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The Effect of Culture on the Teaching and Learning of Science at the Basic Schools in Ghana

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Abstract
The purpose of the study was to investigate how culture influences the teaching and learning of science at the basic schools in the Agona West Municipality of the Central Region, East Akim Municipality of the Eastern Region and the Kwabre District of the Ashanti Region of Ghana. The research design used for this study was descriptive survey. The sampling procedure employed for the study was the purposive sampling. A total of three hundred and thirty (330) subjects were selected, made up of three hundred (300) students and thirty (30) science teachers. The instruments used for collecting data for the study consisted of questionnaire, interview and observation schedules. It was found out that students had cultural knowledge they use in explaining phenomena. Teachers were aware of student's cultural knowledge especially in explaining concepts. It was recommended that teachers should teach their students bearing in mind their cultural knowledge and incorporate that in their teaching.
Keywords: Culture, Cultural knowledge, Scientific concept, Taboos

Introduction

Culture may be said to mean the way a group of people live. The food they eat, the language they speak, the clothes they wear, the festivals they celebrate, songs they sing, and norms, taboos, totem, traditions they believe in. Osborne and Witrock (1983) asserted that culture as a way of life of a group of people has immense effect on the people when it comes to teaching and learning of a subject, for example, learning of science. The culture of students learning science may either positively or negatively influence their understanding of some science concepts, since the knowledge presented to them in the classroom may conflict with the existing knowledge the students carry from the home/society (Fafunwa, 1972; Osborne and Wittrock, 1983).

Learners of science within the African Socio-Cultural Context is seen by some African science educators such as Jegede (1995) and Ogunniyi (1997) as persons of two worlds. The two worlds are the African culture and the culture of school science. Akpan and Anamuah-Mensah (1992), for example, noted a strong interrelationship between the belief systems and scientific way of life in the daily activity of an average African pursuing science education.

In a situation where the culture values are deeply rooted in the student, as it happens in a traditional African home, comprehension of school science could be very difficult to the student. This could only make the student confused and might enhance his/ her dropping out of school. (Akpan and Anamuah-Mensah, 1992).

To achieve the goal of science for all, including socially and culturally diverse students, it is important to consider students ways of knowing, thinking, and communicating in the science teaching and learning process. Studies have shown that there are various ways of knowing, thinking, and communicating among diverse student groups (Atwater, 1994; Lee and Fradd, 1998). However, their ways of knowing may or may not be compatible with the nature of science or the way science is generally taught in science class.

Students construct knowledge and explanations about natural phenomena. They also have beliefs or views of the natural world. Students' knowledge and views of the natural world are products of socio-cultural influences as well as individual construction (Wertsch, 1991). Another fact is that every student is exposed to multiple information sources and discourses in social and cultural contexts (Driver *et al.,* 1994). Science education, which is seen to directly deal with the natural world, could play a major role in shaping students' knowledge and world views. However, in the science classroom, student's knowledge and world views may sometimes be incompatible with scientific knowledge and the scientific world view.

Humans are cultural beings and that culture distinguishes humans from all other animal species (Rosman and Rubel, 1998). Animals for example may be said to live in societies and carry out social roles, but they do not have culture as humans (Rosman and Rubel, 1998).

According to Rosman and Rubel (1998), there is sharp contrast to human cultural behaviour, which is not biologically programmed but rather learned and transmitted from one generation to the next.

As already mentioned, contemporary view holds that an African is operating in two worlds or cultures when it comes to the learning and practicing of Western science and Technology. Based on this view, it is apparently obvious that the curriculum materials drawn out to teach science and other science related subjects to African children must have the recognition for these "two worlds or cultures". Another study has also shown that a typical African is rather practically operating in three ways of life or subcultures. These are scientific, native and religious subcultures (Akpan, 1991).

Before the advent of foreign cultures, an African for time immemorial has been practicing "Africanism" such as customs and belief systems, life style, traditional African religion, habits and behaviours (Akpan and Anamuah-Mensah, 1992). Within the Africanism, life after death syndrome featured prominently in the traditional African religion. These components of Africanism, when carried to the science class may one way or the other affect the teaching and learning of science. For example, a child learning science with some of these belief systems may not easily understand that cholera and malaria are caused by an unkempt environment. This might occur when the child is coming from a community where disaster and illness are attributed to gods. The belief that in the African traditional society there is cause and effect for every action taken is expected to help the African child to refrain from many wrong doings. Hence, the African child tends to cherish and respect the dos and don'ts (Taboos) in a society. These taboos in the African society in their present conditions are likely to influence the teaching and learning of school science.

Western science has its own beliefs, processes, attitudes and methods, thereby making it easy for its practitioners to carry out its doctrines with very little allegiance to the African way of life (Akpan and Anamuah-Mensah, 1992). Nevertheless, a contemporary study in science education has argued that in order to achieve sustainable development in a society, cultural knowledge and scientific information should be combined to solve emerging practical problems (Marrawijk and Lisbensten, 1999). This might imply that sustainable development in Africa cannot be fully achieved with only knowledge and understanding of formal scientific concepts and methods. Rather, one concept that should significantly inform the development process in Africa is the need to forge link between traditional knowledge systems and formal scientific knowledge (Marrawijk and Lisbensten, 1999). Traditional knowledge may provide insight into possible solution to the African's problems when properly linked with formal scientific knowledge. The concern is that science education should be socially orientated, relevant to the learner and the society in general, and must have the potential for direct experience (Andrew, 1980). This is likely to produce persons who have scientific knowledge to benefit their communities, as well as to think scientifically in the context of their culture.

Scientific literacy is defined as the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity (NRC, 1996). Therefore scientific literacy becomes a key issue in the development of any nation, enabling persons to understand science and apply scientific concepts and also strengthens the problem solving skills. Furthermore, it develops capacity to use technology effectively and thereby producing technology-oriented human resource. Therefore, helping the African youth to become scientifically literate is partly the responsibility of the science educator. In this light, one of the goals of science education should be towards producing a critical mass of scientifically literate people who are relevant to society and can use scientific ideas to explain everyday life experiences and events and also solve problems of society. A science educator is central to achieving such a goal. At the moment, scientific literacy among pupils in Ghana appears to be on the low side. A good number of them do not have the spirit of inquiry and cannot relate scientific issues to everyday life (Walker, 1994). This trend should change and the goal of science education in Africa should direct to the building of capacity for improving literacy in science and technology. It has been found that combining formal school science experience (school science curriculum emphases) and informal science experience (outside the school activities) is of critical importance to improving children's scientific literacy (Walker, 1994) and children's cognitive retention in school science (Novak and Gowin, 1984). Besides, informal science knowledge system provides opportunity for children to become aware of and understand their environment through inquiry (Wheatley, 1991). Scientific inquiry then becomes the key to science learning and children can be helped to develop the required skills by maintaining their sense of wonder in everyday experiences during science learning. This is justification for integrating outside the school experiences that have bearing on science into formal science learning. Linking formal science and outside the school experiences within the community is based on the constructivist perspective of the social construction of knowledge (Wheatley, 1991).

Statement of the Problem

No country can boast of growth and development without science and technology. With this respect it is important that the nation's citizens become scientific and technologically literate in order to contribute effectively towards its development. Ghana as a developing country cannot talk of growth and development without paying attention to the factors that influence the teaching and learning of science in our schools. Studies have shown that African's have their cultural beliefs very peculiar to their own ways of life. Some of the cultural

beliefs as indicated in that study include the following:

i. Occurrence of a rainbow in many communities in Nigeria depicts the imminent death of a big man Anamuah-Mensah (1987). However rainbow occurs when light travelling from air into optically dense media such as water or glass, the refraction that occurs causes the colours to separate as each colour changes direction by a different angle (Abbey *et al*., 2001).

ii. A menstruating woman should not cook for a man or her husband because if a man eats such a meal he will fall sick (Anamuah-Mensah, 1987). However, menstruation occurs as a result of failure of fertilization or implantation of an ovum when the thickened inner lining of the uterus breaks down. The break down substances from the uterine wall together with the unfertilized ovum, mucus and a quantity of blood pass out through the birth canal (Nyavor and Seddoh, 2001).

iii. Among the local Ghanaian communities, especially the rural dwellers, there is the belief that whenever a hill or a mountain is to be broken down due to construction of roads, the gods of that mountain must be pacified by providing fire on top of the mountain for a week and then water is poured on top of the hill or the mountain for the gods to use the fire to prepare their food and drink the water after eating (Anamuah-Mensah, 1987). However, the fire set on top of the mountain and the water poured is to bring about sudden expansion and contraction of the solid materials of the mountain. So the rocks will breakdown due to the sudden expansion and contraction to ease the construction of the road (Abbey *et al.*, 2001).

A learner coming into the classroom with these cultural beliefs will find it very difficult to do away with some of them and replace them with scientifically accepted facts. Most of these local beliefs and values are so special, unique and involving that every member of an ethnic group irrespective of his/ her educational qualification might associate with some of them unconditionally (Anamuah-Mensah, 1987). Amidst these traditional beliefs are codes of ethics clearly spelt out to every member of the community including the students who come from such community. Studies have shown that taking accounts of students' prior knowledge during teaching is one of the strategies which enable teaching to be adopted to students (Driver *et al.,* 1985: Rivet and Krajcik, 2002). When student's prior ideas are known, alternative, plausible and reasonable ideas are offered to them to make a negotiation.

Hence the knowledge of student's prior ideas from their cultural settings can play an important role in learning outcomes. This has necessitated the need to investigate the influence of culture on the teaching and learning of science at the Junior High School.

Purpose of the Study

This study was design to investigate how culture influences the teaching and learning of science at the basic schools in the Agona West Municipality of the Central Region, East Akim Municipality of the Eastern Region and the Kwabre District of the Ashanti Region of Ghana

Research Questions

1. What are some of the cultural knowledge students' use in explaining natural phenomena?
2. What is the extent of teachers' awareness of the cultural knowledge of students' in their classrooms?

Methodology

The research design used was descriptive survey. The target population for the study was students and science teachers from the JHS in some selected districts in Ghana. The selected districts are the Kwabre in the Ashanti Region, East Akim in the Eastern Region and Agona West in the Central Region. The accessible population was made up of forms one and two pupils and their science teachers in the selected districts.

The sampling procedure employed for the study was the purposive sampling. The purposive sampling method was used to sample the regions, districts, schools as well as the respondents for the study. In all, three regions and three districts were selected on the assumption that the researcher is familiar with these places and also because of how the regions and the districts highly esteem their cultural values and beliefs. The purposive sampling procedure was again used to select the schools as well as the respondents for the study. Ten schools were selected from each district. Some of these schools were selected in urban areas whiles others were also from rural areas. This was done purposely to get diverse responses both from rural and urban settings. The students were selected on the assumption that they could read and understand the English language and also respond to items on the questionnaire and the interview. Both boys and girls were selected from both forms 1 and 2. This was done to satisfy both class and sex. The researcher intends to have responds from both boys and girls to ascertain if their responses vary or the same. Class was also important to get diverse view points from the classes. The teachers were selected on the bases of the subject they teach. All the thirty science teachers in the thirty schools were selected since they teach science.

A total of three hundred and thirty (330) subjects were selected, made up of three hundred (300) students and thirty (30) science teachers.

The instruments used for collecting data for the study consisted of questionnaire, interview and observation schedules. All the items on the pupils' questionnaire were closed ended whiles that of the science teachers were of both closed ended and open ended types. The questions for the pupils were on a five-point Likert type scale. The science teachers' questionnaire was made up of both open and close ended questions and was on five-point Likert scale.

Both teachers' and pupils' questionnaires were developed in consultation with peers and supervisors providing expert advice to enhance content validity of the instrument.

The questionnaires were pilot-tested at the Agona Swedru District Assembly Junior High School and Agona Duakwa Local Authority Junior High School. The two schools were chosen because they have some attributes similar to the accessible population of the study. That is, one represents a school in the rural setting and the other school also represents schools in the urban setting.

Results/Discussion

Some of the cultural knowledge students used in explaining scientific phenomenon are presented in table 1.

Table 1: Cultural Knowledge of Students.

Cultural knowledge	Mean	Std. Deviation
Rivers	3.11	1.18
Bad days	2.62	1.34
Rainbow	2.53	1.28
Ghost	2.50	1.40
Sacred day	2.32	1.46
Sacred food	2.22	1.45
Anger	2.21	1.42
Totem	2.10	1.32
Animals are magical	2.03	1.47
Plants are magical	1.71	1.50
Malaria and cholera	1.44	1.37
Blessing twins	1.29	1.17
Famine	1.10	1.09
Sea gods	1.06	1.08
Lies	0.99	1.24
Plants talk	0.99	1.29
Resemblance	0.91	1.09
Bush fire	0.89	1.16
Holes	0.68	1.13
Plants as living things	0.65	1.20

It came up from the results that students' had cultural knowledge systems they use in explaining scientific phenomenon. There was a high usage of some cultural knowledge to explain scientific phenomenon by students. For example, the students believed when people pollute rivers and the gods of the rivers are annoyed, the rivers dry up, they saw certain days of the week as bad days and no farmer is expected to visit the farm. They attached the reason that the gods hold meetings on such days. They also believed that rainbow is a sign used by gods to express their anger .They considered some animals and plants as their totem. These animals are neither eaten nor hunted for because some animals are seen as ghost. The mean score values for the above usage of some cultural knowledge in explaining natural phenomena are all above 2.0 (see Table 1).

There were other cultural knowledge systems that were used moderately in explaining scientific phenomenon. Some of them are that plants have magical powers that they use in harming those who offend these plants. Malaria and cholera infestation for example was as a result of one's refusal to show gratitude to the gods after receiving a favour from them and also giving birth to twins' means the gods like that person. The mean score values for the above usage of some cultural knowledge in explaining natural phenomena are all below 2.0 but above 1.0 (see Table 1).

However there were some cultural knowledge systems that were scarcely used to explain natural phenomenon. These include the belief that plant can talk and therefore can be classified as living things, some children resemble their parents because during their birth they looked at their parents' faces and human beings originated from a hole. The mean score values for the above usage of some cultural knowledge in explaining natural phenomena are all below 1.0 (see Table 1).

Teachers were also given the opportunity to indicate the cultural knowledge system students often used to explain scientific concepts. Majority of the teachers revealed from the open ended questions that students had the belief that thunder and lightning, earth quake and other natural disasters do not strike unless it is meant to kill someone who has been cursed as a result of an offence.

Teachers further indicated that students believed giving birth to twins is a blessing. This might be the reason why some of the local people in the study area organize special rituals or rites for twins.

Teachers indicated that pupils believe if you talk or sing whiles eating your mother will die. According to the teacher, in teaching digestion he asked why we should not talk or sing whiles eating. The students said if you talk or sing whiles eating your mother will die. Students belief in reincarnation was expressed when the concept of reproduction and growth was treated. The teachers indicated that students believed children who are extremely extrovert or hyper-active have ones lived, died and have come back to life. Such children according to them are given funny names, like (*Ekobi, Enwu, Donko, Begyinaye, Daadzese, Yerehwe, Bediako, Abebrese and Twen*). They (teachers) also said the reason students attached to bareness is that, during puberty rites girls are given eggs to swallow. Those who swallow their eggs wholly will be fertile and be able to give birth. Those who chew their eggs will be infertile and cannot give birth. The teachers confirmed what students said about their belief in some days being holy (*Daboni*). Some of the days are (‘*Akwesidae’, ‘Wukudae*,’ and ‘*Fofie’*) meaning holy Sunday, Wednesday and Friday. On those days no farmer is to visit the farm since the gods meet and settle disputes.

Certain species of plants and animals that are seen as totem for certain clans should not be hunted or cut down otherwise a prominent member from that particular clan will die. This is a cultural knowledge students used in explaining conservation of natural resources (plants and animals) according to the teachers.

Students believed plants have sexes like animals and that the males do not flower but the females do. The males can be turned into females for them to flower, for example plants like plantain, maize and pawpaw. According to the teachers, this was indicated when the concept of flowering plants was being taught.

The above report from the responses from teachers concerning students’ belief affirms the statement by Driver et al., (1994) that children construct knowledge and explanations about natural phenomena. They also develop beliefs or views of the natural world. In the science classroom, children’s knowledge and world views may sometimes be incompatible with scientific knowledge and the scientific world view. This discussion shows that students have cultural knowledge they used in explaining natural phenomena.

The extent of teachers’ awareness of students’ cultural knowledge in the classroom is presented in table 2.

Table 2. Teachers’ awareness of students’ cultural knowledge in the classroom

Teachers awareness	Mean	Std. Deviation
Previous knowledge base on culture	2.70	1.18
Students’ community ideas	2.60	1.22
Students’ engulfed in culture	2.33	1.03
Students’ activities and actions	2.17	1.26
Cultural knowledge with school science	2.00	1.37
Concept base on culture	1.86	1.00
Blessing twins	1.60	1.65
Natural disaster due to angry gods	1.57	1.36
Previous knowledge from society	1.53	1.14

It is seen from Table 2 that teachers are aware of some of the cultural knowledge students’ use in explaining scientific concepts in their class. There was a high awareness of students’ cultural knowledge by teachers. Most of them were of the opinion that;

- Student’s previous knowledge is based on their cultural beliefs.
- Students’ explanations to concepts are all based on their community ideas
- Students are engulfed in their cultural practices and beliefs.

The mean score values for the above awareness are all above 2.0 (see Table 2). However, there were other cultural knowledge of students that majority of the teachers showed some moderate awareness. These are the beliefs that;

- Students’ ideas on concepts are based on their culture.
- Giving birth to twins is a blessing.
- Natural disasters are due to angry gods.
- Students’ previous knowledge is from the society (see Table 2).

The mean score values for the above awareness are all below 2.0. The responses from the science teachers’ interviews further indicated that teachers were aware of some students’ cultural knowledge in the classroom .This is the reason why they have adopted different teaching methods to make sure that students’ cultural knowledge is fully tapped for their benefit.

Teachers indicated that they are aware of students’ cultural knowledge that is why they link science concepts to student’s everyday activities. For example among the local Ghanaian communities, especially the rural dwellers, there is the belief that whenever a hill or a mountain is to be broken down due to construction of

roads, the gods of that mountain must be pacified by providing fire on top of the mountain for a week and then water is poured on top of the hill or the mountain for the gods to use the fire to prepare their food and drink the water after eating. The fire set on top of the mountain and the water poured is to bring about sudden expansion and contraction of the solid materials of the mountain. Scientifically, when solids absorb heat they expand and contract when they cool down. So the rocks will breakdown due to the sudden expansion and contraction to ease the construction of the road (Abbey *et al.,* 2001).

Conclusions

This study was design to investigate how culture influences the teaching and learning of science at the basic schools in the Agona West Municipality of the Central Region, East Akim Municipality of the Eastern Region and the Kwabre District of the Ashanti Region of Ghana. It was concluded that students had cultural knowledge they use in explaining phenomena. Teachers were aware of student's cultural knowledge especially in explaining concepts.

Recommendations

1. Teachers should teach their students bearing in mind their cultural knowledge and incorporate that in their teaching.
2. In-service training should be organised from time to time to enable teachers to properly link school science to cultural knowledge systems.

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