table 2 above shows that the respondents in two groups (residential occupants and motor vehicle owners) agreed with all the items with the mean score above 2.50 exceptitem 17 with the mean score below 2.5.

Table 3: Mean Response of Residential Occupants and Motor Vehicle Owners on the Strategies for Effective Management of Motor Vehicle Emission (N_1= 50; N_2= 100)

S/N	Items	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_t$	Remarks
21	Efficient vehicle technology development	3.30	3.46	3.38	Agreed
22	Ensuring your vehicle is regularly maintained to reduce smoke emissions	2.80	2.83	2.82	Agreed
23	Shift travel to less carbon-intensive modes (walking,	2.94	3.36	3.15	Agreed

S/N	Items	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_t$	Remarks
	cycling and public transport).				
24	Effective traffic calming	2.32	2.69	1.11	Disagreed
25	Implementing government policies regarding the importation of used cars	3.76	3.82	3.79	Agreed
26	Adequate traffic controls should be implemented	3.28	2.56	3.42	Agreed
27	Awareness of better understanding of the characteristics of air pollution, its related health effects and its principal sources	3.56	2.53	3.06	Disagreed
28	To develop a consensus among concerned stakeholders around a plan of immediate and longer-term actions to improve air quality	3.00	2.76	2.88	Agreed
29	The government should strengthen local capacity for air quality management through improved understanding of issues and technologies	3.36	2.23	2.80	Agreed
30	Establish a participative and multi-sector process in the management of air quality	3.92	3.90	3.19	Agreed

KEY: $\bar{X}_1$ **=** Mean score of residential occupants**,** $\bar{X}_2$ **=**Mean score of motor vehicle owners, $\bar{X}_t$ **=** Average mean score of residential occupants and motor vehicle owners**,** N_1 **=**Number of the residential occupant, N_2 **=** Number of motor vehicle owners.

The result presented in Table 3 above shows that the respondents in two groups (residential occupants and motor vehicle owners) agreed with all the items with the mean score above 2.50 exceptitem 24 and 27 with the mean score below 2.5.

Table 4: Mean, Standard Deviation and t-test Analysis on the Status of Motor Vehicle Emission in Suleja Metropolis

S/N	Respondents	N	Mean	SD	df	t-cal	t-tab
1.	Residential Occupants	50	2.85	1.35	148	0.005*	± 1.96
2.	Motor Vehicle Owners	100	2.81	0.90	148	0.005*	

Key: * = Not significant, N = Number of residential occupants and motor vehicle owners, df = Degree of freedom, t-calculated, t-table value.

The analysis in Table 4 showed that the t-cal value was below the t-tab value. Therefore, the null hypothesis was it was accepted for each of the six items. Hence the opinion of the respondents differed in four items but did not differ concerning the status of motor vehicle emission in Suleja metropolis.

Table 5: Mean, Standard Deviation and t-test Analysis on the Health Problems Resulting from Motor Vehicle Emission in Suleja Metropolis

S/N	Respondents	N	Mean	SD	df	t-cal	t-tab
1.	Residential Occupants	50	3.39	0.53	148	-0.05*	± 1.96
2.	Motor Vehicle Owners	100	3.52	0.61			

*Not significant

The analysis in Table 5 showed that the t-cal value was below the t-tab value. Therefore, the null hypothesis was it was accepted for each of the six items. Hence the opinion of the respondents differed in four items but did not differ about the status of motor vehicle emission in Suleja metropolis.

Table 6: Mean, Standard Deviation and t-test Analysis on the Strategies for Effective Management of Emission from the Motor Vehicle

S/N	Respondents	N	Mean	SD	Df	t-cal	t-tab
1.	Residential occupants	50	3.22	0.78	148	0.08*	± 1.96
2.	Motor vehicle owners	100	3.01	0.93			

*Not significant

The analysis in Table 6 showed that the t-cal value was below the t-tab value. Therefore, the null hypothesis was it was accepted for each of the six items. Hence the opinion of the respondents differed in four items but did not differ to the status of motor vehicle emission in Suleja metropolis.

Discussion of findings

The findings from Table 1, above indicates that motor vehicle emission in Suleja metropolis has increased tremendously because of an increasein urbanization and industrialization which are accelerating the use of motor vehicles. Motor vehicle emission in Suleja metropolis has strongly influenced the air quality of which residents are exposed to, and motor vehicles emission are the major source of air pollutants. The longevity of existing physical infrastructure in cities, therefore, affects transportation choices (Cao, 2009). The design of the city and the design of its transportation network determine whether residents are automobile-dependent or have choices for multiple forms of transportation such as public transport modes- rail and bus rapid transit schemes for examples. Furthermore, the geographical location of an urban area- on the coast, in forested regions, agricultural areas or near existing urban areas, determine their vulnerability to climate change impacts such as sea-level rise, storm surges and desertification. Given this web of interactions, the environmental impacts of urban forms (mediated by transportation systems) become indisputable.

The findings from Table 2, above indicate that motor vehicle emission in Suleja metropolis is one of the major causes of health problems which includes dizziness, confusion, headaches, cancer, respiratory disease, and shorten the lifespan of exposed people. Furthermore, motor vehicle emission has a direct effect on the ozone layer; it harms natural environments, which has caused widespread damage to crops and vegetations. There is a clear link between Green House Gas (GHG) emissions, transport modes and urban morphology. Urban centres are centres of attraction because they provide opportunities for engagement in productive activities and associated remuneration. Productivity in these centres, however, depends largely on mobility within a metropolitan area. Transportation is thus a demand derived from the needs of virtually every sector in the urban market, as the final production of goods and services need to get to end-users. The efficient functioning of the physical elements of a city to a large extent affects the productivity (the economic prosperity) of the city. Transport is thus a key driver of the economies of cities and as noted by Alain (2011), is highly dependent (98 per cent) on fossil oil. Given the phenomenon of globalization, large cities are expected to attract investment and to remain competitive only as long as they are healthy, secure, well planned and efficient. This efficiency is crucial especially in the movement of people, goods and services. However, the several challenges of rapid urban growth include inadequate infrastructure, road congestion and environmental degradation (increasing emission levels from transport and related activities).

The findings on table 3, above indicates that government should develop effective control of automobile emissions quality management programmes; improvement of motor traffic flow and control which requires good city road network; provision of reliable mass transport system which will reduce the number of vehicles and motorcycles on Suleja metropolis road and therefore reduce emissions; and strengthening of the vehicle inspections and maintenance department.

Conclusion

The emission of a greenhouse gas has been contributing to environmental problems in Suleja metropolis in Niger State and Nigeria at large as indicated in this study. This has been documented in numerous studies showing the links between greenhouse gasses, air pollution, ozone depletion and chronic health problems. Greenhouse gasses are major contributors to air pollution, whose levels have been strongly linked to morbidity and mortality from cardiopulmonary and cerebrovascular diseases, lung cancer and infant mortality in Suleja metropolis and Nigeria at large.

Recommendations

1. There should be reliable and efficient mass transport system to reduce the number of motor vehicles and motorcycles on our roads and therefore reduce the emissions of CO_2, N_2O and SO_2.
2. All motor vehicles and motorcycles moving on the road must pass a vehicle inspection and maintenance test.
3. There is a need for immediate and effective traffic control programmes and good city road network to reduce the idling period for vehicles and motorcycles on highways and streets.
4. The Niger State government should be determined to protect the environment and human health by putting in place effective policies and programmes to reduce the effects of CO_2, N_2O and $SO_2$from automobile emissions.

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IMPACT OF INTELLIGENT LEARNING ON STUDENTS' ACHIEVEMENT AND INTEREST IN TECHNICAL DRAWING IN NIGER STATE, NIGERIA

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Abstract: *The study investigated the impact of Intelligent learning on students' achievement and interest in in Technical drawing in Abuja and Niger State, Nigeria. Two research questions were raised and two hypotheses were formulated and tested at .05 level of significance. Pretest-posttest non-equivalent control group design of quasi experimental study was used for the study. The population for the study consisted of 428 National Technical College (NTC) II students. The sample size for this study consisted of 180 students, with 68 students in the experimental group and 112 students in the control group. Purposive sampling technique was used in selecting and assigning Government Technical College, Minna to the experimental group and Simple Random Sampling (SRS) technique was used in selecting and assigning MammanKontagora Technical College (MKTC), Pandogari to the control group. The instruments used for data collection were Technical Drawing Achievement Test (TDAT) andTechnical DrawingInterest Inventory (TDII). The instruments were validated by two experts from Federal University of Technology, Minna and one expert in test development unit, National Examination Council, Minna. The reliability coefficient of TDAT was found to be 0.77 using Pearson Product Moment Correlation coefficient and of TDII was found to be 0.79, using Cronbach's Alpha. Mean was used to answer the research questions; while ANCOVA was employed to test the hypotheses. Findings of the study revealed that Intelligent learning is more effective in improving student's achievement and stimulating student's interest in Technical drawing than conventional teaching method. It was therefore recommended that teachers, especially those teaching Technical drawing should adopt Intelligent learning to teach students at technical colleges.*

Keywords:*Technical drawing, Intelligent learning, Achievement, Interest*

Introduction

Technical drawing is a compulsory trade related subject for engineering and construction trades students in technical colleges in Nigeria. The subject is essentially a language by which technicians, engineers, craftsmen, and industrialist communicate. Apperson*et al.* (2016) defined technical drawing as a universal language that is understood by technicians and engineers all over the world. It is a pictorial language that depends mainly on lines for conveying the intended meaning. The importance of technical drawing cannot be over emphasized as it allows efficient communication among engineers and prospective engineers alike such communication can thus be kept as a record of the planning process. Gambari*et al.* (2018) noted that, there have been continual reports of low achievement in technical drawing amongst technical colleges students. Ogundola (2017) attributed the low achievement in technical drawing to the lack of innovative learning techniques such as Intelligent learning. Intelligent learning could be seen as a learner-centered learning system that provides easy access to learning sources and enhances interaction among learners and between learners and instructor and supports a self-directed learning environment. Li *et al.* (2015) defined Intelligent learning as an intelligent and personalized learning aimed to meet learners' diverse needs and learning styles. Koper (2014) maintained that, the core elements of Intelligent learning the corresponding equipment, tools, technology, media, textbooks, teachers, and students among others. These core elements should be organized according to constructivist learning theory, blended learning theory and modern teaching theory. Hwang (2014) noted that, Intelligent learning improve communication, thinking and problem-solving skills by integrating a new type of e-learning technologies with Intelligent devices. It makes it possible to create and provide a learning environment that is not content and technology-driven but knowledge and learner-driven that enhances learners' academic achievement.

Academic achievement therefore, implies performance in school subject as represented by a score on an achievement test. Oyetunde (2010) refers academic achievement to some methods of expressing a student's scholastic performance. This can be regarded as course or subject grade, an average for a group of subjects in a programme of study. According to Mbah (2002), achievement is dependent upon several factors amongst which are instructional techniques, the learning environment, motivation as well as interest. Agaba (2013) also confirmed that achievement in education is directly connected to students' interest. Interest is a persisting tendency to pay attention and enjoy some activities. It is viewed as emotionally concerned with behavioural trait which determines student's enthusiasm in undertaking educational programmes or other activities (Chukwu, 2002). According to Osuafor (2001), interest is that attraction which forces or compels a student to respond to a particular stimulus. Hidi& Anderson (2002) opined that interest is often tied directly to the content or instructional approach and it also enhances student's achievement. The use of Intelligent learning is important to provide rich atmosphere that will stimulate the interest of technical college students in technical drawing.

Statement of the problem

It is quite unfortunately that despite the efforts by the government to ensure qualitative education at the technical college level, there have been constant reports of low academic achievement in technical drawing amongst students of technical colleges.The low academic achievement in technical drawing amongst students was attributed to the conventional teaching methods used in teaching which include lecture and discussion methods. One of the proven ways of preventing low academic achievement of students and stimulate their interest in learning is the use of interactive teaching methods (Okoli and Nwosu, 2016). Hence, this study was designed to determine the impact of Intelligent learning on students' achievement and interest in technical drawing in Niger state, Nigeria**.**

Research Questions

1. What is the impact of Intelligent learning on students' achievement in Technical drawing?
2. What is the impact of Intelligent learning on students' interest in Technical drawing?

Hypotheses

H_{O1}: There is no significant difference in the mean achievement scores of students taught Technical drawing using Intelligent learning and those taught with conventional teaching method.

H_{O2}: There is no significant difference in the mean interest scores of students taught Technical drawing using Intelligent learning and those taught with the conventional teaching method.

Methodology

Pretest–posttest non-equivalent control group design of quasi-experimental study was adopted for the study. According to Nworgu (2006), random assignment of subjects in such a design is not required.

The design is symbolically represented as follows:

Experimental O_1 X O_2

Control O_1 - O_2

Where: **O_1:** Represents pretest (observation or measurement before the treatment);
O_2: Represents post-test (observation or measurement after treatment);
X: Represents experimental treatment (Intelligent learning);
- : Indicates no treatment (that is, the use of conventional methods)

The study was conducted in Niger State, Nigeria. The population for this study comprised of 428 National Technical Certificate (NTC) II students offering Technical drawingduring 2017/2018 session in Niger State, Nigeria. A sample size of 180 NTC II students was selected for the study. Purposive sampling technique was used in selecting and assigning Government Technical College,Minnato the experimental group and Simple Random Sampling (SRS) technique was used in selecting and assigning MammanKontagora Technical College (MKTC), Pandogarito the control group. Two instruments were used for data collection which includes, Technical Drawing Achievements Test (TDAT) and Technical DrawingInterest Inventory (TDII). The TDAT consisted of 50 multiple choice items with four response options and was developed by the researcher based on Technical drawing modules in the NTC II curriculum. TDII consisted of 30 multiple choice items with five response options were used for testing the student's interest in Technical drawing. The items were designed based on five point Likert scale of Strongly Agree = 5; Agreed = 4; Undecided = 3; Disagreed = 2 and Strongly Disagreed = 1 point respectively.

The researchers prepared two sets of lesson plans for the teaching of the module selected for the study. Each set contains eight lesson plans that lasted for a period of eight weeks for the minimum of two hours duration. One set of the lesson plan was written based on Intelligent learningand was used by the teacher for the experimental group, while the second set was prepared based on conventional teaching method and was used by the teacher for the control group. The instruments were subjected to face and content validation by three experts that include two lecturers from the Department of Industrial and Technology Education, Federal University of Technology, Minna, Nigeria and one staff from the Examination Development Department (Technical drawing Unit), National Examination Council (NECO). To ensure the reliability of the TDAT and TDII, a trial test was conducted using NTC III students in Government Technical College, Mada Station, Nasarawa state, Nigeria. Pearson Product Moment Correlation (PPMC) was used to determine the reliability coefficientof TDAT and found to be 0.77. The reliability coefficient value of TDII was determined as 0.79 using Cronbach's Alpha. Nevertheless, Item Analysis was carried out on the 50 items developed in the TDAT to determine the Difficulty and Discrimination Indices of each item in the test. Items having negative discrimination are rejected and items having discriminationindex above 0.20 are ordinarily regarded as satisfactory for use in most tests ofacademic achievement (Boopathiraj &Chellamani, 2013).

Experimental procedure

The study involved two main stages, which include the administration of pre-test and post-test. The study was conducted for a period of eight weeks during which eight topics in Technical drawing were covered. The pre-test was administered in the first week of the research exercise to the whole students before the experimental and control groups are subjected to the treatments. After the administration of the pre-test, students in the experimental group were taught using the Intelligent learning and students in the control group were taught using the conventional teaching method. Both groups were taught by their regular teachers. The teaching process lasted for eight weeks after which a post-test was administered to all the students to determine their mean achievement and interest scores in Technical drawing. Extraneous variables such as Hawthorne effect was controlled by the use of regular subject teachers, influence of subject interaction was controlled by the use of intact classes, pre-test sensitization was control by re-arrangement of items in the TDAT after the administration of the pre-test.

Method of data analysis

The data collected for this study were analyzed using the Statistical Package for Social Sciences (SPSS) version 23.0. Descriptive and inferential statistics were used to analyze the data. General Linear Model (univariate) function was used to perform the Analysis of Covariance (ANCOVA). Group with higher mean value irrespective of the closeness in the mean value of the other were taken to have performed better in achievement test or showing much interest in Technical drawing. Significant of F less than 0.05 implies that, the null hypothesis should be rejected and significance of F greater than 0.05 implies that, the null hypothesis should be accepted.

Result

Table 1: Mean of Pre-test and Post-test Scores of Students Taught Technical Drawing Using Intelligent learning and Those Taught with Conventional Teaching Method in the Achievement Test

Group	N	Pre-test Mean	Post-test Mean	Mean Gain
Experimental	68	10.93	42.17	31.24
Control	112	11.00	30.27	19.27

Table 1 shows that the experimental group had a mean score of 10.93 in the pre-test and a mean score of 42.17 in the post-test with a pre-test, post-test mean gain in experimental group to be 31.24. The control group had a mean score of 11.00 in the pre-test and a post-test mean of 30.27 with a pre-test, post-test mean gain of 19.27.

Table 2: Mean of Pre-test and Post-test Scores of Students Taught Technical Drawing Using Intelligent learning and Those Taught with Conventional Teaching Method in Interest Inventory Test

Group	N	Pre-test Mean	Post-test Mean	Mean Gain
Experimental	68	98.85	129.56	30.71
Control	112	98.92	106.03	7.11

Table 2 shows that the experimental group had interest mean score of 98.85 in the pre-test and interest mean score of 129.56 in the post-test with a pre-test post-test gain in the experimental group to be 30.71. The control group had interest mean score of 98.92 in the pre-test and a post-test interest mean score of 106.03 with a pre-test post-test gain of 7.11.

Table 3: **Summary of Analysis of Covariance (ANCOVA) for Test of Significant Difference between the Achievements Mean Scores of Students Taught Technical Drawing Using Intelligent learning and Those Taught with Conventional Teaching Method**

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3918.69[a]	2	1959.35	27.20	.00
Intercept	4640.42	1	4640.42	64.41	.00
Pretest	43.33	1	43.33	.60	.44
Group	3763.40	1	3763.40	52.24	.00*
Error	12751.86	177	72.04		
Total	223325.00	180			
Corrected Total	16670.55	179			

Where:

a. R Squared = .235 (Adjusted R Squared = .226)

*Significant (F less than .05)

Table 3 shows the F-calculated value for the effect of instructions on the cognitive achievement of studentstaught Technical drawing using Intelligent learning and those taught with conventional teaching method. The F calculated value for the groups is 52.24 with a significant of F at **.**00 which is less than **.**05. The results indicated that there is statistically significant difference between the achievement mean scores of students taught Technical drawing using Intelligent learning and those taught with conventional teaching method.

Table 4: **Summary of Analysis of Covariance (ANCOVA) for Test of Significant Difference between the Interests Mean Scores of Students Taught Technical Drawing Using Intelligent learning and Those Taught with Conventional Teaching Method**

Source	Type III Sum of Squares	*df*	Mean Square	F	Sig.
Corrected Model	7735.12[a]	2	3867.56	849.51	.00
Intercept	161.47	1	161.47	35.47	.00
Pretest	14.92	1	14.92	3.28	.07
Group	7734.73	1	7734.73	1698.93	.00*
Error	805.83	177	4.55		
Total	2651913.00	180			
Corrected Total	8540.95	179			

Where:

a. R Squared = .906 (Adjusted R Squared = .905)

*Significance (F less than .05)

Table 4 shows the F-calculated value for the effect of instructions on the interest of studentstaught Technical drawing using Intelligent learning and those taught with conventional teaching method. The F calculated value for the groups is 1698.93 with a significant of F at **.**00 which is less than **.**05. The results indicated that there is statistically significant difference between the interest mean scores of students taught Technical drawing using Intelligent learning and those taught with conventional teaching method.

Findings of the study

1. The students taught Technical drawing using Intelligent learningobtained higher achievement mean scores than the students taught with conventional teaching method.
2. The students taught Technical drawing using Intelligent learningobtained higher interest mean scores than the students taught with conventional teaching method.
3. There is significant difference in the achievement mean scores of students taught Technical drawing using Intelligent learning and those taught with the conventional teaching method.
4. There is significant difference in the interest mean scores of students taught Technical drawing using Intelligent learning and those taught with the conventional teaching method.

Discussion of findings

The results presented on student's achievement mean scores in Technical drawing revealed that the students taught using Intelligent learningobtained higher achievement mean scores than the students taught with conventional teaching method in the Technical drawing achievement test. The finding is in-line with the findings of Beck *et al.* (2012) that revealed Intelligent learning environment promotes learning by supporting student's cognitive processing and improvement of detailed mental representations in several ways which consequently improve the achievements of students. Moreover, Shyu (2000) revealed a related view concerning the finding that,Intelligent learning helped students to understand what they learned through the improvement of problem-solving skills.

The summary of Analysis of Covariance (ANCOVA) for the test of significant difference between the achievement mean scores of students taught Technical drawing using Intelligent learning and those taught with conventional teaching method revealed a statistically significant difference. The finding is in conformity with the findings of Adenkunle (2013) that found significant difference in the achievement mean scores of student in the experimental group and the control group.

The results presented on student's interest mean scores in Technical drawing revealed that the students taught using Intelligent learningobtained higher interest mean scores than the students taught with conventional teaching method in the Technical drawing achievement test. The finding confirmed the findings ofHasselbring and Moore (2006) which revealed the Intelligentlearning environments could be of high interest to students with poor literacy skills.

The summary of Analysis of Covariance (ANCOVA) for the test of significant difference between the interest mean scores of students taught Technical drawing using Intelligent learning and those taught with conventional teaching method revealed significant difference. The finding is in conformity with the findings of Oyetunde (2010)thatrevealed similar findings ofsignificant difference between the mean interest score of the students taught Technical drawing using model and students taught using conventional teaching methods.

Conclusion

The results obtained revealed that cognitive achievement and interest of students were enhanced and stimulated using Intelligent learning. Consequently, Intelligent learning has the potential to enhance learning via Intelligent learning technology. The use of Intelligent learning has value as an instructional tool for Technical drawing. Therefore, it is concluded that Intelligent learning has positive impact on student's achievement and interest in Technical drawing.

Recommendations

1. National Board for Technical Education as a body concern with curriculum development should incorporate Intelligent learning into the teaching of Technical drawing.
2. Teachers especially those teaching Technical drawing should adopt Intelligent learning to teach students at technical colleges to stimulate student's interest and enhance student's cognitive achievements in Technical drawing.

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FAMILY PROBLEMS AND IT'S INFLUENCE ON ADOLESCENT DEVIANT BEHAVIOURS: A FOCUS ON FAMILY POVERTY, PARENTAL ILLITERACY AND CONFLICTS IN IMO STATE NIGERIA

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Abstract: *The study was aimed at determining the extent to which family poverty, parental illiteracy and parental conflicts influence adolescent deviant behaviour in Imo East Senatorial Zone of Imo State - Nigeria. The researcher developed 3 research questions and 3 null hypotheses, which guided the study. Survey design was adopted for the study. 300 families (150 male and 150 female parent-teachers) were sampled for the study using the stratified random sampling technique. A 20 item structured questionnaire of 4–point rating scale served as the instrument for data collection. Data generated were analyzed by means and standard deviation statistics for the research questions, while t–test statistics was used to test the hypotheses at .05 level of significance. The study revealed among others that family poverty and parental illiteracy were some factors that influence adolescent deviant behaviour in Imo East Senatorial Zone of Imo State – Nigeria. Based on the findings recommendations were made to the appropriate authorizes in the state.*

Keywords: *Family Problems, Adolescent Deviant Behaviours, Illiteracy, Conflicts*

Inroduction

Family problems are conditions, attributes which challenge a family's wellbeing temporarily or permanently. Family problems are the realities of a family and home life (Adebe, 2010). A family may be characterized by adequate economics standard or high standard of living, poverty, single parenthood or intact family; extended or nuclear family; literate or illiterates parents; conflicting parenthood or divorced marriage responsive or neglectful parenting; or even by the size of occupants living in the home; the list is endless. From the foregoing therefore, the family plays significant roles in moulding the child, and hence circumstances that surround it greatly influence the developmental outcomes of the adolescents.

Adolescence on the other hand, is a transition period between puberty and adulthood in human development (Akambi, Gbadebo, Adekola, Olawole-Isaac, Sowummi and Godwin, 2015) In some cultures adolescence could extend to youth. It is the process or state of growing into maturity; a period or stage of development as of a society preceding maturity (Adebe, 2010). It is a period in human development between childhood and adulthood. It includes some big changes – to the body and to the way a young person relates to the world. It is a period in which physical, sexual, cognitive, social, emotional and effective attributes in a human take the centre stage and can bring anticipation and anxiety for both children and their families. Understanding what to expect at different stages can promotes healthy development adolescence and into early adulthood (Barron & Tipa, 2004). Definition of Addescent phase in human development had engaged scholars in recent times but given by World Health Organization (WHO) is held by many. WHO (2015) defines an adolescent as any person between the ages 10 and 19. In many societies, however, adolescence is narrowly equated with puberty and the cycle of physical changes culminating in productive maturity. In other societies, it is understood in broader terms that ecompass psychological, social and moral terrain as well as the strictly physical aspects of maturity (Barron and Tipa 2004) Depending on the type of environment that plays out in homes during this period, adolescents may be constrain into deviants behaviour.

Deviance can be described as an action or behaviour that violets social norms, including formally enacted rule, as well as informal violations of social norms (Elsnberg, 2001). A deviant act can be committed in one society but maybe normal in another. Perception in deviance alters over time, as the notion of what is a social often changes. Deviance is always associated with adolescents when they deviate from acceptable norms in the society. Without clear roles adolescents, may establish

their own pecking order and spend their times pursuing irresponsible or deviants activities. Deviant behaviour can manifest in many forms: Insecurity and often lead to vandalism, Juvenile delinquency, illegal use of drugs and alcohol. While the family remains significantly inextricable from the development and outcomes of the adolescent, family circumstances and strong in determining how adolescent can develop and act in the society.

Poverty is a social problem, which has the capacity to negatively impact on families. Poverty in families also limits the development of children through budget restrictions of family sources. However, experts (Farrington, 2006) emphasize that these sources cannot be viewed only through market value and costs for quality care. Sources of families includes not only income but also non-financial sources such as education, access to information, materials sources, ie cost of living, food, water, etc. (Gershoff 2002). Poverty, apart from the direct impact on individual family members (Great, 2001) endangers and disrupts the functionality of the family system as a whole (Hanson, 2009), for example, the inability of parents to provide the basic needs of their children and meet their demands can compel the child to get curious which usually ends in seeking for self-help strategies which can result in young persons engaging in unaccepted means to fulfill their needs.

Parents' education level is an important predictor of children's educational and behavioural outcomes. Parental education has been identified as a significant factor in the development of adolescent and children generally in the family (Harp, 2006). The role of parents in children's education is very important, how they provide assistance in child's growth will determine the character of the children during adulthood (Heyley, 2004). On the other hand, one's education will determine one's behaviour and way of thinking. The study of whether parental education and behaviour will affect child behaviour will be an important basis for the development of good parenting patterns (Ibot, 2009). Parent's education can be linked to children's good upbringing and good behaviour particularly, when it is knowledge and moral driven, as the saying goes and I quote 'you cannot give what you don't have' unquote.

Parental or marital conflicts shape children's lives. Marital dissatisfaction and parental conflict are often correlated with how well children adjust to situations (Angeli, 2018) children may experience anxiety, depression, shame or other issues when conflicted parental relationships result in dysfunctional parenting practices (Wopes, 2009). Parental conflict can result in reduced parental involvement, harsh discipline practices, lack of motivation and acknowledgment, and increased parent-child conflict. When overt or covert (silent or aggressive) parental conflict is present, there may be a tendency to create 'alliance' or 'collusion' among family members, which typically only allenate healthy family relationships. Additionally, some parents who do not actively engage in conflicts in front of their children may allow their negative feelings towards each other to guide their decision. These decision, when motivated by resentment and not to the children's interest, may be equally harmful. For explorative adolescents, this may offer opportunities to find solace wherever, thereby subjecting them to risky behaviours. Generally speaking, the lower the level of parental conflict, the more positive parent-child relationships tend to be.

Statement of the problem

The unending rise in myriad of social ills and adolescent involvement in crimes in Imo State Nigeria has culminated to social misnomer and anxiety which continues to draw concerns from policy makers, general public and particularly, the parents and other family members. On daily basic, many young persons or youths are involved in cyber crimes, or the popular "yahoo-yahoo" business, abandoning their education and other skills acquisition programmes to seek for quick or fast ways of making money. Cultism is fast becoming a 'normal' aspect of youth culture, with many younger persons being involved or initiated on regular basis. Constant reports of youths (usually between the ages of 14 and 25) being involved in crimes, such as armed robbery, kidnapping, human trafficking, child abuse and murder cases on national dailies and electronic media in the state has also reached alarming levels. The problem of deviant adolescents, their activities has continued to give parent stressful encounter within their homes and environments.

Research questions

1. To what extent does family poverty influence adolescent deviant behaviour in Imo State Nigeria?
2. To what extent does parental illiteracy influence adolescent deviant behaviour in Imo State Nigeria?
3. To what extent does parental conflict influence adolescent deviant behaviour in Imo State Nigeria?

Hypotheses

H_{O1}: There is no significant difference between the mean scores of male and female parent-teachers on the extent to which family poverty influences adolescent deviant behaviour in Imo East Senatorial Zone of Imo State.

H_{O2}: There is no significant difference between the mean scores of male and female parents-teachers on the extent to which parental illiteracy influence adolescentdeviant behaviour in Imo East Senatorial Zone of Imo State.

H_{O3}: There is no significant difference between mean scores of male and female parent–teachers on the extent to which parental conflict influences adolescent deviant behaviour in Imo East Senatorial Zone of Imo State.

METHOD

The purpose of the study is to find the extent to which family poverty, parental illiteracy and parental conflicts determine adolescent deviant behaviour. This study is therefore aimed at taking a look at family characteristics with parent's illiteracy, conflicts and family poverty (prime variables), as determinants of adolescents deviant behaviour in the State. This will compliment earlier studies which blamed societal influence, weak institutions, peer influence, youth unemployment, bad governance and family structure. The study adopted a survey design, sampled 300 parents–teachers (150 males and 150 females) as respondents using stratified random sampling techniques from Imo East Senatorial Zone of Imo State, Nigeria. A 20-item questionnaire of 4-rating scale served as instruments for data collection. Data generated was analyzed using means and standard deviation for the research questions and t-test statistics for the hypotheses.

RESULTS

Table 1: Means and Standard Deviations of Respondents on the Extent to Which Family Poverty Influences Adolescent Deviant Behaviours in Imo East Senatorial Zone of Imo State

S/N	Variable: Poverty	N = 150 MALE			N = 150 FEMALE		
		$\bar{X}$	SD	RMK	$\bar{X}$	SD	RMK
1.	Inability of parents to provide basic needs of their children will lead them to seek other illegal means	3.42	0.66	HE	2.62	0.67	HE
2.	Lack of adequate shelter will lead children out on the streets	3.74	0.67	HE	3.02	0.68	HE
3.	Inability to send children to school will motivate them into deviancy	3.33	0.72	HE	2.71	0.64	HE
4.	Economic/financial stress can cause distractions from their children's behaviours	3.44	0.63	HE	2.91	0.68	HE

S/N	Variable: Poverty	N = 150 MALE			N = 150 FEMALE		
		$\overline{X}$	SD	RMK	$\overline{X}$	SD	RMK
5.	Children living in slums have high tendency to engage in deviant behaviours	3.24	0.62	HE	2.91	0.68	HE
6.	Involvement in pre-marital sex is a problem of poor living environments caused by parents	3.02	0.68	HE	2.65	0.66	HE
7.	Family poverty imposes some pressure on the adolescents to indulge in crimes	3.71	0.72	HE	2.68	0.69	HE
8.	Family poverty causes adolescents into making end meet at all cost	2.89	0.77	HE	2.68	0.69	HE
Grand Mean		3.34	0.68	HE	2.77	0.68	HE

Key: $\overline{X}$ = mean SD = Standard Deviation, HE = High Extent

Table 1 presents the analyses of data from respondent for research question 1. It shows that the grand mean is 3.84 and 2.77 respectively for male and female respondents.

It also shows range of standard deviation from 0.62 and 0.72 indicating that the opinion of male and female respondents were not far from each other furthermore highest mean recorded was 3.74 (item 2) while the lowest was 2.26 (item 1). In all, High Extent was recorded, hence family poverty is a factor influencing adolescent deviant behaviour in Imo East Senatorial Zone of Imo State, Nigeria.

Table 2: Means and Standard Deviations of Respondents on the Extent to Which Parental Illiteracy Influence Adolescent Deviant Behaviours in Imo East Senatorial Zone of Imo State

S/N	Variable: Poverty	N = 150 MALE			N = 150 FEMALE		
		$\overline{X}$	SD	RMK	$\overline{X}$	SD	RMK
9.	Adolescents will take advantage of their parents educational level to defraud them	2.74	0.63	HE	2.67	0.66	HE
10.	Illiterate parents lack the knowhow of adolescent management	3.53	0.76	HE	3.00	0.71	HE
11.	Illiterate parents may not be able to detect deviant behaviours from their children early	3.73	0.72	HE	2.68	0.67	HE
12.	Children from illiterate parents are prone to crimes	2.64	0.64	HE	2.81	0.81	HE
13.	Children from illiterate parents are likely to exhibit questionable characters	3.00	0.72	HE	2.71	0.65	HE
Grand Mean		3.12	0.69	HE	2.77	0.70	HE

Key: $\overline{X}$ = mean SD = Standard Deviation, HE = High Extent

Table 2.0 presents the analyses to Research Question 2. It reveals a grand mean of 3.12 and 2.77 respectively for male female respondents. It also shows a standard deviation range of 0.63 – 0.76 (males) 0.65 – 0.81 (females) indicating closeness of opinions from respondents.

Furthermore, it shows highest mean of 3.53 (item 10) and lowest mean of 2.64 (item 12). From the above results, HE was exhibited by respondents, and hence parental illiteracy is a factor influencing Imo East Senatorial Zone of Imo State, Nigeria.

Table 3: Means and Standard Deviations of Respondents on the Extent to Which Parental Conflict Influence Adolescent Deviant Behaviours in Imo East Senatorial Zone of Imo State

S/N	Variable: Poverty	N = 150 MALE			N = 150 FEMALE		
		$\overline{X}$	SD	RMK	$\overline{X}$	SD	RMK
14.	Adolescents in conflicting homes have a tendency to exhibit violence	2.64	0.64	HE	2.74	0.66	HE
15.	Adolescents in conflicting homes have a tendency to bully their peers and young ones	2.61	0.61	HE	3.02	0.71	HE
16.	Constant quarrel in the home will compel a child to lack or not to see their parents as role models	2.74	0.62	HE	2.91	0.68	HE
17.	A boy who witnesses constant violence on his mother will grow up hostile to women	2.83	0.60	HE	2.91	0.68	HE
18.	A girl who witnesses constant violence on the mother will grow up hating men	3.01	0.71	HE	2.71	0.67	HE
19.	Parental conflict will impose denial on the adolescents	2.88	0.69	HE	2.72	0.62	HE
20.	Parental conflict draw attention away from children's behaviour	3.01	0.78	HE	3.02	0.73	HE
Grand Mean		2.81	0.66	HE	2.80	0.66	HE

Key: $\overline{X}$ = mean SD = Standard Deviation, HE = High Extent

Table 3.0 presents the analyses of Research Question 3. It reveals a grand mean of 2.81 and 2.80 respectively for male and female respondents. It also shows a SD range of 2.61 – 3.01; and 2.71 – 3.02 respectively for male and female respondents.

Furthermore highest X = 3.02 (item 20) and the lowest X = 2.61 (item 15). The closeness of SD indicates opinions of respondents being close towards same direction. With the Grand mean recorded, indicates HE among respondents. Consequently parental conflict is a factor influencing adolescents deviant behaviours in Imo East Senatorial Zone of Imo State.

Table 4: T – Test Analysis of the Mean Responses of Male and Female Parents Teachers on the Extent to Which Family Poverty Influences Adolescent Deviant Behaviour

Respondents	N	X	SD	df	t-cal	t.crit	∝	Decision
Male	150	3.34	0.68					
				298	1.31	1.40	0.05	Accepted
Female	150	2.77	0.68					

The t – test analysis of table 4.0, reveals that t-cal of (1.31) < t-crit (1.40), consequently the Ho_1 is accepted at 05 level of significance.

Table 5: t–test Analysis of Mean Responses of Male and Female Parent-Teachers on the Extent to Which Parental Illiteracy Influences Adolescent Deviant Behaviour

Respondents	N	X	SD	df	t-cal	t.crit	∝	Decision
Male	150	3.12	0.69					
				298	1.02	1.81	0.05	Accepted
Female	150	2.77	0.70					

The t–test analysis of table 5.0 reveals that t - cal of (1.02) < t-crit (1.81) and since t – cal < t – crit, Ho_2 is accepted

Table 6: t – test Analysis of the Mean Responses of Male and Female Parent – Teachers on the Extent to Which Parental Conflict Influences Adolescent Deviant Behaviours

Respondents	N	X	SD	df	t-cal	t.crit	∝	Decision
Male	150	2.81	0.66					
				298	1.21	2.21	0.05	Accepted
Female	150	2.80	0.66					

The t – test results of table 6.0, reveals that t – cal of (1.21) < t – crit of (2.21). since t – cal < t-crit, Ho_3 is accepted.

Findings

The study found that:

1. Family poverty influences adolescent deviant behaviours in Imo East Senatorial Zone of Imo State, Nigeria, and the opinions of male and female respondents were not different on the findings.
2. Parental illiteracy influences adolescent deviant behaviour in Imo East Senatorial Zone of Imo State, Nigeria, and the respondents were in deferent in their opinion.
3. Parental conflict influences adolescent deviant behaviours in Imo East Senatorial Zone of Imo State, Nigeria and is confirmed by the opinions of the respondents.

Discussion

1. ***On Family Poverty***: The findings is in line with the study carried by Evan and Broda (2005) who noted that families who have not been able to increase their earnings sufficiently to stay out of poverty, the consequences are severe and are not confined to material deprivation. Low-income parents report a greater degree of worry about their financial fortunes and concern for their children's health and education than do more affluent parents.
2. ***Economic Hardship:*** Whether from low wage, sustained poverty, unemployment – significantly diminishes the emotional wellbeing of parents, with direct and indirect effects on children's health and behaviour as opined by Shepard (2004).
3. ***On Parental Illiteracy:*** The finding of parental illiteracy as a factor that influence adolescent deviant behaviour is in agreement to the study of Baker, (2009) who noted that early parental experiences are especially significant for the development of cognitive skills, positive peer relationships while also preventing risky behaviours, school failure and delinquency; Arnold. (2005) who opined that, with no formal training and inadequate support networks risk knowing when their children indulge in deviant behaviours.

4. ***On Parental Conflict****:* The finding on parental conflict as a factor that influences deviant behaviour is supported by Horowitz (2007) who noted that a growing body of scientific research efforts suggests that relationship with family been assumed to influence criminal behaviours of adolescents, social philosophers have also advocated that families with inadequate structure will be unsuccessful to deliver the attachments that could clout children into better social fabric of life (Trentacosta, 2009).

Conclusion

Family characteristics hold the key to good parenting and production of responsible and morally oriented children in the society. This is of course achievable if the family characteristics are positively skewed, so, to avoid deviant behaviours among adolescents, families must as a matter of necessity imbibed in those positive attributes that are instrumental to good behaviours which includes total absence from crime restiveness, cultism, robbery, etc. Anti-social attributes like family poverty, parental illiteracy and conflicts, among others must be avoided. From the foregoing it is seen that a family that is above the challenges of poverty, illiteracy and conflicts stands a chance of bringing up a better adolescent in the society.

Recommendations

1. Concerted efforts to alleviate family poverty should be made by relevant agencies (Ministry of Youth, Sports and Welfare). This should include employment programmes and improvement of family income to enable them meet their basic needs.
2. Parental education, adult education should be promoted and nursing education for nursing mothers should be encouraged.
3. Parental conflict management mechanism should be promoted among parents to avoid the negative effects on the child's development.

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