COMPARATIVE ANALYSIS OF SCIENTIFIC LITERACY OF PRIVATE AND PUBLIC SCHOOL STUDENTS AT UPPER BASIC LEVEL OF EDUCATION IN KATSINA-ALA LGA

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Introduction

Nigeria is the most populated country in Africa with over 140 million people. The teeming population of Nigeria needs to be educated for the country to move forward socially, economically, scientifically and technologically. This implies that the country needs an education programme that will be readily available and responsive to meet the needs of her citizens. In this regard, Onoja (2015) posits that human development history has shown that sustainable development and self sustaining progress of any nation generally follow the development and application of science and technology education that is responsive to the needs and endowment of the country. This is the more reason why many nations of the World (developed and developing) are investing in the development of science and technology education with a view to attaining high level of self sufficiency and sustainable development in many facets of life.

Goal 4 of the 17 sustainable development goals is aimed at ensuring inclusive and quality education for all and promotion of lifelong learning (SDGs, 2015). Obtaining quality education is the foundation to improving people's lives and sustainable development. Major progress has been made by the Universal Basic Education programme towards increasing access to education at the basic level of education and increasing enrollment rates for girls in the North and boys in the South Eastern part of Nigeria. Similarly, basic literacy skills have improved tremendously, yet bolder efforts are needed to make even greater strives for achieving universal education goals.

The Nigerian government realized the importance of education to her citizen and the special benefit accruable when the citizens become literate in science and technology education. In pursuance of the laudable goals of education, several educational programmes have been instituted by different administrations in Nigeria. Latest among the educational programmes in

Nigeria was the introduction of the Universal Basic Education (UBE) by the Obasanjo led administration. In September, 1999, the Obasanjo administration launched the Universal Basic Education (UBE) programme in Sokoto State. The Universal Basic Education bill was however signed into law on 26th May 2004 following its passage by the National Asssembly. According to Sote, Aramide and Gbotoso (2011), the UBE Act (2004) makes primary and junior secondary education in Nigeria free for all children within the target population and also guarantees regular funding from the Federal Government for the programme. The Act also provides for the establishment of the State Universal Basic Education Boards (SUBEBs) in all the 36 States of the Federation including the Federal Capital Territory (FCT).

The Universal Basic Education (UBE) is a free and compulsory 9 year education programme for all children within the age range of six to fifteen years. It also includes the adult and non-formal education programmes at Primary and junior secondary education levels for the adults and out-of-school youths (Federal Government of Nigeria, 2004). In Nigeria, UBE programme was introduced to fulfill the UNESCO declaration of Jomtien, Thailand framework on Basic Education for all by the year 2015. The implementation of the programme commenced in July 2005 (Danmole, 2011). The decision of the Federal Government to introduce the 9–year Basic Education Programme was propelled by government realization that basic education is crucial in the attainment of the Millennium Development Goals (MDGs) by the year 2015 and achievement of the four target goals of the National Economic Empowerment and Development Strategies (NEEDS). The four target goals of NEEDS are value re-orientation, poverty eradication, job creation and wealth creation through empowerment of the people through education.

Major reforms of the UBE programme include the re-alignment of the pre-existing primary and junior secondary school curricula to meet the targets of the nine-year basic education programme. The features of the nine-year basic education programme as pointed out by Osuafor and Okoli (2013) include; three years of Primary 1-3, three years of Primary 4-6 and 3 years of Juniour Secondary School.

The goals of basic education as provided by section 3 of the National Policy on Education (FRN, 2004) are the same as the goals of the primary education, junior secondary education and adult and non-formal education. The overall objectives of the Universal Basic Education are enumerated by Edho (2009) to include; ensuring unaltered access to 9 years of formal basic education, provision of free and universal education for every Nigerian child of school age, reducing drastically the incidence of dropout from the formal

school system through improved relevance, quality and efficiency and ensuring the acquisition of appropriate levels of literacy..

It is therefore expected as stressed by Igbokwe (2015), that every learner who has gone through the 9 years of basic education should have acquired appropriate levels of literacy, numeracy, manipulative, communicative and life skills; as well as the ethical, moral and civic values needed for laying a solid foundation for a life-long learning; as a basis for scientific and reflective thinking. The implication of the much emphasis placed on literacy and numeracy skills in the Universal Basic Education curriculum is that learners should acquire these skills in all the subjects taught at this level.

Basic Science and Eechnology education is a core science and Technology composite subject that is taught to learners in Universal Basic Education programme to provide the basic scientific literacy to them. The overall objectives of Basic Science and Technology education curriculum at the Juniour Secondary School level of the 9-year compulsory education programme are to; develop interest in science and technology, acquire basic knowledge and skills in science and technology, apply scientific and technological knowledge and skills to meet societal needs, take advantage of the numerous career opportunities offered by science and technology and become prepared for further studies in science and technology education (NERDC, 2007). These objectives are in line with the overall UBE objectives and have also laid emphasis on the basic knowledge and skills in science and technology education as a foundation for future carriers and professions in the fields of sciences, engineering and technology.

Scientific literacy goes beyond the simple definition of literacy as the ability to read and write or ability to decode meaning from alphabets or represent words or speech in alphabets for storage or communication. Scientific literacy is the basic knowledge of the systematic approach or procedure which scientists use to carry out investigations about natural phenomena. The Organization for Economic Co-Operation and Development (OECD) Programme for International Student Assessment (PISA) define scientific literacy as the capacity to use scientific knowledge, identify questions and draw conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity (OECD, 2011).

Students are taught scientific literacy under the UBE as they learn concepts in the Basic Science and Technology. As students learn these subjects they are not only expected to learn about scientific processes but to acquire the attitudes of scientists and apply them in everyday life processes.

Expounding on the expectation of the UBE programme, Tahir in Hamza & Mohammed (2011) explains that at the end of nine years of continuous education, every child should acquire appropriate level of literacy, numeracy, communication, manipulative and life skills. The products of the UBE programme should be employable, useful to themselves and the society by possessing relevant ethical, moral and civic values. Thus, the vision of UBE has taken care of all that it entails to bring about socio – economic and sustainable development. Scientific literacy is very important to all students irrespective of their discipline especially in the 21st century, which is a digital and technological age with emerging health, security and weather challenges that require basic scientific knowledge. A scientifically literate student is expected to apply the knowledge of scientific concepts and processes to the evaluation of issues and problems that may arise and to the decisions made in daily life, about the natural world and changes made to it through human activity (OECD, 2011).

The Universal Basic Education had been launched for over a decade and has undergone re-structuring to merge subjects with similar concepts to enhance its success amidst challenges ranging from poor funding to poor manpower and poor infrastructure (Ejere, 2011). The target of the Universal Basic Education is to achieve 100% enrollment of all children of school age by the year 2015. The year 2015 have come and gone, yet many children of school age in Nigeria are still out of school and have not received the desired Universal Basic Education. This trend has marred the realization of the goals of the Universal Basic Education (UBE) in Nigeria.

Haggai (2009) laments that in spite of the concerted efforts made by the Nigerian government at funding the Universal Basic Education in the country; 11 million children of school age are still out of school. If this number does not have access to education, then, it is an indication that something is wrong along the line in implementing the programme. The concern of this study is to investigate the impact of Universal Basic Education on scientific literacy of students in upper basic level of education in Benue State.

The study determined the impact of Universal Basic Education on students' scientific literacy of private and public school students at the upper basic level of education. Specifically, the study focused on determining:

1. the extent to which students are curious about the natural world
2. the extent to which students read science articles with understanding.
3. the extent to which students express positions that are scientifically informed.

4. the difference in scientific literacy of students in private and public schools.

The following research questions guided the conduct of the study.

1. To what extent are students curious about the natural world?
2. To what extent do students read with understanding science articles?
3. To what extent do students express positions that are scientifically informed?
4. What is the difference in scientific literacy of students in public and private schools?

One null hypothesis was formulated thus:

There is no significance difference in scientific literacy of students in public and private schools.

Method

This study was carried out in private and public schools at upper Basic level of education in Katsina-Ala Local Government Area of Benue State. The expost-facto research design was adopted for the study. The population of the study comprised 3035 Juniour Secondary School students offering Basic Science and Technology in 42 public and private schools in the area. Three hundred students were selected using stratified random sampling technique from 10 Juniour Secondary Schools (public and private) from the area. A four points Students Scientific Literacy Questionnaire (SSLQ) was used to collect the data. Both face and content validity of the instrument was established by specialists in Science Education, Psychology, Measurement and Evaluation. A reliability coefficient of 0.75 was obtained for the Students Scientific Literacy Questionnaire using test retest method. Data were collected with the assistance of the Basic Science teachers in each of the sampled schools. Data collected were analyzed using mean and independent t-test torespectively answer the research questions and test the hypothesis at 0.05 level of significance. The mean of the responses is 2.5. Thus any response that has mean of up to 2.5 and above is a positive response. Similarly any response that has mean of less than 2.5 is a negative response. Similarly, in testing the hypothesis, if the calculated value is greater than the table value, the null hypothesis will be rejected. However, if the calculated value is less than the table value, the null hypothesis will be retained.

Results

Table 1: Students curiosity about the natural world. N = 300

S/N	Items	Always	Often	Rarely	Never	$\bar{X}$	SD	Decision
i	I enjoy talking with my friends and family about the happenings in the environment.	207	45	26	22	3.45	0.86	Positive
ii	I enjoy helping the environment through science projects.	150	60	45	45	3.05	1.27	Positive
iii	I like to restore devastated areas in the community.	100	70	50	80	2.63	1.43	Positive
iv	I consider it fun to collect data from the natural environment.	140	54	38	68	2.88	1.48	Positive
	Grand mean response/SD = 3.00						**1.26**	

The result of data analyzed in Table 1 on students' curiosity about the natural world shows that the mean response on each of the items on this attribute is greater than the average mean response of 2.5. This is an indication that students are curious about the natural environment as a result of knowledge gained from the Universal Basic Education programme. Also, a grand mean value of 3.00 was obtained which fall within the scale of often, showing that students are often curious about the natural world. The average standard deviation value of 1.26 shows that the individual scores of the items cluster around the mean value.

Table 2: Reading and understanding of scientific articles. N = 300

S/N	Items	Always	Often	Rarely	Never	$\bar{X}$	SD	Decision
i	I enjoy reading science articles.	195	48	30	27	3.37	0.97	Positive
ii	I learn about new discoveries in science from science articles.	150	72	52	26	3.15	0.60	Positive
iii	Science articles increase my knowledge of science concepts.	160	60	58	22	3.19	0.98	Positive
iv	I derive satisfaction from reading science articles.	130	60	55	55	2.88	0.64	Positive
	Grand mean response/SD				**=**	**3.14**	**0.79**	

Table 2 shows the analysis of data on ability of students to read and understand science articles. The mean of all the responses exceed the average mean of 2.5. This implies that students can read and understand scientific articles. The grand mean value of 3.14 which was obtained fall within the scale range of often, indicating that students' often read and

understand scientific articles. The average standard deviation value of 0.79 indicates that the difference in the scores of the group is so small.

Table 3: Extent to which students express positions that are scientifically informed. N = 300

S/N	Items	Always	Often	Rarely	Never	$\bar{X}$	SD	Decision
I	I believe that change in weather is as a result of human activities.	46	72	105	77	2.29	1.02	Negative
II	I am convinced that food scarcity is partly due to increase in population.	103	70	66	61	2.71	1.29	Positive
III	I doubt the notion that sickness can be caused by evil spirit.	63	56	74	107	2.25	1.32	Negative
IV	I attach incidence of drought to climate change.	81	66	68	85	2.47	1.35	Negative
	Grand mean response/SD =					**2.43**	**1.24**	

The result of data analyzed on research question 3 as in Table 3 shows that students find it difficult to express positions that are scientifically informed. This is evident in the fact that the mean score of their response score to all the items except one in this section are less than 2.5. The grand mean response of 2.43 falls within the scale range of rarely, showing that students rarely express positions that are scientifically informed. The average standard deviation value of 1.24 shows that the scores of the items are clustered round the group mean.

Table 4: Comparison of scientific literacy of students in public and private schools.

S/N	Items	Public schools N= 90		Private schools N= 210	
		$\bar{X}$	SD	$\bar{X}$	SD
i	I enjoy talking with my friends and family about the happenings in the environment.	3.62	1.04	3.37	1.40
ii	I enjoy helping the environment through science projects.	3.02	1.75	3.07	1.60
iii	I like to restore devastated areas in the community.	2.45	1.92	2.64	1.83
iv	I consider it fun to collect data from the natural environment.	2.77	1.73	2.42	2.13
V	I enjoy reading science articles.	3.16	1.59	3.37	1.37

vi	I learn about new discoveries in science from science articles.	2.88	1.66	3.07	1.58
vii	Science articles increase my knowledge of science concepts.	3.02	1.72	3.14	1.55
Viii	I derive satisfaction from reading science articles.	3.12	1.50	3.00	1.60
ix	I believe that change in weather is as a result of human activities.	2.58	1.13	2.39	1.89
X	I am convinced that food scarcity is partly due to increase in population.	2.27	1.76	2.74	1.72
xi	I doubt the notion that sickness can be caused by evil spirit.	2.42	2.05	2.52	1.84
xii	I attach incidence of drought to climate change.	2.72	1.72	1.21	2.00
	Grand mean response/SD =	**2.83**	**1.63**	**2.74**	**1.70**

Table 4 shows the result of data analyzed on the difference in scientific literacy of students in public and private schools. The grand mean response value of 2.83 for public schools and 2.74 for private schools indicate that both public and private schools have mean response value greater than the cut-off response mean value of 2.5. This is a positive value showing that the students in both public and private schools exhibit high level of scientific literacy. The mean difference between public and private schools is 0.09 in favour of public schools. The difference will be tested statistically to ascertain whether it is significant. The standard deviation of 1.63 and 1.70 for public and private schools is an indication that the individual score from the responses are not widely dispersed from the group mean.

Table 5: T-test analysis on the difference in scientific literacy of students in public and private schools

S/N	Schools	Mean	SD	N	DF	t-cal	t-crit	Decision
1.	Public	2.83	1.63	90				Significant.
2.	Private	2.74	1.70	210	298	5.29	1.96	

The result of data analysis in Table 5 shows t-calculated value of 5.29 at 0.05 with 298 degree of freedom and a critical value of 1.96. Since the calculated value of 5.29 is greater than the t-critical value of 1.96, the null hypothesis of no significant difference in scientific literacy of students' in public and private schools is rejected. Thus, significant difference exists in scientific literacy of students in public and private schools. The actual difference between the two groups was determined using Eta squared (Es).

The value of Es is 0.085 which means that the difference in scientific literacy of students in public and private schools is 8.5%.

Discussion

The result of the study shows that students are curious about the natural environment as a result of knowledge gained from the Universal Basic Education programme. The result equally indicates that students can read and understand scientific articles. This finding agrees with the opinion of Igbokwe (2015) that every learner who has gone through the 9 years of basic education should have appropriate levels of literacy, numeracy, manipulative and life skills as a basis for scientific and reflective thinking. This finding is also in line with the attainment of the overall objectives of Basic Science and Technology curriculum (NERDC, 2007), which includes; acquisition of basic skills in science and technology, applying scientific and technological knowledge and skills to meet societal needs and become prepared for further studies in science and technology education. Teachers should sustain this tempo by engaging students in scientific activities that will further boost their desire to learn and explore the natural world.

The result also shows that students find it difficult to express positions that are scientifically informed. This finding is in contrast with the view of OECD, (2011) that scientific literacy is the capacity to use scientific knowledge, identify questions and draw conclusions in order to understand and help make decisions about the natural world. Since students cannot express positions that are scientifically informed, it suggests that the learning of science has not yet shaped their belief system. The result is also at variance with the position of Hamza and mohammed (2011) that the product of UBE should be employable, useful to themselves and the society by possessing relevant moral, ethical and civic values given the high rate of youth restiveness and unemployment that lingers among the age group of UBE graduates in the study area.

The result of data analyzed on the difference in scientific literacy of students in public and private schools shows that there is 8.5% difference. This result negates the attainment of one of the objectives of Universal Basic Education of ensuring the acquisition of appropriate levels of literacy as pointed out by Edho (2009). The aim of the UBE programme is to ensure the attainment of adequate levels of literacy by all learners that are exposed to the content of the curriculum irrespective of the school where the learners interact with the learning experiences. Thus, the relevant agencies that monitor the implementation of the UBE programme should guide schools (public or

private) for proper implementation. This may reduce the gap in the knowledge levels of students irrespective of the schools attended.

Conclusion

Based on the findings of the study, it was concluded that:

i. Students are curious about the natural world
ii. Students are able to read and understand science articles
iii. Students rarely express positions that are scientifically informed
iv. Significant differences exist in scientific literacy of students in public and private schools in favour of private schools.

The much needed sustainable development by nations of the world largely depends on the level of scientific literacy of her citizens. It may not be an overstatement to say that no nations of the world may develop beyond the level of her scientific literacy. The introduction and implementation of the Universal Basic Education (UBE) in the Nigerian education system is a giant stride by the Federal Government of Nigeria to break the barrier of illiteracy and make her citizens relevant in various spheres of life. The UBE programme has provided learning opportunity for every children of school age in Nigeria to attain basic level of scientific literacy. Scientific literacy is necessary for every individual in this country for the country to attain the needed technological breakthrough. All hands must be on deck in the pursuance of the slogan 'education for all citizens'.

Recommendations

The following recommendations are made in line with the findings of this study:

i. Students should be engaged in hands-on activities by the science teacher that may stir up their concern about the environment.
ii. Schools should provide recent science articles for students to read and understand recent knowledge in science.
iii. Science clubs should be organized by the science teacher in schools to inform students on trends in science so that students can express position that are scientifically informed.
iv. Inspectorate Unit of Ministry of Education should monitor both public and private schools to ensure uniformity of standards.

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