

Attitude of Students Towards the Study of Physics: A Case of Tamale College of Education, Ghana.



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ABSTRACT

The study examined the attitude of third-year science and mathematics students towards the study of Physics in the Tamale College of Education, Ghana. A case study involving a sample of one hundred and thirty-three students was adopted for the study. Using a structured questionnaire, data was collected from the selected sample. The Likert rating scale was adopted to indicate the extent of agreement or disagreement. General findings from the study indicated that the majority of the respondents had a negative perception towards the study of Physics. The research recommended that preferably only students who offered Elective Physics at the Senior High School level should be admitted to study Physics at the College level as this would facilitate the smooth teaching and learning of the subject. It was also suggested that Physics tutors should use innovative strategies to make the teaching and learning of the subject interesting and attractive.

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INTRODUCTION

Physics, a component of science, is concerned with the basic principles of the universe. It is one of the foundations on which the other Applied Sciences such as Astronomy and Geology are based. Physics is second only to Mathematics in the purity of its principles. The beauty of Physics lies in its fundamental theories and a number of basic concepts, equations and assumptions.¹ These combined describe the human being's view of the universe. It is a branch of science that has developed strong abstract theories about the universe. Through Physics, a better understanding of nature has been gained and this has helped in the discovery of ways of solving problems that confront humans.²

Although Physics features in every area of life and facilitates efficient living, national and international studies show that success in Physics education is lower than in other disciplines. According to Rivard and Straw, physics is considered the most problematic area in the main realm of science, and it traditionally attracts fewer students than Chemistry and Biology. Physics is perceived as a difficult course for students from secondary to university and also for adults in graduate education. It is well known that both high school and college students find Physics difficult.³ This research, therefore, sought to investigate the challenges students faced in the study of this important aspect of science using the Tamale College of Education as a reference point. It then offers certain recommendations on how to facilitate the study of Physics since it is a crucial part of human life.

The Importance of Physics as a Science

According to Nolan, Physics describes how the natural world works through applied mathematical formulae. It deals

¹ Raymond Serway and Robert J. Beichner, *Physics for Scientists and Engineers (5th ed)*(Fort Worth: Saunders College Publishing , 2000), 1.

² William Nault, *The World Book Encyclopedia* (Chicago: Aldine – Atherton Press, 1999).

³ Leonard P. Rivard and Stanly P. Straw, "The Effect of Talk and Writing on Learning Science: An Exploratory Study." *Science Education Journal* 84 (2000): 566.

with the fundamental forces of the universe and how they interact with matter holistically from the galaxies and planets to atoms and quarks. All other natural sciences stem from Physics. Chemistry is essentially Applied Physics and Biology is essentially Applied Chemistry. A Physics theory was responsible for the breakthrough in electronics that precipitated advances in modern computers and electronic media.⁴

Among the goals of Physics is to provide an understanding of nature by developing theories based on experimentation. These theories are usually expressed in mathematical forms. Through Physics, it is possible to explain the behavior of a variety of physical systems with a limited number of fundamental laws. Newton, for example, discovered the law of gravitation and this has made it possible to predict planetary motion with great precision⁵.

As a science, Physics plays an important role in explaining the events that occur in the universe. It enables human beings to answer questions that nature poses. This can be found in the physical laws and principles in all events that surround the earth. The development in Physics in the 20th century has been extremely successful in that it greatly benefited other basic and applied sciences.⁵

In the formulation of general scientific laws, interlocking relationships among the sciences are recognized. These interrelationships are considered responsible for much of the progress today in several specialized fields of research, such as Molecular Biology and Genetics. Biology which traditionally has been considered independent of Physics now uses many of the principles of Physics in its study of Molecular Biology. The Health sciences use so many new techniques and equipment based on the principles of physics. As such it has become necessary to have an understanding of physics as a fundamental requirement to pursue many courses in the field of science.⁶ Mathematics is one of the most important tools that Physics requires as it is basically the application of Mathematics. According to Jones and Chassy, a deeply integrated understanding of concepts in Physics cannot exist without understanding their mathematical descriptions.⁷ An example of this is the consideration of the simple laws of classical mechanics. Physics at this point is generally described by a series of equations. The simplest one usually introduced early in the curriculum is $d = vt$. Students are typically asked to find either v or d , and are provided other quantities. Thus, at the core of mastery of this simple equation lies a solid understanding of multiplication and division. Quale stated that mathematical formulation is very much needed to represent the laws, principles, theories, etc in Physics. He stressed that the relationship between Mathematics and Physics is inseparable.⁸

The Challenges with the Study of Physics

The causes of science anxiety/fear (physics inclusive) are many. These include bad experiences in science classes, science-anxious teachers in elementary and secondary schools, lack of role models, gender and racial stereotyping, and stereotyping of scientists in the mass media.⁹ In Physics, students have to memorize theories, formulae, principles, and everything in between. It is extremely hard and stressful. More importantly, most find that they don't have the essential skills and aptitude to apply their theoretical knowledge for solving problems. Consequently, they end up hating physics. Some students think their teachers are incapable of teaching Physics in the way that they want to teach, while some blame the complexity of the discipline.

Students Attitude Towards the Study of Physics

Extensive research has shown that a person's attitudes are learned as opposed to being inherited. Many factors can influence a person's attitude, including previous experiences and social influences. Attitude towards science may be defined as a favorable (positive) or unfavorable (negative) feeling about science as a school subject, which is the definition used for the study.¹⁰ Craker attested that students' attitude to one or another subject has been proven to lead to good performance in that subject. A negative attitude towards a certain subject makes learning difficult, while a positive attitude stimulates students to put in the adequate effort that often leads to high achievement in that subject.¹¹ Relative to Physics, Godwin and Okoronka showed that a significant relationship exists between students' attitude and their corresponding academic performance in physics.¹² Determining students' attitude towards a subject is therefore a useful task if one wishes to improve the performance of students in that subject. The estimation of students' attitudes towards natural science has been carried out by many researchers. In their research, Wilson et al, concluded that students'

⁴ Peter Nolan, *Fundamentals of College Physics (6th ed)*, (Dubuque: WmC. Brown Publishers, 1993), 3.

⁵ Uri Haber-Schaim and Judson Cross, *Physics(4thed)*, (Lexington: D.C Heath and Company, 1976), 3.

⁶ Fifi Mensah and Joseph Y. Appiah, *Methods of Teaching Basic School Science* (Cape Coast: University of Cape Coast Publishers, 2015), 18.

⁷ Jessica Jones and Phillippe Chassy, "The Role of Mathematics in Physics." *Open Access Journal of Mathematical and Theoretical Physics*, 2 no.1, (2019): 23.

⁸ Andreas Quale, *Radical Constructivism, a Relativist Epistemic Approach to Science Education*. (Rotterdam: Taipei Sense Publishers, 2008).

⁹ Rum Tan, *A Closer Look at Why Students Hate Physics and How to Do it Differently* (2017), accessed May 24, 2021.

<https://smiletutor.sg/a-closer-look-at-why-students-hate-physics-and-how-to-do-it-differently/>

¹⁰ Dana E. Craker, "Attitude Toward Science of Students Enrolled in Introductory Level Science Courses at UW – La Crosse," *Journal of Undergraduate Research*, (2006): 9.

¹¹ Craker, "Attitude Toward Science of Students Enrolled in Introductory Level Science," 6.

¹² Ballah Godwin and Ugwumba Okoronka, *Attitude and Academic Performance of Senior Secondary School Students in Physics*. (Ibadan: Macmillan, 2015), 9.

positive attitudes towards science highly correlated with their achievement in the subject.¹³

In the particular area of physics, a visible decline in the enrolment in Physics and a fall in its interest around the world has been made to estimate the attitude of students towards the subject at secondary schools and universities. Olusola and Rotimini came to the same conclusion that the decrease in physics academic achievements is alarming. The outstanding factor that caused this is students' negative attitude towards Physics.¹⁴

Some Causes of Poor Academic Performance in the Study of Physics

Poor academic performance in Physics has been a concern in many high learning institutions in recent times around the world. Studies have revealed that the major challenges affecting student's learning of the subject have been inadequate facilities, poor administration, inadequate training of teachers, overcrowded classrooms and laboratories as well as poor attitude of students towards the subject. Also, students' increasing reluctance to choose science courses, and physical science courses in particular, during their final years of secondary education has crucial implications not only for the continuity of scientific endeavor but for the scientific literacy of future generations. As a result, the development of positive attitudes towards science, scientists, and learning science is increasingly becoming a necessary phenomenon. The importance of science particularly physics in the technological development of a nation cannot be overemphasized. However, one cannot lose sight of the fact that in any teaching and learning situation, the student, teachers, curriculum, and the learning environment are the four pilot factors that make learning meaningful.¹⁵

Sitotaw and Tadele noted that a problem concurrently predominant in schools is that of students' having a poor attitude towards learning which makes the teaching-learning process tedious.¹⁶ As related to the tenets of this research work, it has been reported that students' academic achievement in Physics has been lowered by the interactions they have with their teachers on the teaching methodology used.¹⁷

From these studies, it can be deduced that students, attitude to one or another subject has been proven to lead to a good performance in that subject. A negative attitude towards a certain subject makes learning difficult, while a positive attitude stimulates students to put in more effort leading to high achievement in that subject.

The Process of Gaining Admission to Study Physics and its Implications

For a student to be admitted to pursue a science and mathematics programme in a College of Education in Ghana, he/she must obtain at least a credit in Elective Mathematics and also at least a credit in any two of the three pure science subjects. Any of the following combinations below thus qualifies a student to pursue a Science and Mathematics programme:

1. Elective Mathematics, Physics and Chemistry;
2. Elective Mathematics, Physics and Biology;
3. Elective Mathematics, Chemistry and Biology.

From the above combinations, it is possible to find a student who did not study Physics at the Senior High School (SHS) level but is made to offer it in the New Bachelor of Education (BEd) Programme in the College Of Education. Thus, in the Tamale College of Education, the negative student attitude towards the learning of Physics may be attributed to several factors including the lack of adequate knowledge of Physics. It must also be noted that such a student might have obtained at least a credit in three core subjects which include Mathematics, English and Integrated Science at the SHS level. However, the student may not possess the temerity to study Physics at such a higher level without a basic understanding of concepts.

METHODOLOGY

The research design employed in the study was a case study. This design is an intensive study geared towards a thorough understanding of a given social unit. The social unit may be an individual, a group of individuals, a community, or an institution. For the purpose of this study, the researcher employed a group of individuals. The target population for the study included 227 Science and Mathematics second and third-year students of Tamale College of Education. The first-year students were excluded from the study as they do not offer Physics as a course. From the target population, 133 students participated in the study. These were made up of 111 males and 22 females.

¹³ Victor Wilson, Cheryl Ackerman and Ceasar Malave, "Cross-Time Attitudes, Concept Formation, and Achievement in College Freshman Physics." *Journal of Research in Science Teaching*, 37 no.10, (2000): 1112.

¹⁴ Olasimbo Olusola and Christopher Rotimini, "Attitude of Students towards the Study of Physics in Colleges of Education," *American International Journal of Contemporary Research*, 2 no.12 (2012): 86.

¹⁵ Ricardo Trumper, "Factors Affecting Junior High School Students' Interest In Biology," *International Journal of Science Education*, 17 (2006): 31.

¹⁶ Belay Sitotaw and Kummeger Tadele, "Students Attitude Towards Physics in Primary and Secondary Schools of Dire Dawa City Administration, Ethiopia." *World Journal of Educational Research and Reviews*. 2 no. (2016):14.

¹⁷ Sitotaw and Tadele, "Students Attitude Towards Physics, Ethiopia," 14-21.

Data was collected from the respondents using a questionnaire. These were administered by the three researchers undertaking the study within April 2021. All questionnaires administered were retrieved. The first section of the questionnaire sought to gather data on the background of students in relation to the study of Physics at the SHS level. The other part of the questionnaire was the attitude measuring scale consisting of ten items with four like-type options. A four-point Likert rating scale was used ranging from strongly disagree – SD, disagree – D, strongly agree – SA and Agree – A.

The data collected from the respondents was analysed using SPSS to retrieve descriptive statistics of frequency counts and simple percentages.

RESULTS AND DISCUSSION

In question 1, respondents were required to indicate whether they studied physics at the SHS level. Their responses are displayed in Table 1.

Table 1: Study of Physics at SHS Level

Item (Physics)	Frequency	Percentage(%)
Yes	87	65.4
No	46	34.6
No response	00	00.0
Total	133	100.0

From Table 1, 87 respondents representing 65.4% of the sample indicated that they studied Physics in SHS. This may be a clear indication that such students may find some basic concepts in Physics easy in the College of Education because the topics taught in SHS are the same topics taught in the College of Education.

The table also revealed that 46 respondents representing 34.6% of the sample indicated that they did not study Physics in SHS. The foundation in Physics of such students may be weak and therefore may affect the learning of the subject at the college level.

The second question sought to find out the attitude of students towards physics The answer to the research question is displayed in Table 2.

Table 2: Students' Attitude towards Learning of Physics

Item	SD	%	D	%	SA	%	A	%	Total (number of students/ percentage)
I find physics difficult	17	12.8	22	16.5	37	27.8	57	42.9	133 100
I get good scores/ grades in physics.	37	27.8	48	36.1	17	12.8	31	23.3	133 100
I do physics because it is compulsory	25	18.8	23	17.3	33	24.8	50	37.6	131 98.8
I get scared in physics classes	19	14.3	31	23.3	27	20.3	52	39.1	129 97
I don't see the relevance of physics in everyday life	32	24.1	23	17.3	35	26.3	43	32.3	133 100
The methodology employed by my physics does not suit me.	42	31.6	26	19.5	31	23.3	34	25.6	133 100
I hate the mathematics aspect in physics	19	14.3	26	19.5	47	35.3	41	30.8	133 100

I find Physics Difficult

From the table, 12.8% of the sample strongly disagreed with the notion that physics is difficult whilst 16.5% disagreed

that Physics is difficult. The table also reveals that 27.8% of the sample strongly agreed that they find Physics difficult whilst 42.9% agreed that physics is difficult.

The combined percentage of students who strongly agree and agree to the difficulty of physics was (27.8% + 42.9% = 70.7%). This high percentage agrees with Rivard and Straw, who hold the view that Physics is perceived as a difficult course for students from secondary to university levels.¹⁸

I hate the Mathematics Aspect in Physics

It cannot be over-emphasized that mathematics plays a pivotal role in the teaching and learning of physics. The calculations in physics can scare students and may even make them hate physics.

As displayed by the table, 14.3% of the students strongly disagreed that they hate the mathematics aspect of physics while 19.5% agreed to the item. The sum of these percentages (14.3% + 19.3% = 33.5%) though is on the lower side, still indicates that some students love the mathematics aspect of physics. The attitude of such students might be positive when dealing with mathematical concepts in physics.

Also, from the table, 35.3% strongly agreed that they hated the mathematics aspect of physics while 30.1% agreed to the item. These percentages are high and students with such attitudes could perform poorly in physics because mathematics is one of the best tools to understand Physics. Hating Physics because of mathematical applications has a negative implication in learning the subject.

I get good scores/grades in Physics

As revealed by the table 27.8% of the students strongly disagreed that they got good scores/grades in physics while 36.1% disagreed with the question. Thus, a combined percentage of 63.1% do not get good scores/grades in physics. This may lead to the development of a poor/negative attitude towards physics. The development of a negative attitude leads to poor performance which was shared by Olusola and Rotimini in their study.¹⁹

The table also revealed that 12.8% strongly agreed while 23.3% agreed that they got good scores/grades in physics. This agrees with Veloo, Nor & Khalid that students' attitude to another subject has been proven to foster good performance in that subject.²⁰

I do Physics because it is Compulsory

Only two students out of the sample did not attend to this item. It is mandatory for all students offering Science and Mathematics as a programme in the College to read Physics. The question sought to seek the views of respondents as to whether they study Physics because it is compulsory. The responses displayed on the table indicated that 25 respondents representing 18.8% of the sample strongly disagreed whilst 17.3% disagreed with this question. Also, from the table, 24.8% of the respondents strongly agreed that they read physics because it is compulsory whilst 37.6% agreed with that statement. The total of students who strongly agreed and agreed with this statement was 24.8% + 36.8% = 61.6%. This percentage is high enough for one to conclude that but for Physics being compulsory, many of the students who offer it in the college would have opted out.

I get Scared in Physics Lessons

Studies have shown that fear can hinder learning. Students were required to respond to the statement; I get scared in Physics lessons. From the table, 18.3% strongly disagreed while 23.3% disagreed with this statement. The table also reveals that 21.8% strongly agreed whilst 31.1% agreed. The difficult nature of physics may pose fear to students and if not properly managed could lead to underachievement. Getting scared in physics lessons is a negative attitude and if not managed properly could lead to low performance.

I do not see the Relevance of Physics in Everyday Life.

Applications of the concepts in physics can be seen in the reading glasses that people use to correct abnormal vision, microscopes that biologists use, telescopes that astronomers use, and electrical appliances that are used in homes. A statement required students to respond to the relevance of physics in everyday life. From the display of their responses, 25.6% strongly disagreed while 23.3% disagreed with the. Thus in total, 48.9% of the students see physics to be relevant in everyday life. This could lead to students developing positive attitudes towards physics.

The table also reveals that 24.1% strongly agreed that they do not see the relevance of physics in everyday life while 27.1% agreed to this assertion. In total, 51.2% of the students do not see the relevance of physics in everyday life.

¹⁸ Rivard and Straw, "The Effect of Talk and Writing on Learning Science", 566.

¹⁹ Olusola & Rotimini, "Attitude of students towards the study of physics in Colleges of Education," 86.

²⁰ Arsaythamby Veloo, Rahima Nor and Rozalina Khalid, "Attitudes towards physics and Additional Mathematics Achievement towards Physics Achievement," *International Education Studies*, 8 no 3 (2015): 35.

These students not seeing the relevance of physics could develop a negative attitude towards it.

The Methodology used by my Tutor is not Suitable to me

One of the major causes of poor academic performance in physics is poor teaching methods which can be an impediment in learning physics. Responses from the students about the teaching methodology and its suitability are also displayed in the table. From the table, 31.6% of the sample strongly disagreed that the method employed by their tutor was an impediment to the learning of physics while 19.5% disagreed. Such students would therefore have good feelings towards physics because appropriate teaching methodology induces positive attitudes towards a subject. Some students were however not comfortable with the teaching methodology as revealed by the statistics of the table. This could lead to developing negative attitudes towards studying physics.

RECOMMENDATIONS

The responses from the study have revealed the reasons or factors behind students' attitudes (negative attitude) towards physics. It is therefore, necessary that positive steps be taken towards mitigating these factors to ensure and maintain a positive attitude which will in turn boost students' interest in physics.

It is therefore recommended that:

1. only students with a background in Physics should be enrolled to learn the subject at the college level.
2. the negative attitude towards physics leads to low performance. To change this attitude the science department should organize sensitization sessions for students to focus on the important role physics plays in society.
3. physics lessons should be made more attractive by encouraging tutors to use more innovative strategies such as simulations, stories, computer animations, and videos. to support and enhance learning.

CONCLUSION

This study was conducted to determine the cause of the negative attitude of science and mathematics students towards the study of Physics. A questionnaire was used to elicit information from students. The data revealed that a combination of factors accounts for students getting good scores/grades in physics. These include appropriate teaching strategies, fear, teacher motivation, students' foundation in physics at the senior high school, etc. However, from the issues discussed, it has been revealed that Physics is fundamental to the basic activities of life. Hence, students must be encouraged to pursue the subject to develop mechanisms that would further enhance the lives of mankind.

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