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Influence of Alternative Conceptions on Upper Basic Education Students' Interest in Basic Science and Technology in Benue State, Nigeria

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Abstract

This study investigated the influence of alternative conceptions on Upper Basic Education (UBE) students' interest in Basic Science and Technology in Benue State, Nigeria. The study had three objectives and three research questions. Two research hypotheses were formulated and tested at 0.05 level of significance. The study was an ex-post facto descriptive research design. A total of 79,600 UBE 1 students in Benue State formed the population of the study. The sample used in the study was 398 students randomly sampled from three educational zones in Benue State. Basic Science Alternative Conceptions Identification Checklist (BSACIC) and Basic Science Alternative Conceptions Influence on Students' Interest Questionnaire (BSACISIQ) were instruments for data collection. The reliability of the instruments were 0.74 and 0.87 for BSACIC and BSACISIQ respectively. Data were collected and analyzed using frequency count and percentages, means, standard deviations and student t-test. The findings of this study show that students held alternative conceptions in Basic Science and Technology, alternative conceptions significantly influenced students interest and there was no significant difference in the influence of alternative conceptions on male and female students' interest in Basic Science and Technology. Based on these findings, it was concluded that UBE students have alternative conceptions that influence their interest in Basic Science and Technology, gender do not determines how alternative conceptions influence UBE students' interest in Basic Science and Technology in Benue State. It was recommended that Basic Science and Technology Teachers should be conscious of the identified alternative conceptions held by students while teaching Basic Science and Technology. They should also apply appropriate teaching strategies for correcting students' alternative conceptions in order to improve their interest in Basic Science and Technology in Benue State.

Keywords: alternative conceptions, interest, basic science and technology, upper basic education

1. Introduction

Science when viewed as knowledge takes various forms such as concepts, facts, principles, theories and laws. In Basic Science and Technology (BST) curriculum, various scientific concepts are taught alongside scientific skills

and attitudes. BST concepts are found in four subjects (themes), the themes are Basic Science, Basic Technology, Physical and Health Education and Information Technology. One of the objectives of BST is to develop students' interest in science and technology (Nigeria Educational Research Development Council NERDC, 2013): According to NERDC (2013) BST concepts such as matter, plants, animals, pollution, air, water, digestion among others are infused in topics spirally sequenced, from simple to complex across the 3 (three) years of schooling at Upper Basic Education (UBE) level in order to sustain the interest of learners and promote meaningful learning. However, students find it difficult to define, explain, differentiate and classify such science concepts correctly during examination (Benue State Examinations Board, 2019).

BST curriculum promotes teaching and learning with examples that are indigenous and familiar to learners' experience (NERDC, 2013). This implies that the teaching and learning of Basic Science and Technology concepts has to do with the learners pre-existing knowledge be it right or wrong. Hence, Uzoechi and Adejoh (2014), Thomson and Logue (2016) emphasized that before students learn a new material, many of them already have some kind of understanding of the problem. They have pre-conceptions in mind about the new concepts that may be relevant or not in conformity with new concept they are to learn (Ododo, 2014; Ezechi, 2018). Smolleck and Hershberger (2011) stated that as students explore the world; their conceptions are based on their everyday experiences. For the authors, there are two types of conceptions students hold in the class and these are: pre-conceptions and alternative conceptions. Pre-conceptions are students' prior knowledge that provides a good foundation for learning, this is the meaning the learner has that is in agreement with the expert meaning before coming to class, whereas alternative conception is a prior knowledge that may be partially correct to be used as the foundation for further learning of scientific concept (Smolleck & Hershberger, 2011; Jody, 2011; Omwirhiren & Ubanwa, 2016).

Alternative conceptions are known by different authors as misconceptions, naïve conceptions, non-scientific beliefs, pre-instructional beliefs, intuitive knowledge, phenomenological primitives (p-prims), facets, or alternative framework (Erol, Salih & Erdem, 2012; Okafor, 2014; Omwirhiren & Ubanwa, 2016). Titiana (2010) states that alternative conceptions are not always condemned as mistaken notions that need repair or replacement but are understood as understandings that are simply different from the views of experts. Okafor (2014) revealed that science education researchers have recommended the use of conceptual change pedagogy for science teaching. This entails that science learning occurs when students' understandings about specific science concepts are restructured in major ways. In other words, to use conceptual change pedagogy effectively, a teacher needs to understand the alternative conceptions the learner holds.

Current research findings have shown that students of all ages across the world have alternative conceptions of science concepts and other related disciplines (Jody, 2011; Ishaya, Danjuma, Dazi & Manji, 2017). For instance, a belief that all liquids are drinkable, solids cannot be broken, plants roots are organs for feeding, plants carry out photosynthesis in the day and respiration at night, rotation of the earth is the same as revolution, a child can inherit the characters of the animal whose meat the mother ate during pregnancy, light is matter, gas is not matter among others.

In simplest term interest is the great concentration and anxiety to know or learn about something. According to interest researchers (Harackiewich & Knogler, 2017), the state of interest combines positive affective qualities, such as feelings of enjoyment and curiosity, with cognitive qualities of focused attention, as well as perceptions of value and personal importance. Thus, being in a state of interest means that positive affective reactions and cognitive functioning are intertwined, which makes cognitive engagement and focusing of attention feel relatively effortless. Ortony, Swarat and Revelle (2012) stated that students come to school with strong innate interest in science, and the decline of their interest stems from the way science is taught. The authors reveal that students found concepts that they perceived as personally ''meaningful'' and related to their daily lives to be interesting but abstract concepts that are not in consonant with their daily experience not interesting to them. However, if the students' abstract and misunderstood concepts are quickly identified and appropriately taken care through effective

teaching method, then, the teaching and learning of scientific concepts may move on smoothly, thereby, resulting to increase in interest. At any level of graduation students have greater achievement in the subject they have interest in. (Eriba, 2013; Yaapera & Adejoh, 2019)

Since, the environment and the experience of the learner is not static across the globe, it is necessary that the learner's alternative conceptions of science concepts may be at variance based on their environment. BST been relatively a new curriculum developed at upper basic education level, it is imperative that students may have different viewpoints about the scientific concepts in the subjects which may have positive or negative influence on their interest. Since, the current innovative teaching strategies are not improving students' interest in BST. It could be that the influence of alternative conceptions on learning in BST is a contributing factor. Hence, there is need to investigate the influence of alternative conceptions held by students on their interest.

1.1 Research Questions

The following research questions guided the study:

1) What are the alternative conceptions held by UBE 1 students in selected Basic Science concepts in Benue State?

2) What is the influence of alternative conceptions held by UBE 1 students in selected Basic Science concepts on their interest in Basic Science in Benue State?

3) What is the difference in the influence of alternative conceptions on male and female students' interest in Basic Science in Benue State?

1.2 Statement of Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance.

1) There is no significant influence of alternative conceptions held by UBE 1 students in selected Basic Science concepts and interest in Basic Science in Benue State.

2) There is no significant difference in the influence of alternative conceptions on male and female students' interest in Basic Science in Benue State.

2. Methodology

This study adopted a causal-comparative descriptive research design. It is a kind of research in which the researcher predicts the possible causes behind an effect that has already occurred. It does not involve the researchers' direct control over the independent variables because they have already led to effects which can no more be manipulated. It is a study in which a researcher, instead of finding a treatment, examines the effect of a naturally occurring treatment after it has occurred. In this study the alternative conception held by students served as independent variable whereas interest was dependent variable. Students come to their classes with various alternative conceptions which the researcher could not determine who had the alternative conception or not. The duty of the researcher was to examine alternative conceptions students have before coming to class, find out the relationship between students' alternative conceptions and their interest. The researcher did not give any training to the teachers.

The study area for this research work was Benue state, Nigeria. The target population of this study was 79,600 Upper Basic Education 1 (UBE 1) Basic Science and Technology students from 732 mixed sex Government approved Junior Secondary Schools in Benue State (Benue State Ministry of Education, 2019). The sample of this study comprised 398 of UBE 1 students randomly selected from 14 (fourteen) mixed sex Government approved Secondary Schools in Benue State. The sample was made up of 198 male and 200 female students. Proportionate stratified random sampling and purposive sampling techniques were employed in selecting schools. Simple random sampling technique was used in selecting students to participate in this study.

Two instruments used for this study were Basic Science Alternative Conceptions Identification Checklist (BSACIC) and Basic Science Alternative Conceptions Influence on Students' Interest Questionnaire (BSACISIQ). The face and content validation of the instruments for this study was done by three experts, two in science education and one expert in measurement and evaluation. Kuder-Richardson Formula (K-R Formula 20) was used to measure internal consistency of BSACIC and was given the values of 0.74. Cronbach' Alpha Coefficient was used for checking internal consistency of BSACISIQ and it was given a value of 0.82.

When the permission was granted research

assistants in their various schools were educated on the essence of this study before the first batch of questionnaire administered. BSACIC was administered first and then normal lesson was allowed for the period of six weeks before BSACISIQ was administered. The six weeks duration was to allow the Basic Science and Technology teachers complete their lessons on the topics used for this study.

The researcher did not give any training to Basic Science and Technology teacher on how to teach. Respondents for BSACISIQ were only students who responded to BSACIC at the beginning of the process. The researcher supervised the whole process while research assistant supports the researcher. All the copies of BSACIC and BSACISIQ were retrieved from the respondents for analysis. Scores of respondents on BSACISIQ were converted to percentage before analysis. Respondents with 50% and above have high interest and those below 50% have low interest conceptions. Data collected for this study were analyzed using frequency count and percentage, mean, standard deviation, and student t-test for answering research questions and testing of the hypotheses at 0.05 level of significance.

3. Results

Presentations in this section are based on research question and null hypotheses.

3.1 Research Question One

What are the alternative conceptions held by UBE 1 students in selected Basic Science concepts in Benue State? To answer this research question, data collected on alternative conceptions held by UBE 1 students in selected Basic Science concepts in Benue State are presented on Table 1.

Table 1. Frequency and Percentage Data collected on Alternative Conceptions held by UBE 1 Students in Selected Basic Science Concepts

Concept	Responses		Remarks
	False	True	
1) Nutrition	157(39.5%)	241(60.5%)	Alternative Conceptions Exist
2) Excretion	16 (4.0%)	382(96.0%)	Alternative Conceptions Exist
3) Respiration	118(29.7%)	280(70.3%)	Alternative Conceptions Exist
4) Reproduction	75(18.8%)	323(81.2%)	Alternative Conceptions Exist
5) Plants	122(30.7%)	276(69.3%)	Alternative Conceptions Exist
6) Living things	111(27.9%)	287(72.1%)	Alternative Conceptions Exist
7) Irritability	119(29.9%)	279(70.1%)	Alternative Conceptions Exist
8) Matter	166(41.7%)	232(58.3%)	Alternative Conceptions Exist
9) Animals	182(45.7%)	216(54.3%)	Alternative Conceptions Exist
10) Mass	96(24.1%)	302(75.9%)	Alternative Conceptions Exist
11) Metals	122(30.7%)	276(69.3%)	Alternative Conceptions Exist
12) Evaporation	185(46.5%)	213(53.5%)	Alternative Conceptions Exist
13) Weight	134(33.7%)	264(66.3%)	Alternative Conceptions Exist
14) Water	69(17.3%)	329(82.7%)	Alternative Conceptions Exist
15) Non-living thing	75(18.8%)	323(81.2%)	Alternative Conceptions Exist
Total	**117(29.4%)**	**281 (70.6%)**	

The question can be answered that the alternative conceptions with 50 % and above in the table are held by UBE I students in Basic Science and Technology in Benue State. From Table 1 above, it can be seen that all the items captured on alternative conceptions have 50 percent (%) and above as true with a total of 281 (70.6%). It therefore, means that UBE I students held alternative conceptions in Basic Science and Technology in Benue State.

3.2 Research Question Two

What is the influence of alternative conceptions

held by UBE 1 students in selected Basic Science concepts on their interest in Basic Science in Benue State? To answer research question 2, data collected on the influence of alternative conceptions held by UBE 1 students in selected Basic Science concepts on their interest in Basic Science in Benue State are presented on Table 2.

Table 2. Mean Scores and Standard Deviation of Influence of Alternative Conceptions Held by UBE 1 Students in Selected Basic Science Concepts on their Interest

	Mean	N	Std. Deviation
Conception	55.71	398	11.08
Interest	61.85	398	15.82
Mean difference	6.14		

From Table 2, the mean score for alternative conception is 55.71 with standard deviation of 11.08 and interest mean score is 61.85 with standard deviation of 15.82. The mean difference is 6.14. Since, alternative conception and interest mean scores above 50, it therefore means the students have alternative conceptions and also have high interest in Basic Science with more homogeneous scores in alternative conceptions. The question can be answered that alternative conceptions held by UBE 1 students in selected Basic Science concepts influence their interest positively, when students have alternative conceptions, they have interest in Basic Science in Benue State.

3.3 Research Question Three

What is the difference in the influence of alternative conceptions held by male and female UBE 1 students in selected Basic Science concepts on their interest in Basic Science in Benue State? To answer research question 3, data collected on the influence of alternative conceptions held by male and female UBE 1 students in selected Basic Science concepts on their interest in Basic Science in Benue State is presented in Table 3.

Table 3. Mean Score and Standard Deviation of the Difference between Influence of Alternative Conceptions Held by Male and Female UBE 1 Students

	Sex	N	Mean	Std. Deviation
Interest	Male	193	62.36	15.78
	Female	205	61.37	15.89
Mean difference			0.99	

From Table 5, the mean score for male is 62.36 with standard deviation of 15.78 and the mean score for female is 61.37 with standard deviation of 15.89. The mean difference is 0.99. Since, the male and female mean scores above 50, it therefore, means that both male and female students have interest in Basic Science. However, male students have more interest than female, but female students' scores are more homogeneous. Then the question can be answered that there is difference in the influence of alternative conceptions held by UBE 1 students in selected Basic Science concepts on their interest in Basic Science in Benue State.

3.4 Hypothesis One

There is no significant influence of alternative conceptions held by UBE 1 students in selected Basic Science concepts on their interest in Basic Science in Benue State. To test hypothesis one, data collected on influence of alternative conceptions held by UBE 1 students in selected Basic Science concepts on their interest in Basic Science in Benue State is presented on Table 4.

Table 4. Paired Sample t-test of Significance of the Influence of Alternative Conceptions of UBE 1 Students and their Interest in Basic Science

	Pair difference	t	Df	Sig.(2-tailed)	eta squared
	Mean				
Pair Conception and Interest	6.14	6.66	397	0.00	0.10

Note: df = degree of freedom; t = t-test value; Sig. = P-Value, P< 0.05.

From Table 4, the mean difference = 6.14, t = 6.66, df =397, sig. (2 tailed) = 0.00 = p and eta squared = 0.10. Since p<0.05, it therefore means that the result is significant and the null hypothesis is rejected with the conclusion that there is a significant influence of alternative conceptions held by UBE 1 students in selected Basic Science concepts on their interest in Basic Science in Benue State. The eta squared statistic of 0.10 (10%) shows that the influence of alternative conceptions on interest is large. It therefore, means that alternative conception contribute 10% in influencing UBE students interest positively in Basic Science and Technology in Benue State.

3.5 Hypothesis Two

There is no significant difference in the influence of alternative conceptions held by male and female UBE 1 students in selected Basic Science concepts on their interest in Basic Science in Benue State. To test hypothesis two, data collected on the influence of alternative conceptions held by male and female UBE 1 students in selected Basic Science concepts on their interest in Basic Science is presented on Table 5.

Table 5. Independent Sample t-test of Significance Difference between the Influence of Alternative Conceptions held by Male and Female UBE 1 Students in selected Basic Science Concepts on their Interest in Basic Science

	t	df	Sig.(2-tailed)	eta squared
Interest	0.62	396	0.54	0.0009

Note: df = degree of freedom; t = t-test value; Sig. = P-Value, P< 0.05.

From Table 5, t = 0.62, df =396, sig. (2 tailed) = 0.54 = p and eta squared = 0.0009. Since p>0.05, it therefore, means that the result is not significant and the null hypothesis is not rejected with the conclusion that there is no significant difference in the influence of alternative conceptions held by male and female UBE 1 students in selected Basic Science concepts on their interest in Basic Science in Benue State. The eta squared statistic of 0.0009 (.09%) shows that the influence of alternative conceptions on interest of students due to gender is very small.

4. Findings of the Study

The major findings of the study are that:

1) UBE 1 students held alternative conceptions in Basic Science and Technology in Benue State.
2) Alternative conceptions held by UBE 1 students in Basic Science and Technology significantly influence their interest in Basic Science and Technology.
3) There is no significant difference between the influences of alternative conceptions on the interest of male and female UBE 1 students in Basic Science and Technology.

5. Conclusion and Recommendation

Based on the findings of this study, it was concluded that Upper Basic Education students held alternative conceptions in Basic Science and Technology. Alternative conceptions held by UBE students significantly influence their interest in Basic Science and Technology and there is no significant difference in the influence of alternative conceptions on interest of male and female UBE students in Basic Science and Technology in Benue State. Based on the findings, the following recommendations were made:

i. Basic Science and Technology Teachers should be conscious of the identified

alternative conceptions and their sources while teaching and apply appropriate teaching strategies for correcting them.

ii. Basic Science and Technology teachers should expose students to teaching strategies that can reduce alternative conceptions in Basic Science and Technology since it has negative influence on interest.

iii. Basic Science and Technology teachers should be discouraged from teacher centered method of teaching, but apply learner centered method, so that students can construct knowledge from known to unknown conceptions.

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