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PERCEPTION OF INDIGENOUS KNOWLEDGE BY TEACHERS' AND STUDENTS' OF SCIENCE IN SENIOR HIGH SCHOOLS IN GHANA

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ABSTRACT
Research in teachers' and students' view toward science often involves western science in general, but a particular discipline like indigenous knowledge (IK) is often overlooked. Thus, a study was planned and carried out in a metropolis (Kumasi) and two other districts (Ahafo-Ano South and Atwima Mponua) in the Ashanti Region of Ghana. It is about teachers' and students' view toward indigenous knowledge and its integration into the teaching and learning of science. The study used a questionnaire to determine teachers' and students' view toward indigenous knowledge. The data was obtained from a sample size of two hundred and eighty-five (285) individuals, made up of eighty-five (85) teachers and two hundred (200) students selected randomly from ten schools in the region. Data gathered were statistically analyzed. It was found that there was a greater awareness of indigenous knowledge among the teachers and students who took part in the research**.** Again, one of the finding proves that students feel disconnected to nature but science should be viewed as a way of exploring nature, not as unknown course that students experience. Lastly, integrating indigenous knowledge will enhance students' interest and understanding, and also help them appreciate their culture and environment.

KEYWORDS: Indigenous knowledge, constructivists, Cognitive theory, Integration.

INTRODUCTION

Science is an effort we make to understand ourselves and our environment. Every human community does a lot of science through their basic activities like cooking, communicating, etc. this is not different from what happens in Ghana. Unfortunately, performance of students offering science is horrible. Students come to the classroom with preformed ideas about how the natural world works. Most of these ideas come from the knowledge that the students in a given community have developed over time, and continue to develop. For instance students' basic knowledge in farming, food preparation, and a host of other activities will affect their concept formation in Agriculture and Catering that they study at school. Tobin, Tippins & Gallard (1994) noted that learning is a social process of making sense of experience in terms of existing knowledge. They assert that individuals interact with objects and events through their senses inextricably associated with existing knowledge that includes beliefs and images. According to Glassersfield (1988), learning through construction expresses the view that knowledge is constructed by the individual, and that knowledge is neither passively received from the environment nor acquired by discovering an independent pre-existing world outside the mind of the knower. In this view, knowledge schemas have to be constructed by every individual learner in his own mind, and these schemas are; therefore; constructed from new experiences and social interaction (Skemp, 1989). From the social constructivist viewpoint, it is important to take into account the background and culture of the learner throughout the learning process, as this background also helps to shape the knowledge and truth that the learner creates, discovers and attains in the learning process (Wertsch, 1997). Vygosky (1978) argued that cognitive development occurs as a consequence of social interactions. Vygosky further saw intellectual abilities as being much more specific to the culture in which the child was nurtured. Learning is effective only when the new knowledge is meaningfully linked to the prior ideas (Rivet & Krajcik, 2002). Dorchy (1994) defines prior knowledge as the whole of a person's actual knowledge. Johanassen & Gabrowski (1993) also define prior knowledge as "the knowledge, skills or ability that students bring to the learning process". According to Ausubel (1968), the single most important factor influencing learning is what the learner already knows which must be ascertained and used accordingly. It is commonly argued that one of the securest findings of educational research is that new information, to be best understood, must be attached to pre-existing knowledge possessed by the student (Jack, 2004). Jegede (1998) asserts that the learners understanding of any new meaning is strongly influenced and determined by culture, belief, traditions and customs governed by a world view. A study of the scientific process also reveals that science does not always begin with mathematical abstractions or empirical findings. It rather begins with ideas close to the surface of everyday knowledge. Some writers, for example, root their own intellectual development not in mathematics, but rather in everyday ideas of rigidity, simultaneity and measurement (Miller, 1986). Neglect of prior knowledge can result in the audience learning something opposed to the educator's intentions, no matter how well those intentions are executed in an exhibit, book, or lecture. Evidence on scientific conceptual change leads to a recommendation to view science learning as a refinement

of everyday ideas, requiring a long time to understand, and is also rich in social context (Jeremy, 1995).

For students to understand science, one needs to link scientific concepts to students' IK. This will make the learning of science effective since such a strategy will make the student see science as part of everyday life activities. Indigenous knowledge represents an important component of students' knowledge of the environment which is very important if they are to understand scientific concepts. However, it is often an under-utilized resource in the classroom instructional process. A key basis for the under-utilization of indigenous knowledge in the instructional process is that, science is taught as if it is a foreign subject forced on the learners to memorize without any bearing on their daily activity. Furnham (1992) has identified several subgroups that influence students' understanding about science: family, peers, the school, the mass media and the physical, social and economic environment. Gao (1997) noted that culture, as a contextual lens, has a direct influence on the learner cognitive process and understanding of science. Hull (1983) asserted that even among scientists, social and cultural diversity may lead to different interpretations of the same series of events. Lutterodt (1980) noted that the use of indigenous knowledge improves significantly the performance of students in science. Ogawa, 1986 and Cobern, 1991 claim that science education is an aspect of culture. In 1980, Lutterodt noted that to significantly improve science learning in developing nations' researchers and educators needed to know more about the influence of local culture on science learning. Lewin, 1990 detected that the profession still had a long way to go in developing ways of representing science that are not foreign, expert, and culturally unsympathetic. Kyle (1993) argued - to embrace and affirm cultural diversity in the science classroom there will be the need for science education reform and research. Great concern has been raised about the fact that the teaching and learning of science in African schools has been divorced from the variety of science and technology concepts that appear to be in indigenous industrial activities within learners' environment of which they may have prior knowledge (Anamuah –Mensah, Asabere-Ameyaw, Dennis & Aiduen, 2008). Science appears to be taught as if it is a foreign subject forced on the learners to memorize without any bearing on their everyday life activity.

Ghanaian students have difficulty understanding science because it is not linked to their experiences and therefore, affects the way they perceive science. In Ghana, the activities of some local industries, which are scientifically based like brewing (*e.g.* pito), extraction of dye, fish preservation and so on may not be interpreted as science by those involved even though elements of scientific techniques are present in them. For growing awareness and making science education effective, it must take into account the cultural context of the society. Education should offer students an opportunity to explore the community. It is against this background that the present study was undertaken to find out whether the use of indigenous knowledge can influence the teaching and learning of science at Senior High School (SHS). The purpose of this study was to examine SHS science teachers and students in three selected communities (a metropolis and two other districts) in the Ashanti Region of Ghana on how they perceive indigenous knowledge, and how the use of indigenous knowledge can influence the teaching and learning of science. Finally, it also tries to assess whether there is any difference between teachers' and students' view about indigenous knowledge in the teaching and learning of science.

Research questions

1. What views do science teachers hold about indigenous knowledge?
2. What are students' views on indigenous knowledge?
3. What are teachers' and students' view of indigenous knowledge vis-a-vis teaching and learning of science?
4. Is there any significant difference between teachers' and students' views of indigenous knowledge?

METHODOLOGY

The study covered a metropolis and two other districts in the Ashanti Region of Ghana. The selected metropolis was Kumasi which is the capital of the Region and considered to be urban and two other locations are rural districts, namely, Ahafo-Ano South and Atwima Mponua. Kumasi is the second largest city in Ghana. Its geographical locations are 6° 41"N and 1° 37"W with a total coverage area of about 299 km^2 (115.4sqm). Ahafo-Ano South District covers a total surface area of about 1241 km², and is located on latitude 6° 42"N, 7° 10"N and longitude 1° 45"N and 2° 20"W. About 63.2 percent of the working population is estimated to be engaged in agriculture. The Atwima Mponua District is located in the south-western part of the Ashanti Region covering an area of approximately 894.15 square kilometers and lies between longitude 2^o 00"W and 2° 32"W and latitude 6° 32"N and 6° 75"N. Descriptive survey was employed in this study as surveys are useful for gathering factual information, data on preferences, beliefs, behaviour and experiences (Weisberg, Krosnick & Browen, 1996). Cross-sectional survey was employed because the information was drawn from a pre-determined population. The target population for this study consisted of all science teachers and students at the SHS in the Kumasi Metropolis, Ahafo-Ano South and Atwima Mponua Districts.

Convenient sampling was applied to this research because it involves choosing the nearest individuals to serve as respondents (Cohen, Manion & Morrison, 2007). A total of 10 schools were selected from the three Districts. Eighty five (85) science teachers were selected from the ten (10) selected schools. Also, Twenty (20) students each were selected from the ten selected schools making a sample size of two hundred (200) students. In all, the sample size was two hundred and eighty-five (285). The students were, randomly selected from the convenience selected schools. The random selection was to make sure that everyone in the population had equal chance of being included in the sample.

Questionnaire and observation were the instruments that were used to gather data from the teachers and students involved in this study. In addition, a prepared lesson notes was made to augment information that was obtained from the main research instruments. Questionnaire is a useful

instrument for collecting survey information and is comparatively straight forward to analyse (Wilson & Maclean, 1994).

The questionnaire for students was on a four- point Likert scale. A Likert scale was employed for all close ended items. The Likert scale rating used was a 4 – point. The questionnaire was scored from 1 for 'Strongly Disagree' through to 4 for 'Strongly agree. Response rated 3 and 4 were characterized as positive to the question, while responses rated 1 and 2 were characterized as negative to the question.The neutral stance usually in Likert scale such as "Undecided" was omitted. Respondents were in a way forced to take a stance (Anderson, 2006).

A pilot test of the instruments was carried out with 40 science teachers and 30 students from the Atwima Nwabiagya District. The chronbach alpha reliability for the teachers' questionnaire was found to be 0.82 and that of the students was found to be 0.71. According to Fraenkel and Wallen (2003), reliability should be at least 0.70 and preferably higher. These values are quite high, implying that the questionnaires used were reliable.

Quantitative data and qualitative data analysis were employed. The data obtained from the questionnaire were tabulated, and statistically analyzed. Means and percentages were used to analyse the data collected. A mean value below 2.5 represents disagreement while a mean value above 2.5 represents agreement. Some of the data analyzed statistically in percentage score values were plotted into graphs.

RESULTS & DISCUSSION

The results and discussions of the study were systematically documented and have been presented below in organised manner:

Teachers understanding of indigenous knowledge

According to fig. 1, most of the teachers numbering 20% of the sampled population considered indigenous knowledge as an informal knowledge. Others covering 8.2% of the teachers also alleged that IK is a local knowledge. Roughly 16.5% of the respondents took IK to be a knowledge that has been acquired through observation, whereas 14.1% stated that IK was a kind of knowledge gained from the environment. Aside the above attributions of IK, a further 14.1% did consider it as a knowledge tied to a specific group of people. Again, 15.3% of the teachers alleged that IK was acquired through experience, and finally, 11.8% of them considered it as a knowledge that originates from ones own culture.

The above explanations given by the teachers about indigenous knowledge have some common traits. This is supported by the World Bank, 1998 report that indigenous knowledge does not provide a single definition of the concept. Teachers according to their response have shown that they have some knowledge about indigenous knowledge. This shows a greater awareness of indigenous knowledge among teachers.

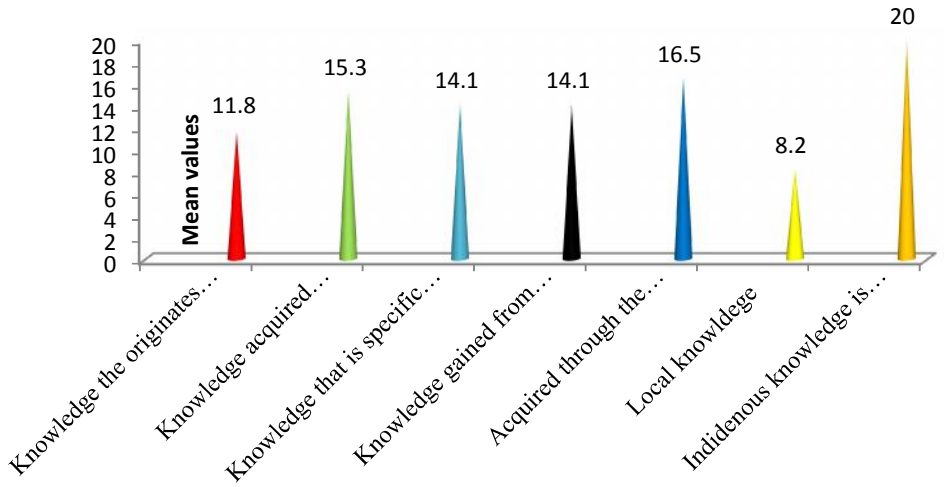

FIGURE 1: Teachers' responses on their views about indigenous knowledge

There was a greater awareness of indigenous knowledge among the teachers who took part in the research**.** The table 1 shows the mean scores of teachers on their views about indigenous knowledge and the teaching and learning of science. The items 1, 2, 4, 7, 8 and 11 with mean scores 3.78, 3.55, 3.55, 3.17, 3.49 and 3.53 respectively were rated high (Table 1). This confirms that there is science in our indigenous knowledge, and that science must be taught by incorporating indigenous knowledge. This finding is in agreement with Warren *(*1991) who asserted that science must be shown to be congruent with common ways of logical thinking that students recognize from within their own culture in order to illuminate and provide context for science instruction.

The findings; however; showed that science is taught as a foreign subject and has no place for indigenous knowledge. This is in consonance with some earlier studies, which indicate that modern education systems have had no place for either indigenous knowledge or indigenous methods of education (Ulluwishewa, Kaloko & Morrican, 1997). They claimed that successive connection can be made between science and everyday experience of

the students (Warren, 1991). This means that it would not be difficult integrating indigenous knowledge in the teaching and learning of science. Teachers stressed that students should use their own traditional applications to support scientific investigations. Teachers' belief that science education will be effective when linked to students' indigenous knowledge. The findings are in agreement with Piaget (1928) who reported that effective pedagogical practice in science education includes the teaching and learning of science in contexts in which the student can make links between their existing knowledge, the classroom experiences, and the science to be learnt. McKinley (1998) also reported that the well being for indigenous students comes from an approach that involves social, economic and cultural development and a strong sense of identity as indigenous. This means that the teaching and learning of science would be practicable if, a teacher applies both systems (indigenous and science knowledge) in his/her teaching. The respondents rated with agreement for items 5 and 6. They belief that it is not difficult to integrate indigenous knowledge into ones views of the natural world. They also claimed that indigenous science is seen as a subculture of western science (Cobern, 1991; Jegede, 1994, 1995; Ogawa, 1986a, 1986b, 1989; Pomeroy, 1994).

TABLE 1: Mean scores on teachers' view on indigenous knowledge

No.	Responses	Mean
1	There is science in our indigenous knowledge	3.78
2	Science must be taught by incorporating it with indigenous knowledge	3.55
3	Indigenous knowledge is outmoded .	1.73
4	Science is taught and learnt as a foreign subject and has no place for indigenous knowledge	3.55
5	It is simple to integrate science into ones individual views of the natural World	2.88
6	Indigenous science is seen as a sub- culture of western science.	2.32
7	Successive linkages can be made between science and everyday experience of students	3.17
8	Students should use their own traditional applications to support scientific investigations	3.49
9	Learning science which is not linked to our way of life empower students by providing them with a new way of thinking	1.90
10	Science taught in Ghana provide education that adheres to students' everyday experiences	1.96
11	Science education will be effective when linked to students' indigenous knowledge	3.53

The respondents; however; showed a strong disagreement on items 3, 9 and 10. They disagree with the statement that indigenous knowledge is outmoded, they also disagree on the statements that science which is not linked to our way of life can empower students by providing them with a new way of thinking. They belief that science taught in Ghana does not adhere to students indigenous knowledge. This is not different from what Anamuah –Mensah, *et al*. (2008) discovered, that the teaching and learning of science in African schools has been divorced from the variety of science and technology concepts that appear to be in indigenous industrial activities within the learners' environment. This finding proves that students feel disconnected to nature but science should be viewed as a way of exploring nature, not as unknown course that students experience.

Major findings: Science taught in Ghana is divorced of indigenous knowledge. Integrating indigenous knowledge into science will not pose any difficulties to teachers since both can easily be integrated.

What are students' views on indigenous knowledge?

Table 2 shows that respondents rated with agreement toward the statement of items 12, 13, 14, 15, 16 and 17. The mean scores for the items are 3.49, 3.29, 3.32, 3.33, 3.3.36 and 3.14 respectively. This indicated a high agreement among students that use of indigenous knowledge will enhance students' understanding in science. Jegede (1998) asserts that the learners' understanding of any new meaning is strongly influenced and determined by culture, belief, traditions and customs governed by a world view. It is commonly argued that one of the securest findings of educational research is that new information, to be best understood, must be attached to knowledge the student already possesses (Jack, 2004). Students' belief the use of indigenous materials enhances interest in science very well; research has shown that when students are made to interact with materials from the cultural environment in learning, the better the understanding and learners retain what they are taught for a very long time (Hansen, 2002). Ability to apply scientific concepts will be enhanced when indigenous knowledge is integrated with science. They assert that science and technology will be greatly enhanced when indigenous knowledge is integrated in science teaching and learning and also students will be motivated to learn science when scientific concepts are linked to their indigenous knowledge (Table 2). Students stressed that the use of indigenous knowledge in science will help us appreciate our culture. According to Entua-Mensah (2004), indigenous knowledge views humans as part of the world. Students showed agreement on items 18 and 19 with mean score of 2.99, 2.99 respectively. The students alleged that the use of indigenous knowledge will help them to explore the things in their immediate environment. According to Ogunniyi (1988), science cannot exist without interactions between human and nature. The findings prove that use of indigenous knowledge will definitely help change the way we relate to the world.

According to Novak and Gowin (1984) when a teacher revises students' previous knowledge and links it to the new concept under study, it facilitates the understanding of the new concept. According to Ausubel (1968) philosophy of "from known to unknown" should be adopted if education is to be effective. Neisser (1986) declared learning is more effective when ideas are related to prior

knowledge. There is therefore the need to teach students using their indigenous knowledge.

TABLE 2: Mean scores on students' knowledge level on indigenous knowledge.

No.	Responses	Mean
12	The use of indigenous knowledge will enhance students understanding in science.	3.49
13	The use of indigenous materials enhances interest in science very well.	3.29
14	Applying scientific concepts will be enhanced when indigenous knowledge is integrated with science.	3.32
15	Science and technology will be greatly enhanced when indigenous knowledge is integrated in science teaching and learning	3.33
16	Students will be motivated to learn science when scientific concepts are linked to their indigenous knowledge.	3.36
17	The use of indigenous knowledge in science will help students appreciate our culture.	3.14
18	The use of indigenous knowledge will help students to explore the things in their immediate environment.	2.99
19	The use of indigenous knowledge will help change the way we relate to the world.	2.99
	Grand mean	3.11

Major findings

Integrating indigenous knowledge will enhance students' interest and understanding, and also help them appreciate their culture and environment.

Mean score values for teachers view about indigenous knowledge and the teaching and learning of science. The results obtained are presented in Fig. 2.

The views of teachers about indigenous knowledge in the teaching and learning science have been expressed in Fig. 2. They showed high agreement for all the items except for the item: it is simple to integrate science into ones' individual views of the natural world. This statement has the lowest mean score of 2.88. Nevertheless there is high agreement among teachers that the use of indigenous knowledge will boost the teaching and learning of science.

FIGURE 2: Teachers' view about indigenous knowledge and the teaching and learning of science.

Students showed high agreement for all the items with their means ranging from 3.29-3.49. This indicates positive view among students about the use of indigenous knowledge in the teaching and learning of science.

Statistically, mean scores showed no difference between teachers' and students' view about indigenous knowledge and the teaching and learning of science. The results obtained are presented in Table 3.

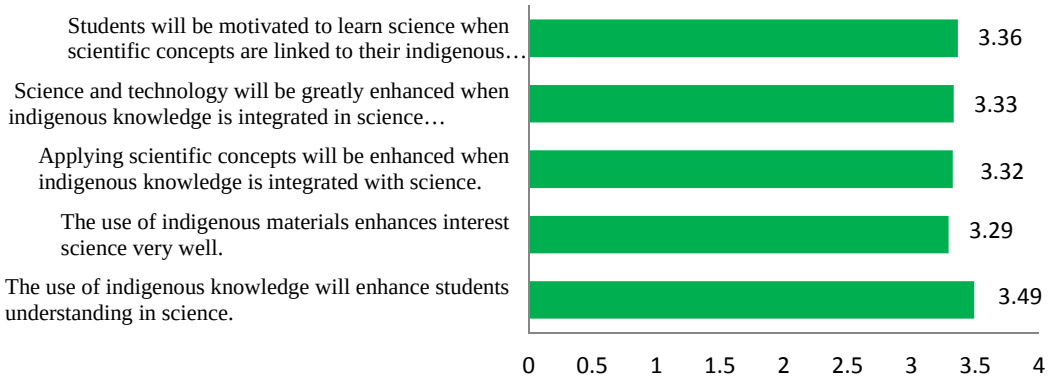

FIGURE 3: Students' views about indigenous knowledge in the teaching and learning of science.

TABLE 3: Mean score difference between teachers' and students' view about indigenous knowledge, and the teaching and learning of science

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	teachers view - students view	.00843	.41844	.04539	-.08182	.09869	.186	84	.853

The t-test statistics shown in table 3 (t-test statistic = 0.186, p = 0.853> 0.05) means that the null hypothesis reflects that there is no significant difference between teachers' and students' view about indigenous knowledge, and the teaching and learning of science is accepted. This means that the way teachers perceive indigenous knowledge does not differ from that of the students. The study therefore revealed that both teachers and students agreed that integrating indigenous knowledge will enhance the teaching and learning of science.

CONCLUSION

In concluding, it is better for science teachers to know that science and indigenous knowledge are inseparable Therefore, the following should be adhered to by both teachers and students:

- Teachers should place a high premium on incorporating indigenous knowledge in the teaching and learning of science so that students will have a better understanding of science.
- The great awareness about indigenous knowledge that both teachers' and students' possess should encourage them to incorporate the IK in their daily science teaching and learning.
- Since science and indigenous knowledge are interwoven, the two should be made to work together all the time without separation.
- Finally, integrating indigenous knowledge into science teaching will not pose any difficulties; therefore, teachers should make good use of their indigenous knowledge anytime they are teaching.

RECOMMENDATIONS

The following recommendations can be made:

- Science teachers should be motivated to integrate indigenous knowledge in their instructions.
- Science teachers should be recruited locally by the local councils and posted to the localities from which they come from. Indigenous teachers may be able to teach science effectively using the knowledge that is unique to their community.
- Workshops on indigenous knowledge should be organized for teachers to enable them link indigenous knowledge well in the teaching of science.
- The Ministry of Education should from time to time organize exhibitions involving indigenous science discoveries.

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