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An appraisal of students' skill acquisition and application in basic science and technology in north central Nigeria

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Abstract
The study investigated the extent to which students have acquired and applied skills in Basic Science and Technology for sustainable living in north central Nigeria. The study adopted a cross-sectional survey research design. The population for the study comprised all the 2,703,427 Basic Science and Technology students in North Central Nigeria. The sample consists of 2,160 students randomly selected from government and private secondary schools in the area. Students Skills Acquisition and Application Inventory (SSAAI) was used for data collection. The instrument was validated by three experts, two in Science Education and one in Test and Measurement. The reliability coefficient of the instrument was determined using Crombach alpha and internal consistence of instrument was obtained as 0.84. The two research questions which guided the study were answered using mean, while the two null hypotheses were tested at 0.05 level of significance. The findings revealed that although students acquired skills in Basic Science and Technology moderately. The acquired skills are applied by students in the major areas of livelihood to a less extent. This implies that there is no significance difference on the extent to which students in government and private secondary schools acquired and applied skills in Basic Science and Technology for sustainable living. Based on the findings, it was recommended among other things that the Ministry of Education via State Universal Basic Education Boards and other relevant agencies should intensify monitoring of the teaching/learning process especially in Basic Science and Technology to ensure that students acquire skills in Basic Science and Technology to a great extent and apply same for sustainable living. This is because Science and Technology is a veritable tool for the attainment of the Sustainable Development Goals (SDGs) in Nigeria.

Keywords: students, science, technology, skill acquisition and application

Introduction

Science, in its simple term, is regarded as the attempt by humans to gain better understanding and clearer interpretation of the natural world. On the other hand, Technology is the use of science ideas for sustainable living. Science and technology education is therefore training an individual to acquire scientific knowledge and apply appropriate technologies for social economic advancement. The focus of education system all over the world is the development of the human capital required to meet present and future challenges of globalization and knowledge economy (Alih, 2015) [5]. Science has moved away from being the business of intellectual facts and theories with only scientific results, to pioneering the frontiers of societal development and expanding the potentials of human activities (Jose, 2015) [12].

Technology has drastically changed the face of the earth by expanding all the sectors of civilization across the globe. Science and technology is automatically driving societys' progress in every nation (Blas & Boren, 2016) [6]. Nwankwo (2014) asserts that any nation which has no solid scientific and technological base cannot develop its natural resources; it only stands the risk of being permanently poor and economically dependent on other countries.

In all developing countries of the world, attention has been focused on science and technology education so that there can be social, economic and even political development (Alih, 2015) [5]. Nigeria is no exception to this drive. The National Policy on Education (FRN 2012) [9] and the Universal Basic Education (UBE) Act of 2004 clearly spell out Nigerias' commitment towards this move by indicating that: "Every learner who has gone through nine years of Basic Education should have numeracy, manipulation, community and lifelong skills; as well as ethical, moral and civic values needed for laying a solid foundation for lifelong learning; as the basis for scientific and reflective thinking". The National Policy on Education (FRN 2012) [9] and the UBE act both provide for nine (9) years of Basic Education; six (6) years at lower Basic Education (primary one to six) and three years at Upper Basic Education (The first three years of Secondary Education). One of the subjects through which the aims of the Universal Basic Education could be achieved is Basic Science and Technology (Akpokiniovo, & Odebala, 2015) [4].

According to Akpan (2012) [3], Basic Science and Technology curriculum, if naturally and positively implemented, could achieve the objective of motivating learning; acquiring scientific knowledge and technological skills, applying the acquired skills to the key sectors of human endeavors for sustainable development. The major aims and objectives of the merged 3-year Upper Basic Science and Technology curriculum as stated by NERDC (2012) [14] are to help learners;

1. Develop interest in the study of Science and Technology
2. Acquire scientific and technological knowledge and skills
3. Apply the scientific and technological knowledge and skills for sustainable community development
4. Take advantage of numerous career opportunities

offered by science and technology
5. Become prepared for further studies in science and technology

These objectives are laudable and are at the hearts of the needs of every nation (Kurumeh, Onah & Mohammed 2012) [13]. Consequently, efforts are being made to ensure that students acquire the required scientific knowledge and with appropriate technological skills and apply same for sustainable living as stated in objective number two and three. Jack (2018) [10] opine that students acquire scientific knowledge by the processes of thinking, analyzing and interpreting observed facts. The approach capable of triggering the processes of thinking and inferring in the students' mind is called "Process approach" it is design to help students gain better understanding of the world and put science in a better position to influence positively, conditions for life on earth. According to Afif and Majdi (2015) [1] the process approach to teaching and learning science is meant to foster inquiry and manipulative skills in students and discourage rote learning. This approach embraces problem solving methods of science teaching/learning and is mainly activity based in order to sharpen the skills acquired by the students (Ajaja, 2010) [2].

Jadrich and Bruxoort (2011) asserts that science process skills acquisition in a generic term refers to a heterogeneous group ability manifested in the acquisition and use of listening, speaking, reading, writing, and reasoning. Ajaja (2010) [2] points out those science process skills have general commonality in all science subjects, serving as necessary tools to be applied in all the key sectors of human endeavor to facilitate: information gathering, problem solving, decision making and adaptation. The science process skills are; Observation, Classification, Measurement, Prediction, Problem identification, Testing hypothesis, Analyzing, Inferring, Experimenting, Collection of data and Interpretation of data (American Association for the Advancement in Science in Jadrich & Bruxoort 2011).

Vijay (2017) [18] states that tools and materials abounds every environment for Technology application in order to make life easy. Technology is not only the use modern machines like cars, generators, aeroplanes, ships, and so on but also things (services) that are done locally and use in the environment to sustain life which most schools ignore such as; Carpentry, Building, Welding and Fabrication, Refrigeration, Automobiles, Electricians, Mechanics, GSM Maintenance, Games/Athletes Typing/Photocopying (Nwosu & Micah 2017) [16]. According to Elisha and Ugochukwu (2014) [7], Technology application also referred to as Transfer of Technology (TOT) is necessary for the use of skills, knowledge, methods of manufacturing, sample of manufacturing and facilities especially at the Upper Basic Education level. The authors maintained that the students have acquired reasonable knowledge and skills in Basic Science and Technology, to ensure that scientific and technological advancements are accessible and applied for sustainable community development.

From the foregoing, it is well recognized that the skills acquired and applied in the various aspect of life by students in Basic Science and Technology needs to be constantly checked to ensure quality and standard. This would place policy makers and educational planners especially in Nigeria in a better position to actually gauge if the Sustainable Development Goals (SDGs) could be achieve by the year 2030. Thus, the need for a critical appraisal of the skills acquired by students in Basic Science and Technology as well as the areas these skills are applied for sustainable living.

Statement of the Problem

The role of science and technology in the attainment of Sustainable Development Goals (SDGs) particularly in developing counties like Nigeria cannot be over emphasized. That means the teaching of Basic Science and Technology at the Upper Basic Education level as specified by the National Education Research and Development Council (NERDC, 2012) [14] is a deliberate attempt towards helping the young children to acquire the desired skills in Science and Technology and applies same for sustainable development. Hence, the previous studies by; Jack (2018) [10], Nwosu & Micah (2017) [16], Vijay (2017) [18], Jadrich and Bruxoort (2011), and Ajaja (2010) [2] has already identified the skills acquired by students at this level including the areas that these skills are applied for sustainable living. However, the previous studies have failed to establish the extent students in both government and private schools acquired skills in Basic Science and Technology and the extent acquired skills are applied for sustainable living. Therefore, the major problem of this study is that, to what extent do students acquire skills in Basic Science and Technology and what is the extent the acquired skills are applied by students in both government and private schools for sustainable living?

Research Questions

The following research questions guided the study

Question 1. To what extent have students acquired skills in Basic Science and Technology?

Question 2. To what extent are the acquired skills applied by Basic Science and Technology students for sustainable living?

Research Hypotheses

The following null hypotheses were tested in the study 0.05 level of significance.

1. There is no significant difference in the mean rating scores of students on the extent to which skills are acquired in Basic Science and Technology in Government and Private Secondary Schools.
2. There is no significant difference in the mean rating scores of students on the extent to which acquired skills in Basic Science and Technology are applied in Government and Private Secondary Schools.

Research Method

The study is a cross sectional survey of the students' skill acquisition and application in Basic Science and Technology. The population comprised all the 2,703,427 students in North Central Nigeria. The sample consists of 2,160 students randomly selected in both government and private secondary schools in the study area. Students Skills Acquisition and Application Inventory (SSAAI) was used for data collection. The instrument was validated by three experts, two in Science Education and one in Test and Measurement. The reliability coefficient of the instrument was determined using Crombach alpha and internal

consistence of instrument was obtained as 0.84. The instrument was divided into two clusters of 10 items each. Developed on a modified Likert-type four point rating scale of 4, 3, 2, and 1 as follows: each item in clusters A and B has; Great Extent (GE) = 4pionts = 3.50 – 4.00, Moderate Extent (ME) = 3pionts = 2.50 – 3.49, Less Extent (LE) = 2pionts = 1.50 – 2.49, No Extent (NE) = 1piont= 0.50 – 1.49. The data collected was analyzed using mean and simple percentage.

Results

Question 1. To what extent have students acquired skills in Basic Science and Technology?

Table 1: The extent students have acquired Skills in Basic Science and Technology

S/N	Acquired Skills	GSS		PSS	
		Mean	Decision	Mean	Decision
1	BST students have acquired observational skills	2.50	ME	2.57	ME
2	BST students have acquired manipulative skills	2.36	LE	2.51	ME
3	BST students have acquired measurement skills	2.62	ME	2.70	ME
4	BST students have acquired games/athletic skills	2.55	ME	2.45	ME
5	BST students have acquired entrepreneurship skills	2.53	ME	2.57	ME

Composite Mean = 2.51

Key: Great Extent =(GE), Moderate Extent =(ME), Less Extent =\(LE) No Extent= (NE)
GSS = Government Secondary Schools
PSS = Private Secondary Schools
BST= Basic Science and Technology

Results in Table 1 of research question 1 on the extent students have acquired skills in Basic Science and Technology. The result showed that the students have acquired skills in Basic Science and Technology moderately with a composite mean of 2.51.

Question 2. To what extent are the acquired skills applied by Basic Science and Technology students for sustainable living?

Table 2: The extent to which acquired skills applied by Basic Science and Technology students for sustainable living

S/N	Areas of Skill Application	GSS		PSS	
		Mean	Decision	Mean	Decision
1	Carpentry	2.34	LE	1.88	LE
2	Building	1.90	LE	1.76	LE
3	Welding and Fabrication	2.00	LE	1.56	LE
4	Refrigeration	1.21	NE	1.33	NE
5	Electricians	2.35	LE	2.56	ME
6	Automobiles	1.20	NE	1.45	NE
7	Mechanics	1.90	LE	1.79	LE
8	GSM Maintenance	2.10	ME	2.00	ME
9	Games/Athletic	2.70	ME	2.67	ME
10	Typing/Photocopying	1.46	LE	1.55	LE

Composite Mean = 1.92

Key: Great Extent = (GE), Moderate Extent = (ME), Less Extent = (LE) No Extent= (NE)
GSS = Government Secondary Schools
PSS = Private Secondary Schools

Results in Table 2 of research question 2 on the extent students have applied the acquired skills in Basic Science and Technology. The result showed that both students in government and private secondary schools have applied the acquired skills in Basic Science and Technology for sustainable living to a less extent with a composite mean of 1.92.

Research Null Hypothesis one (HO1)

There is no significant difference in the mean rating scores of students on the extent to which skills are acquired in Basic Science and Technology in Government and Private Secondary Schools.

Table 3

Variables	N	Mean	SD	t	Df	P	Level of Sig	Dec
Students GSS	1080	2.5120	0.5710	0.055	104	0.065	0.05	S
PSS	1080	2.5600	0.5315					

The t-test of independent sample on the extent skills are acquired in Basic Science and Technology in Government and Private Secondary Schools recorded t-test value of 0.055 with a p-value of 0.065 which is greater than 0.05 level of significance (p=0.065>0.05). Based on this result the null hypothesis is not rejected. This implies that there is no difference on the extent to which students in government and private secondary schools acquired skills in Basic Science and Technology.

Research Null Hypothesis two (HO2)

There is no significant difference in the mean rating scores of students on the extent to which acquired skills in Basic Science and Technology are applied in Government and Private Secondary Schools.

Table 4

Variables	N	Mean	SD	t	Df	P	Level of Sig	Dec
Students GSS	1080	1.9160	0.3200	0.053	104	0.071	0.05	S
PSS	1080	1.8550	0.1891					

The t-test of independent sample on the extent acquired skills in Basic Science and Technology are applied in Government and Private Secondary Schools recorded t-test value of 0.053 with a p-value of 0.071 which is greater than 0.05 level of significance (p=0.071>0.05). Based on this result the null hypothesis is not rejected. This means no there no difference on the extent to which students in government and private secondary schools apply the acquired skills to the major areas of livelihood for sustainable development.

Discussion

The result revealed that students in both government and

private secondary schools have acquired skills in Basic Science and Technology moderately. The result recorded t-test value of 0.055 with a p-value of 0.065 which is greater than 0.05 level of significance (p=0.065>0.05). Based on this result the null hypothesis is not rejected. This result is in line with Elisha and Ugochukwu (2014) [7] who asserted that students have acquired reasonable knowledge and skills in Basic Science and Technology which could serves as necessary tools for sustainable development. The result also showed that students in both government and private schools have applied the skills acquired in Basic Science and Technology to a less extent. The result recorded t-test value of 0.053 with a p-value of 0.071 which is greater than 0.05 level of significance (p=0.071>0.05). Based on this result the null hypothesis is not rejected. The result has confirmed the report of Nwosu and Micah (2017) [16] who opines that most schools ignore the area of skills application for sustainable living.

Conclusion

It is concluded based on the findings that, although the students have acquired skills in Basic Science and Technology to a moderate extent. The acquired skills are applied to a less extent which is a bad signal for Nigeria if actually Basic Science and Technology at this level is to lay the necessary foundation for the attainment of the Sustainable Development Goals (SDGs) by the year 2030.

Recommendations

Based on the findings of the study, the following recommendations are made.

1. Teachers should ensure that students acquire skills in Basic Science and Technology to a great extent.
2. School administrators and teachers should provide facilities and avenues for Basic science and Technology students to ensure that the acquired skills are applied to the major areas of livelihood to a great extent for sustainable living.
3. The government via the Ministry of Education, State Universal Basic Education Boards and other relevant agencies should intensify monitoring of the teaching/learning process especially in Basic Science and Technology, hence it a veritable tool for the attainment of the Sustainable Development Goals (SDGs).

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