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INVESTIGATING STUDENTS' ATTITUDE TOWARDS SCIENCE IN THE COLLEGES OF EDUCATION

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Abstract:
The study investigated the attitude of teacher trainees towards the study of science in the Colleges of Education in Ghana. It looked at the students' attitude from four main perspectives; their motivation (encouragement) to learn science, their interest (enjoyment) in science lessons, their level of involvement (participation) in science lessons, and the type of interpersonal relationship that exist between them and their science tutors. A twenty (20) - item questionnaire on a five-point Likert-type scale for students was used to collect data on students' attitude towards science. The respondents consisted of one hundred and fifty (150) students from the Colleges of Education in Ghana, namely Foso College of Education, Enchi College of Education, and Komenda College of Education. The attitude of the students was determined by descriptive analysis by calculating the average (mean) score (X/N) for each dimension (i.e., sum score of items under a dimension, X divided by the total number of responded items, N for dimension). Since attitude students have towards science are influential in determining their performance in science, this study hoped to find out the extent to which students in the selected colleges of education possess the four positive attitudes measured in this study. The result produced indicated that the students possessed none of the positive attitudes towards the study of science.

Keywords: attitude, dimension, motivation, involvement, interpersonal

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1. Introduction

The ever-increasing attention on the topic, "attitude towards science" shows that all is not well with school science and as such far more people are alienated by a subject that has an ever-increasing importance in man's life, both at a personal and societal level. Where then lies the solution to this problem? While the body of research conducted has been good at identifying a problem, it has had little to talk about how the problem might be eradicated.

According to Osborne *et al.* (2003), a cursory examination of the research documents reveals that one of the most prominent aspects of the literature is that the research into the topic, "Attitude of students towards science" has been bedeviled with a lack of clarity about this issue under investigation. They added that an early notable contribution towards the elaboration of this topic was made by Klopfer (1971), who categorised a set of affective behaviour in science education as: (a) the manifestation of favorable attitude towards science and scientists, (b) the acceptance of scientific enquiry as a way of thought, (c) the adoption of scientific attitude, (d) enjoyment of scientific learning experiences, (e) development of interests in science and science-related activities and (f) the development of an interest in pursuing a career in science or science-related work.

Also, Gardner (1975) made a further clarification by a fundamental and basic distinction between "attitudes towards science" and "scientific attitudes". The latter is a complex mixture of longing to know and understand, a questioning approach to all statements, a search for data and their meaning, a demand for verification, a respect for logic, a consideration of premises, and a consideration of consequences (Education Policies Commission, 1962); and this aspect has been explored in some depth in a seminal review by Gauld and Hukins (1980). However, Osborne *et al* (2003) advocate for a clear distinction between these attributes and the affective attitudes towards science, which are feelings, beliefs, and values held about an object that may be the enterprise of science, school science, the impact of science on society or scientists themselves. It is this latter that constitutes the majority of Klopfer's attitude components.

According to Osborne *et al* (2003), the first stumbling block for research into attitudes towards science is that such attitudes do not consist of a single unitary construct but rather consist of a large number of subcontracts all of which contribute in varying proportions towards an individual's attitude towards science. The stumbling block towards assessing the significance and importance of attitude is that they are essentially a measure of the subject's expressed preferences and feeling towards an object. They further observed that it is behaviour rather than the attitude that has become the focus of interest and that has led researchers to explore models developed from studies in social psychology; in particular, the theory of reasoned action, which is concerned fundamentally with predicting behaviour. The theory focuses on the distinction between attitudes towards some "object" and attitudes towards some specific action to be performed towards that "object" (e.g. between attitudes towards science and attitudes

doing school science). They believe that some doubt is cast on what is being measured by the many instruments that have been devised to assess attitude.

It is believed that in all these struggles by researchers to find out the true attitude of students towards the study of science have failed because they did not use correct attitude traits and research methodology to gather data about students' attitudes. This study, therefore, focused on four main traits or dimensions to determine the attitude of students towards the study of science. It tried to determine if motivation (encouragement), interest (enjoyment), involvement (participation), and interpersonal relationship affect the kind of attitude that trainee students have towards science. The purpose of the study was to identify the extent to which the trainee students possess these four traits of positive attitudes towards science in the colleges of education.

2. Literature Review

Murphy and Beggs (2001) and Murphy, Ambusaidi, & Beggs (2006) try to determine changes in the enjoyment of science over time between Oman, English, and Northern Ireland students. The results demonstrate that nine year old children show significantly more positive responses to the statements relating to the enjoyment of science than the older students, especially in the Omani and the Ireland samples. The results showed that 44% of the fourth graders were enjoying the subject compared to 23% of eighth graders. In 2003, these percentages were 55% and 44%, respectively, which shows a clear indication of attitude decline with age and grade level.

Also, according to a report of the House of Commons (2002), students' interest in school science is declining with an accompanied declining number of students taking science, which consequently causes a shortage of science literates in different science-based professions. Lyons' (2006) summary indicates that enrolment rates in the natural sciences have been steadily declining in Australia, Canada, India, Japan, and the USA, as well as nearly every country in the European Union. On the other hand, students in developed countries show little interest in the subject (Beaton *et al.*, 1996; Martin *et al.*, 1997; Martin *et al.*, 2004; Martin *et al.*, 2008; Martin *et al.*, 1999; OECD, 2006; Sjøberg, 2002; and Schreiner & Sjøberg, 2007).

A comparative investigation between nations about pupils' affective dispositions toward the learning of school science could be a good starting point to move in this direction. In the database of attitude research, there are some very comprehensive review studies, like "Gender Differences in Student Attitudes Toward Science: A Meta-Analysis of the Literature from 1970 to 1991" by Weinburgh (1995), "Attitudes Towards Science: A Review of the Literature and its Implications" by Osborne *et al.* (2003) and "In Pursuit of Validity: A Comprehensive Review of Science Attitude Instruments 1935-2005" by Blalock *et al.* (2008). Whitfield's (1980) analysis of data on English students about their preferences for science learning also shows that physics and chemistry were two of the least popular subjects and that these were distanced in pupils' minds from biology. Whitfield is of the view that rejection of science by the student is as a result of their perception that it is a difficult subject. Perhaps surprisingly, Whitfield's type of study has

not been repeated on a large scale. If so, a recent study in one school, using a slightly more sophisticated preference ranking system, has shown that boys were far more likely to report liking science than girls-a finding given additional salience by the work of Jovanovic and King (1998), which suggest that one of the major factors in girls' antipathy towards science is their perception that they are better at other subjects. Preference ranking is simple to use and the result of such research are easily presented and interpreted. It is possible for a student with an extremely positive attitude to all school subjects to rank science as the least popular. Hence science educators have much to learn from the growing body of literature on the study of motivation (Bergin, 1999; Dweck, 1986; Dweck & Leggett, 1988; Hidi, 2000; Paris, 1998). The common feature of much of this work is the recognition of the distinction between individual and interest and situational and extrinsic interest. The latter is stimulated by contextual factors such as good teaching that stimulate interest and engagement. Hidi (2000) argues that the role of situational interest is highly significant in a classroom or subject where children are disinterested in the subject at hand or are academically unmotivated. Paris (1998) also argued that the essential ingredients of motivation are opportunities to choose, challenge, control over the pace and nature of learning and collaboration.

Wallace's (1996) detailed research on the views of pupils about learning and its implications led her to conclude that engagement was raised by pupils to take control of their learning and greater pupils' autonomy. Osborne and Collins' (2000) work has revealed that pupils desired more opportunities in science for practical work, extended investigations, and opportunities for discussion, which provide an enhanced role for personal autonomy. A number of studies have confirmed the significant role that teachers play in learners' attitude formation. The work of Sundberg *et al*. (1994) which studied 2,965 United States college pupils' attitude towards science is a typical example. Again, Simpson and Oliver (1990), Myers and Fouts (1992), Piburn and Baker (1993) in their studies, agreed that teachers' attitude has been cited by several studies as an important determinant in attitude formation of students. Also, students' attitudes towards science are significantly influenced by teachers' instructional strategies, interpersonal relationships with students, and the motivation of students to learn. Student-centered instructional approach, regular motivation of students to learn science, and maintaining cordial interpersonal relationships with students, therefore, evoke their interest and actively participate in science lessons.

In addition, Mihladiz *et al.* (2011) expressed that there are many factors that determine students' attitudes toward science. These are factors such as teacher, education environment, peer group, and parents (Scantlebury *et al*., 2001). Another thing that affects a positive attitude towards science is the teaching method (Mihladiz *et al*., 2011). An effective teaching environment increases a positive attitude towards science (Papanastasiou & Zembylas, 2002). The students, who have a positive attitude towards science, keep a positive attitude towards their teacher, educational programs, and lessons and even towards their school at the same time (Mihladiz *et al*., 2011). Again in students' developing a positive attitude towards science, teachers and parents play an important role (Mihladiz *et al.*, 2011). There is a positive relationship between students' attitude

towards school and their parents' interest in education (Keeves, 1975). At the same time, parents' directing their children to scientific activities lead the children to develop a positive attitude towards science (Mihladiz *et al.,* 2011). There are also researches showing that classmates' attitudes toward science are more effective than teachers' and parents' (Walberg *et al*., 1992). Also, there are some studies in the literature dealing with the relationships between the attitudes towards science and teaching methods, variables in the learning environment affecting the attitudes towards science, and students' and teachers' perceptions of science and their attitudes towards it (Mihladiz, *et al*, 2011). Kyle (1988) investigated the development of "Science through Discovery" program implemented in a school and found that the program made positive contributions to students' attitudes towards science, enhanced their interest in technological developments and their implications, and improved their decision-making and performing skills. Kurt and Akdeniz (2002) found that worksheets, Baúdaú and Kiriúçiolu (2006); science activities based on (5E) approach, Ornstein (2006) regular science activities carried out with simple and cheap materials improved the students' attitudes towards science. Chuang and Cheng (2002) found that there are significant positive relationships between the students' attitudes towards biology and biology competency, scientific attitudes, scientific process skills, and logical questioning ability; moreover, girls have better scientific attitude scores and boys have better logical thinking skills.

3. Material and Methods

3.1 Research Design

The study was quantitative action research. In this, a structured questionnaire was the instrument used in order to enable the collection of data from a large and diverse group of students in the Colleges of Education in Ghana. The instrument for this study was named Attitude of Students Towards Science (ASTS) - Questionnaire. It was a restructured form of that of Fennema – Sherman (1976) mathematics and science attitude test. In their study of students' attitude towards science in the early 1970s, a forty–eight (48) item questionnaire from four subscales namely, a usefulness scale, a confidence scale, science as a male domain scale, and a teacher perception scale was used.

This instrument (ASTS) however, consisted of twenty (20) items. The items were constructed in line with four students' attitudinal dimension scale: students' interest (enjoyment) in science, their motivation (encouragement) to do science, their involvement (participation) in science lessons, and their interpersonal relationship with science teachers. Under each of these dimensions, both positive and negative items were constructed. It was a 5-point Likert scales for which trainee students responded according to their degree of agreement or disagreement with each item. Out of the twenty (20) items, seven (7), five (5), four (4), and four (4) items were constructed under students' motivation (encouragement) to do science, students' interest (enjoyment) in science, their involvement (participation) in science lessons and their interpersonal relationship with science teachers respectively.

The questionnaire consisted of two sections;' A' and 'B'. The section 'A' was about the demographic information of the respondents. The section 'B' covered items (statements) relating to the students' attitude under study. The information obtained from the administration of the questionnaire was quantified and analyzed using descriptive statistics; frequencies and their corresponding percentage values. The conclusion was drawn based on the findings and recommendations were done.

3.2 Research Population

The target population was made up of all the six (6) public Colleges of Education in Central, Western and Western-North Regions of Ghana. These Colleges were Foso College of Education, Our Lady of Apostles (OLA) College of Education, and Komenda College of Education in the Central Region. Holy Child College of Education from the Western Region with Enchi College of Education and Wiawso College of Education, from the Western-North Regions.

3.3 Sample and Sampling Procedure

The sampled population was made up of one hundred and fifty students (150) science students from the selected Colleges of Education. Thirty (30) students were selected from each of the five sampled colleges. The sampling techniques that were used were cluster sampling, stratified random sampling, and purposive sampling techniques. Due to the geographical distribution of the population of the study (Colleges of Education) which is widely scattered across the length and breadth of Ghana, the researcher adapted cluster sampling to select Colleges that were confined in a certain area of the country. That is the Central, Western, and Western-North Colleges which are all within the southern part of Ghana. Stratified random sampling was used to select respondents from two categories of students; science major students and non-science major students who offered science courses as their second area. Purposive sampling was also used to select the sample to include the female science students in the colleges where the number of females who offered science courses was few.

3.4 Research Instrument

The instrument used was a twenty (20) - item questionnaire. The items were constructed in line with four students' attitudinal traits or dimensions: students' interest (enjoyment in science), their motivation (encouragement to do science), their involvement (participation) in science lessons, and their interpersonal relationship with science teachers. Items constructed under each dimension consisted of both positive and negative items. Each of the 20 items was scored on a five-point Likert scale with every item scored one (1) for "Strongly Disagree" and five (5) for "Strongly Agree". There was also an intermediate score of 2 which means "Disagree", 3 which means "Not Certain" and 4 meaning "Agree". A respondent could select from these intermediate scores depending upon one's degree of agreement or disagreement with a particular item.

3.5 Validity and Reliability of the Instrument

The questionnaire was sent to Science Education Department, University of Education, Winneba – Ghana for some senior science lecturers (Professors and Senior lecturers) to do face validity of the items. They were of the view that double sentences should be avoided. For example, the sentence, "I do understand when my science teachers teach and therefore enjoy college science lessons" was rather separated into, "I do understand when my science teachers teach" and "I enjoy college science lessons". They suggested also that, long and compound sentences such as "I dislike science because I do not understand when my science teachers teach and learning science is, therefore, waste of time" should be avoided. Such items statements were rather shortened and simplified to "I dislike science," "I do not understand when my science teachers teach'' and 'Learning science is a waste of time". Again, they verified whether negative items conveyed their intended meaning. In summary, they all agreed that the instrument was appropriate for the intended purpose. Afterward, the instrument was pilot tested with twenty (20) students from Foso College of Education.

For reliability, reliability analysis was done using Cronbach's Alpha. The alpha coefficient was determined for the questionnaire and the Reliability Coefficient Alpha of 0.91 was reached indicating that the instrument was reliable.

3.6 Data Collection Procedure

Visits were made to the selected colleges on different days. Permission was sought from the authorities of the colleges (Principals and Heads of Science Departments) to administer the questionnaire.

Each subject sampled was given a questionnaire to complete independently and return it. The items were answered under my personal supervision with the help of some of the science tutors in the departments.

Subjects were given enough time to answer the questions according to their levels of agreement or disagreement with each of the items.

3.7 Method of Data Analysis

The attitude of the students was determined by descriptive statistics by calculating the average (mean) score (X/N) for each dimension (i.e., sum score of items under a dimension, X divided by the total number of responded items, N for dimension). Also, the percentage for an average response for each dimension was calculated (i.e., mean value for each dimension divided by 5and multiplied by 100). Any attitude dimension with an average (mean) greater than or equal to 3.0 implies that students have a positive attitude toward that dimension and vice versa.

4. Results and Discussions

Four main traits or dimensions of students' attitude were investigated; students' motivation (encouragement) to do science, students' interest (enjoyment) in science, students' participation (involvement) in science, and students' interpersonal relationship

with science tutors were considered to help find out the type of attitude teacher trainees exhibit towards science in the Colleges of Education in Ghana. The descriptive statistics representing the disposition of the subjects (teacher trainees) on the four dimensions or traits of their attitudes towards the study of science are represented below.

Table 1: Teacher trainees' response about their attitude towards the study of science

Attitude dimension	Sum of score for items per dimension (X)	Total no. of responded items per dimension (N)	Average (mean) response per dimension (X/N)	% for average (mean) response per dimension
Students' motivation (encouragement) to do science	2352	1050	2.24	44.8
Students' interest (enjoyment) in science.	1584	750	2.11	42.2
Students' involvement (participation) in science	1015	600	1.69	33.8
Students' Interpersonal relationship with science teachers	1276	600	2.13	42.6

From the table above, students' motivation (encouragement) to do science produced an average (mean) value of 2.24 which represents 44.8%. Also, students' interest (enjoyment) in science lessons came out with an average (mean) value of 2.11which corresponds to a percentage of 42.2. Students' involvement (participation) in science gave an average (mean) value of 1. 69 with a corresponding percentage of 33.8 whiles students' interpersonal relationship with their science teachers as a dimension or trait of students' attitude also produced an average (mean) value of 2.13 which also represents 42.6%.

4.1 Findings

From the statistics, it means that these teacher trainees were of the view that they were not motivated (encouraged) enough by their science teachers to pursue science and therefore do not have any interest (enjoyment) in learning science. The data shows once again that these teacher trainees do not actively participate (involved) in a science lesson. For this, I believe that it might be due to the fact that they do not show interest in learning science because they were not encouraged (motivated) to do it. This outcome confirms Beaton *et al.* (1996), Martin *et al.*, (1997), Martin *et al.*, (2004), Martin *et al.* (2008), Martin *et al.*, (1999), OECD (2006), Sjøberg, (2002), and Schreiner & Sjøberg (2007) findings that students in developed countries show little interest in the subject. I believe 'the subject' mentioned in their findings refers to science. Also, according to a report of House of Commons (2002), students' interest in school science is declining with an accompanied declining number of students taking science, which consequently causes a shortage of science literates in different science-based professions. Again, the findings from this

study are not surprising because Mogari (2003) believed that motivated learners are those who tend to pursue subjects with eagerness and persistence. Tilger (1990) has also observed that effective participation of pupils in learning depends a lot more on the encouragement they receive from their teachers.

Again, it can also be said that, the above characteristics which are expressed by teacher trainees about their attitude towards science could be as a result of the unhealthy interpersonal relationship that exist between them and their science teachers.

5. Recommendations

It is therefore recommended that science tutors in the Colleges of Education in Ghana must give the trainee students the necessary encouragement and motivation so as to pursue science with eagerness and persistence (i.e. participate effectively in science lessons). Science tutors in the Colleges of Education in Ghana must also ensure that good interpersonal relationships exist between them and the trainee students so as to make them motivated to learn. This will help inculcate in the students' positive attitude towards science.

6. Conclusion

The statistics above give an indication that none of the dimensions of teacher trainees' attitude towards the study of science exceeded or amounted to an average (mean) value of 3.0. This means that teacher trainees do not have a positive attitude towards science. That is, they did not show motivation (encouragement) to do science, and neither did they show interest (enjoyment) in science. Again, students did not show any involvement (participation) in science nor did they show that there was any cordial interpersonal relationship with their science teachers.

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Conflict of Interest Statement
The authors declare no conflicts of interest.

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