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Influence of Cultural Belief and Values on Secondary School Students' Understanding of Atmospheric Related Physics Concepts.

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Abstract

The study identified the different cultural concepts that secondary school students' believe in and determined the believe and idea of students about the cultural concepts. It also investigated students' source of information about the cultural concepts and determined the influence of these cultural believes on students' academic performance in Physics. The study employed the use of descriptive survey research design. The sample consisted of 940 secondary school students who were randomly selected from 25 public and private secondary schools in the southwestern region of Nigeria using stratified and simple random techniques. The instruments used for data collection are questionnaires titled "Cultural Belief and Atmospheric-related Physics Concepts Questionnaire" (CBAPCQ) and "Cultural Belief Misconceptions in Physics Achievement Test" (CBMPAT). Data collected were analyzed using inferential and descriptive statistics. Result revealed that among the different cultural concepts held by students, high percentage of them believe that rain falling and sun shining means lion is giving birth. Also, majority of the students claimed that the different believes of student about the cultural concepts were superstition and lies. The study identified students' major source of information about the cultural concepts to be grandparents, parents and story books. Also, it was found that cultural beliefs of students have negative influence on the academic performance of students in Physics. The study concluded that students held different misconceptions about cultural belief and values which they take into classroom. It therefore recommends that science teachers should intensify on the teaching of scientific concepts that give better explanation to most of these concepts.

Keywords: Cultural belief, Atmospheric concepts, Misconceptions, Physics, Superstition.

1. Introduction

Physics is one of the most important branches of science and a core subject in science which plays important role in the day-to-day activities of man. It occupies a very sensitive position in all science-oriented courses such as engineering, mining, medicine and many others. Students who will pick up careers in sciences and engineering must have undergone training in Physics in their secondary school level and must not only be good in Physics but must have passed the subject at least at credit level in the Senior Secondary School Examination (SSCE). Besides, Physics enables learners to understand the world around them, what happens around them. It helps them to solve simple problems they encounter daily. Fahmy (2000) stated that the most interesting aspect of Physics is that it applies to our daily lives. The importance of Physics in making the world worth living are too numerous to mention.

However, it is disheartening to know that despite its key role, it is plagued by persistent low enrolment and under-achievement by students. This has elicited a lot of concern and generated researches to establish the causes of repeated failures. Some of these had been ascribed to poor teaching methods, limited number of professionally trained teachers, lack of instructional facilities, unavailability of suitable practical equipment, inadequate funding among others (Simon, 2000; Stokking, 2000; Ogunniyi, 2009; Owolabi and Oginni, 2013; Bello, 2012). Attempts have been made by educational stakeholders to find ways of improving students' performance in the subject some of which have focused on identifying appropriate teaching methodology (Bello, 2011; Orora, Wachanga and Keraro, 2005, Kibett and Kathuri, 2005), improving on teachers' mastery of content and provision of instructional materials (Omosewo, 2009; Adeyemo, 2011; Akinfe, Olofinniyi and Fashiku, 2012). Despite all these efforts, the performance of students in Physics is still below expectation; it is therefore pertinent to consider other factors that could be responsible for under-achievement in the subject.

A major cause of under-achievement has been traced to the influence of misconceptions which students bring to science classroom especially Physics class (Samba, 2003; Ivowi, 2010). Research had shown that students' explanations of scientific phenomena are controlled by what they perceived from their cultural beliefs (Okebukola, 2002 and Yip, 2001).

Learning is known to be culture dependent (Mwamwenda, 1996). As noted by Okoye and Okeke (2007), it has been very difficult to explain most natural occurrences and issues in African life using scientific knowledge; this is because most of the people's beliefs have been crowded with mythology and superstitions. It is mostly based on power of witchcraft and evil spirits which is a departure from scientific explanations. This has resulted to divergence between students' daily experience in the classroom and the scientific world with most of the students having significant difficulties in describing, understanding, interpreting and predicting natural

phenomena (Driver et. al., 1994, Engelhardt et al, 2004, Osborne and Freyberg, 1985). Science educators are now conscious of the need to relate science more closely to the students' cultural environment in order to minimize the possible conflicts that might arise from their view of the world and that of science. This could be done by carefully considering the traditional point of view that has appropriate relation to scientific concepts. Ausubel (2000) have argued that the construction of new knowledge in science is strongly influenced by prior knowledge that is conceptions gained prior to the new learning. Since Physics is an important science subject taught in secondary schools which relates with physical phenomena and how they are connected to man's daily lives, there is therefore the likelihood of cultural beliefs exerting influence on learning and manipulation of concepts. It is therefore pertinent that Physics teachers assist their students to use their knowledge in ways that draw on their cultural experiences for meaningful learning to take place. This study therefore aimed at investigating the influence of cultural believes and practice on secondary school students' understanding of atmospheric-related Physics concepts.

1.1 The Objectives of the Study

The main objective of this study is to examine the influence of selected cultural beliefs and values on secondary school students' understanding of atmospheres-related Physics concepts, therefore, the specific objectives are to:

i. identify different cultural concepts that secondary school students' have heard and believe in;
ii. determine the different believes and ideas of students about the cultural concepts;
iii. investigate students' sources of information about the cultural concepts; and
iv. examine the influence of cultural belief on students' academic performance in Physics.

1.2 Research Questions

The following research questions were raised to guide the study.

i. What are the different cultural concepts that secondary school student have heard and believe in?
ii. What are the different believes and ideas of students about the cultural concepts?
iii. What are the students' sources of information about the cultural concept?
iv. What is the influence of students' believe in the cultural concepts on their academic performance in Physics?

2. Methodology

2.1 Research Design

The research design employed for this study was the survey research design. A descriptive survey design was used to establish the relationship between variables. Also, in using this design, a relatively large number of respondents considered to be the representative of the entire population were used. The sample consisted of 940 secondary school students who were randomly selected from 26 public and private secondary schools in the southwestern region of Nigeria using stratified and simple random sampling techniques. The instruments used for data collection is a questionnaire titled "Cultural Belief and Atmospheric-related Physics Concepts Questionnaire" (CBAPCQ) and an achievement test titled "Cultural Belief Misconceptions in Physics Achievement Test" (CBMPAT). The CBAPCQ is divided into two sections. Section A sought for information on the demographic variables of the students, section B sought for information related to the objectives of the study such as believes and ideals of students about cultural concepts in Physics, source of believe and their influence on students' academic performance. The second instrument (CBMPAT) is a ten-item multiple choice test which was based on atmospheric-related concepts that the students have been taught in their syllabus and are also related to the identified concepts where they hold misconceptions. Students were required to choose the correct option from the different options given in the answers to each of the question. The instrument was validated by experts in science education and test and measurement. Corrections were noted and adhered to; useful suggestions offered to ensure that the instruments were measurable to the objectives of the study were carried out.

2.2 Procedure for Data Collection

The selected schools were initially visited in order to meet with the head-teachers and the Physics teachers so as to facilitate the administration of the instruments. Copies of the questionnaire were administered to the students and collected after completion. The administration of the questionnaire was done at an agreed time between the researcher and the teachers. After few hours, copies of the CBMPAT were also administered to the students. About 95% of the copies distributed were collected back. The CBMPAT was marked and graded which was further subjected to analysis. The data collected were analyzed using descriptive statistics such as mean score, frequency distribution and percentages.

3. Results

3.1 Research Question One: What are the different cultural concepts that secondary school students have heard and believe in?

To answer the above stated research question, the responses to the statements on the questionnaire related to the main question were collated, analyzed and presented in table 1.

Table 1: Statistical distribution of the different cultural concepts that secondary school students have heard and believe in

S/N	Cultural Concepts	Heard	Believe in
		Frequency (%)	Frequency (%)
A	Rainbow means rain will fall	439 (6.9)	370 (7.5)
B	Rain falls and sun shines means Lion is giving birth	569 (9.0)	489 (9.9)
C	Rain falls and sun shines means a king has given birth	284 (4.5)	275 (5.6)
D	Thunderstorm indicate that sango is striking someone	555 (8.8)	387 (7.8)
E	Brightness of the moon is an indication that rain will not fall	420 (6.6)	318 (6.4)
F	Using hand to collect rain water can cause thunderstorm to strike	546 (8.6)	410 (8.3)
G	Using radio during thunderstorm can cause the radio to catch fire	429 (6.8)	336 (6.8)
H	Standing at the doorpost when it is raining can cause thunderstorm to strike	501 (7.9)	362 (7.3)
I	The presence of whirlwind is an indication of evil spirit	424 (6.7)	294 (6.0)
J	Heavy and stormy rain that causes damages is an indication of the wrath of God on man	381 (6.0)	289 (5.9)
K	Small fishes that falls during heavy and stormy rain is an indication that fish comes from heaven	492 (7.8)	376 (7.6)
L	When ocean/big river flows over the bank is an indication that the goddess of the ocean / river is angry	391 (6.2)	300 (6.1)
m	When someone swims and get drowns is an indication that goddess of the river is angry	448 (7.1)	344 (7.0)
N	Water taken from osun and oya rivers cannot be put/mix together	458 (7.2)	391 (7.9)

The result in table 1 showed that most of the students (9.0% and 9.9%) have heard and believed in the fact that when rain falls and sun shines means lion is giving birth, followed by 8.8% and 7.8 who have heard and believed that electrical discharging by thunderstorm is an indication that sango (god of thunder as believed by the African tradition) is striking someone. Also, 8.6% and 8.3% have heard and believed that using hand to collect rain water can cause thunderstorm to strike. Very few of the students (4.5% and 5.6) have heard and believed that when rain falls and sun shines simultaneously is an indication that a king has given birth.

3.2 Research Question Two: What are the different believes and ideas of students about the cultural concepts?

To answer the above stated question, the responses to the statements on the questionnaire related to the different believes and ideas of students about the cultural concepts were collated, analyzed and presented in table 2.

Table 2: Statistical distribution of the different believes and ideas of students about the cultural concepts

S/N	Students' believe and idea about each of the cultural concept	Frequency (%)
a.	Believe / True	372 (41.6)
b.	Unbelievable / False	136 (15.2)
c.	Superstition	122 (13.7)
d.	Doctrinal Issues	34 (3.8)
e.	Stories	49 (5.5)
f.	Cultural	35 (3.9)
g.	Believe of the fore fathers	20 (2.2)
h.	Religious	17 (1.9)
i.	Real	68 (7.6)
j.	Not real	10 (1.1)
k.	Philosophical	18 (2.0)
l.	Destructive concepts	13 (1.5)

From table 2, it can be shown that larger percentage of the students (41.6%) believed that these cultural concepts are true; 15.2% believed that the statements are false while 13.7% believed that they are superstitions. Few of the students (1.1% and 1.5%) believed that the statements are not real and are destructive concepts. Some of the students even believed that they are doctrinal issues (3.8%), stories (5.5%), cultural (3.9%), religious (1.9%),

believe of the forefathers (2.2%) and philosophical (2.0%).

3.3 Research Question Three: What are students' sources of information about the cultural concepts?
Responses to statements relating to the above stated research question were collated, analyzed and presented in table 3.

Table 3: Statistical distribution of students' sources of information about the cultural concepts

S/N	Sources of information about the cultural concepts	Frequency (%)
A	Grand parent	546 (14.8)
B	Parent	504 (13.6)
C	Television	248 (6.7)
D	Radio	282 (7.7)
E	Newspaper	237 (6.4)
F	Internet	220 (6.0)
G	School	347 (9.4)
H	Story Books	421 (11.4)
I	Academic Journals	161 (4.4)
J	Library	169 (4.6)
K	Friends	368 (10.0)
L	Others Specify	181 (4.9)

The responses from the table 3 above showed the students' source of information about the cultural concepts. The result revealed that majority of the students (14.8%) claimed to have heard from their grandparents; 13.6% heard from their parents; 11.4% heard from story books while 10% heard from their friends. Few of them (4.4% and 4.5%) have heard from academic journals and library respectively. Others sources are television (6.7%), radio (7.7%), newspaper (6.4%), internet (6.0%), school (9.4%) and friends (10.0%).

3.4 Research Question Four: What is the influence of cultural beliefs on students' academic performance in Physics?
The CBMPAT was graded and the mean score analyzed using mean score. The average scores were further classified into high, average, low as shown in the table 4.

Table 4: Statistical Distribution of the influence of cultural beliefs on students' academic performance in Physics

S/N	Cultural Belief Misconceptions in Physics Achievement Test (CBMPAT)	Frequency (%)	Mean ($\bar{X}$)	SD
A	70- 100 (High)	183 (21.8)	44.8	20.72
B	60 – 50 (Average)	106 (12.6)		
C	00 – 40 (Low)	551 (65.6)		

Table 4 above shows the percentage distribution of cultural belief misconceptions in Physics achievement test (CBMPAT). From the table, 21.8% of the students scored within the score range of 70 – 100; 12.6% of the students scored between 60 – 50 while most of them (65.6%) scored below 40 and the mean score of the students is 44.8 which is below average. This result showed that there was significance influence of the belief of the students in cultural concepts on their academic performance in atmospheric-related Physics concepts.

4.1 Discussion
The result of this study from research question one revealed that most of the students have heard and believed in the fact that when rain falls and sun shines means lion is giving birth, they also have heard and believed that electrical discharging by thunderstorm is an indication that sango is striking someone. The result further showed that some of the students have heard and believed that using hand to collect rain water can cause thunderstorm to strike. Although, few of them claimed to have heard and believed that when rain falls and sun shines simultaneously is an indication that a king has given birth. This is an indication that students come to Physics class with the cultural misconception believe that they hold, this is in consonant with Ododo (2014) who opined that students bring many of their cultural practices that they have heard or held into Biology classes.
Furthermore, from research question two, the study found that the majority of the students believed that these cultural concepts are true; although some of them believed that the statements are false and superstitious. Some of them even believed that they are doctrinal issues, stories, cultural, religious, believe of the forefathers and philosophical. According to Yip (2001), personal experience and opinion are related to cultural factors prevalent in the society. This is because cultural situation at home give room for conflicting traditional beliefs and

superstitions which cause misconceptions that lead to underachievement in the related subject where misconceptions are held. In addition, Samba (2003) found that students cannot learn new concepts if alternative models that gives explanation about a phenomenon exist in their mind except a platform is made available to them to confront their misconceptions, reconstruct and internalize their knowledge.

Also, result from research question three which aimed at finding the students' sources of information about the cultural concepts revealed the sources of information to be majorly from their grandparents, parents, story books and friends. Few of them have their sources to be from academic journals and library. Others sources were found to be from television, radio, newspaper, internet, school and friends.

In addition, the findings from research question four which sought to find the influence of cultural beliefs on students' academic performance in Physics revealed that most of the students scored below average. This showed that there was significance influence of the belief of students in cultural concepts on their academic performance in Physics with many of them performing below average. This is an indication that the misconceptions held by students have negative influence on their academic performance in Physics. This is so because Okebukola (2002) opined that learners who have had themselves established in their cultural belief are likely to find the study of science mystifying because of the likely conflict between their anthropomorphic view of their world and the mechanistic views presented in science. Also, Okoye & Okeke, (2007) and Igbokwe (2010) also found that the cultural environment in which science is taught significantly affects its learning. This implies that misconceptions from cultural believe brought into Physics class by students significantly affect their learning of Physics.

4.2 Conclusion

Based on the findings of this study, it can be concluded that Physics students hold cultural believes and ideas which they heard mainly from their grandparents and parents. It was further that they bring their cultural believes into Physics class which can lead to misconceptions in understanding Physics concepts. Also, the misconceptions held by students due to their cultural believe significantly influence their academic performance in Physics negatively.

It is therefore recommended that workshops, seminars and refresher courses be organized for Physics teachers on how to correct identified misconceptions. This will enhance scientific worth like significant mindedness and understanding of Physics concepts. Identified cultural beliefs and related misconceptions should be used by Physics textbooks authors to illustrate Physics concepts so as to sufficiently explain them and significantly advance learning.

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