FACTORS INFLUENCING SECONDARY SCHOOL STUDENTS' ATTITUDE TOWARDS THE STUDY OF PHYSICS IN IMENTI SOUTH DISTRICT, KENYA

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ABSTRACT

The study was conducted in January and February 2011. It aimed at investigating the factors that were considered to influence students' attitude towards the study of Physics in secondary schools in Imenti South District, Kenya. The factors under consideration were perceived adequacy of physics laboratory equipment, perceived teacher competence, the influence of calculations in the physics curriculum and sex differences in students' attitude. The study sample consisted of 120 students. These were drawn from four secondary schools sampled through stratified random technique. Descriptive survey design was used. Two instruments were used for data collection. These were a students' questionnaire and a laboratory equipment checklist. The questionnaire was administered to the students at one sitting in each of the schools. The observation checklist was filled by the laboratory assistant in each of the schools. Each of the independent variables had its items scored separately. A single attitude score was thus obtained for each attitudinal object per student. The research findings revealed that students have a positive attitude towards physics, perceive the physics' teachers as competent and they perceive the physics laboratories as well equipped. It was recommended among others that teachers teaching physics and mathematics should work in consultation with each other so as to help the students in appreciating the role of mathematics in physics and girls should be helped to interact with ladies who have excelled in physics so as to boost their attitude towards physics.

Keywords: *Secondary school, Students' attitude, Physics, Laboratory*

INTRODUCTION

Physics is one of the science subjects studied in secondary schools in Kenya. In the third year of studies (form 3), students choose to study at least two science subjects from biology, physics and chemistry and are assessed at the end of the forth year. Imenti South District is in Eastern province of Kenya. The district is productive with sufficient resources for supporting educational programs but few students opt to study physics in form 3 and 4. In the years 2006, 2007 and 2008, candidates opted to study physics were 21.74% out of 1780, 23.31% out of 2347 and 20.94% out of 2880 respectively. This prompted the researchers into desiring to carry out this research. From the Kenya National Examinations Council KCSE Report (2008),

percentage candidature for physics for the years 2005, 2006, and 2007 were 30.41%, 26.69% and 26.78% respectively. The other science subjects had figure above 90%. In the same years physics was better performed than biology and chemistry. This showed that although students have the ability to score high grades in physics, other factors were hindering them. It may be that the attitude that students develop towards a subject is dependent on their experiences in school. Furthermore, Waititu (2004) asserts that although the link between performance and attitude is not very strong, what is very clear is the strong relationship between attitude and the choice of a subject of study. A key property of physics is that there are many mathematical concepts and processes.

The mathematical calculations in physics may make the subject a preserve of very few learners. The high number of these concepts and processes do provide a background or have a high utilitarian value in understanding scientific programs especially in physics. In this case, calculations are very important in expressing physics content (Bassey, 2003). In contrast, Murithi (1996) states that physics is taught to selected students who have knowledge of its mathematical concepts and symbols. This reveals that while some scholars value the contribution that mathematics has on the physics content, others view the interdependence as an obstacle to excellence in physics. Contributing on the issue, Knecht (1965) says that physics and mathematics are closely linked that their teachings overlap. The requirement of mathematical knowledge thus could be blocking some students from venturing into physics.

Wadsworth (1998) puts it that underachievers who fail in mathematics remain passive and are often blocked out of physics since the mathematical principals and applications lower their morale in pursuing their physics agenda. Thus, the relationship between physics and mathematics deserved investigation. Statistics from the Imenti South District results reports revealed that in the years 2006, 2007 and 2008, the highest candidature registered for physics in the district was 23.31% in 2007. This represents low candidature registration for the subject and predicts negative attitude towards physics. Kungania (2006) conducted an investigation on the factors influencing attitude of diploma teacher trainees towards science and mathematics in Kenya. Further, Waititu (2004) explored students' perception of difficulty in topic areas of the Kenya secondary school physics syllabus. It was thus evident that no study has been conducted to investigate the attitude of students towards physics in Imenti South District of Kenya. The researcher thus found it necessary to carryout the research on the factors influencing students' attitude towards physics in Imenti South District, Kenya. The specific objectives of this study are:

1. To find out the students' attitude towards Physics.
2. To find out if the mathematical calculations in physics influenced students' attitude towards Physics.
3. To find out whether availability of equipped physics laboratories influences students' attitude towards Physics.
4. To find out if perceived teacher competence influences students' attitude towards Physics.

5. To find out whether there is sex differences in students' attitude towards Physics.

The factors influencing students' attitude towards Physics were explored by addressing the following questions: To what extent does mathematical calculations influence students' attitude towards Physics? How does well equipped laboratories influence students' attitude towards Physics? To what extent does perceived teacher competence influence students' attitude towards Physics? To what extent does the gender of students influence their attitude towards Physics?

METHODOLOGY

The study used descriptive survey design. It was carried out in Imenti South District in Eastern province of Kenya. The district has 52 secondary schools and a students' population of about 13 500 students. Two instruments were used; a students' questionnaire and a laboratory equipment observation checklist. Questionnaires were used on a representative sample (120 students) of the target population. To get the representative sample, four schools were selected by cluster sampling. From each of the schools, 30 students were selected using simple random sampling. Laboratory assistants from the four sampled schools were picked purposively since no school had more than one assistant. These helped in filling the observation checklist. To develop and test measures and procedures used in the main study, a pilot test was used as explained by Maina (2004). The researcher selected by convenience sampling 20 students from a school not in the study sample. Ambiguous items were modified into better form and this was used to ascertain the validity and reliability of the instruments. The number of items per attitudinal aspect was also increased to increase the validity of the questionnaires.

The independent variables of the study were, influence of mathematical calculations in the physics syllabus on students' attitude towards physics, perceived equipping of the physics laboratories, and perceived teacher competence and sex differences in students' attitude towards physics. The dependent variable was the students' attitude towards physics. Upon authorisation to collect data, questionnaires were administered in one sitting in each of the selected schools. Laboratory equipment observation checklist was filled by the laboratory assistants while the students filled the questionnaire. The students' questionnaire consisted of four parts, one for each variable. A five-point likert scale with alternatives strongly agree, agree, undecided, disagree and strongly disagree was used except in the perception of equipping of the laboratory where the alternatives were very adequate, fairy adequate, adequate, inadequate and non-existent. After the questionnaire copies were filled and returned, an attitude score was determined for each respondent per variable. Descriptive statistics were used for analysing the data. The analysed data were presented in tables showing frequencies, percentages and means. These showed where particular perceptions were concentrated. The analysis per objective was done as indicated in the sub-sections that follow in the results and discussion section.

RESULTS AND DISCUSSION

Table 1: Attitude score ranges for the research variables

Variables	Possible score		Actual score	
	Max.	Min.	High	Low
Students' attitude towards physics	85	17	85	21
Perceived teacher competence	55	11	55	26
Perceived equipping of physics labs	65	13	65	25
Mathematics factor in physics	50	10	48	11

Source: Survey, 2011

Distribution of attitude scores in each research variable: Table 1 shows the possible maximum and minimum attitude scores and the actual highest and lowest scores obtained in each of the variables. The students' attitude scores were tallied together per student for each of the variables. A high score value indicated positive attitude towards the attitudinal object (research variable) while a low score implied negative attitude. Scores midway between the maximum and minimum value and within an allowance of ±2 were considered as neutral (undecided) attitude. Table 2 shows the frequencies and percentages of the attitude scores obtained for each of the research variables under study.

Table 2: Attitude scores for the research variables

Variable	Positive Attitude		Neutral		Negative Attitude		Total
	Freq	%	Freq	%	Freq	%	
Attitude towards physics	63	52.50	15	12.50	42	35.00	120
Perceived teacher competence	107	89.17	9	7.50	4	3.33	120
Perceived equipping of labs	93	77.50	16	13.33	11	9.17	120
Mathematics factor in physics	36	30.00	22	18.33	62	51.67	120

Source: Survey, 2011

Students' Attitude towards Physics: From the results analysed on table 2, it is observed that 52.50% of the study sample have positive attitude towards secondary school physics. Even with this it is worth noting that 35.00% of the respondents have a negative attitude towards the subject. With 12.50% in the undecided category, it means that most of the students have formed an opinion (attitude) towards physics. Although respondents with positive attitude comprise of 52.50%, it is significantly high than the 35.00% attained by those with negative attitude. Furthermore the sample population was significantly representative and hence provided confidence in stating that the students have a positive attitude towards physics. Similar findings have been made by Kungania (2006) who observed that diploma teacher trainees have a positive attitude towards science and mathematics. That Kungania's study was conducted on diploma teacher trainees and not specific to physics was the reason why the researcher found it necessary to carry out the study. The results have now helped in answering one of the research questions. Secondary school students in Imenti South District have a positive attitude towards physics.

Perceived teacher competence: The results analysed indicated that 89.17 % of the

respondents consider their physics teachers as competent in handling the subject content. This is a high attitude score towards teachers' characteristics and ability. The assumption was that a positive attitude towards the teachers' competence is likely to influence students' attitude. This has been confirmed. The high attitude score reveals that although other factors (not investigated in this study) may affect attitude towards physics negatively, teacher competence is not one of them. The 3.33% having negative attitude towards the physics teacher and 7.50% in the neutral category was explained by considering that the physics teacher is a disciplinarian and a role model to students with differing expectations.

The results are similar to those of Waititu (2004) who observed that the attitude that a student develops towards a science subject like physics can be directly linked to the degree of competence that the presenter (teacher) portrays when presenting it. It is important to appreciate that teacher competence will translate into learning gain by the students if they are utilised in the process of instruction. Additional support of the study results was given by Marube in Murithi (1996) who states those teachers' characteristics and more so their competence that influence students' attitude towards physics.

Perceived equipping of Physics Laboratories: On equipping of physics laboratories, the results from the students' questionnaire were supplemented by the observations from the laboratory observation checklist. From table 2, 77.50% respondents considered the school laboratories to be well equipped. This translates into positive attitude towards the level of laboratory equipping and hence usefulness. Respondents who perceived the laboratories to be poorly equipped (negative attitude) comprised of 9.17% while 13.33% were neutral about the issue. Laboratory equipment observation checklist consisted of 71 types of basic equipment in a laboratory.

Table 3: Physics laboratory equipment

School	**No. of Equip Available**	**%**
Nkubu high school	69	97.18
Nkuene girls' sec. school	61	85.92
Igoki sec. School	59	83.10
Ukuu sec. School	44	61.97

Source: Survey, 2011

The checklist results revealed in table 3 show that Nkubu high school has 97.18% equipment availability. Ukuu secondary has the least percentage index of 61.97%. These findings tally with those of the students' perception of the equipping of the physics laboratory. It was noted that Nkubu high school (with 97.18%) also had the highest score in students' attitude towards physics at 73.32% (table 4). Table 3 reveals that Ukuu secondary has the lowest equipment availability index at 61.97% and the lowest positive attitude score as seen on table 2.

Table 4: Students' attitude scores per school

School	Positive attitude		Undecided		Negative attitude		Total
	Freq.	%	Frequency	%	Frequency	%	
Nkubu	22	73.32	3	9.99	5	16.67	30
Nkuene	13	43.33	3	9.99	14	46.67	30
Igoki	16	53.33	5	16.67	9	29.99	30
Ukuu	12	39.99	4	13.33	14	46.67	30
Total	63	52.50	15	12.50	42	35.00	120

Source: Survey, 2011

The findings on equipping of laboratories differ sharply with findings by Squares (1983) who noted that in many secondary schools, the necessary facilities for teaching were lacking. This may be explained if we consider that his research was conducted 26 years ago. Many school managers must have taken the challenge and provided the schools with the necessary teaching and learning resources. Students need to be encouraged to make accurate observations especially in the science subjects (physics, chemistry and biology). Graham (1985) adds that modern methods treat science not as an accumulation of facts but as an experience in investigating and discovery that has an aim of stimulating an inquiring and analytical mind. As students get involved in performance of experiments, making of observations and descriptions, they develop a liking for the subject.

However, the warning by Eshiwani (1983) that the mere creation of more facilities for science education does not necessarily lead to improved achievement or affection for the discipline needs to be remembered and taken into consideration during teaching. The assumption held was that availability of teaching equipment and hence practical work improves students' attitude towards physics. It was established that the availability of physics equipment influences students' attitude towards physics positively. This answered research question number 3.

The influence of mathematical calculations, principles and symbols in the physics curriculum on Students' Attitude towards Physics: The results presented in table 2 indicated that 36 (30.00%) respondents had a positive attitude towards the inclusion of mathematical principles, concepts and symbols in the physics curriculum while 62 (51.67%) had a negative attitude. Considering that the sample group had positive attitude towards physics, this implies that the respondents (students) do not appreciate the inclusion of mathematical work into the physics curriculum. It further implies that mathematical calculations make students to have a negative attitude towards physics. Since the perceived teacher competence and perceived level of equipping of laboratories had a positive attitude score of 89.17% and 77.50% respectively, then the score on mathematics ability (30.00%) explains why the general students' attitude towards physics declined to 52.50%.

Wadsworth (1998) realizes similar results and stated that under achievers who fail in mathematics remain passive and are often blocked from physics since the mathematical calculations and principles lower their morale in pursuing their

physics agenda. While some scholars value the contribution that mathematics has on physics studies, others view the relationship between the two as an obstacle to affection and excellence in physics. There is need for teachers and other educators to investigate further, the nature of this relationship. The revelation that inclusion of mathematical calculations contributes negatively to students' attitude towards physics answers the second research question of the study. The calculations affect students' attitude towards physics negatively. Psychologists, physics teachers and curriculum developers should face the reality and think together on ways in which the interdependence between physics and mathematics can be maintained and be of positive significance to the two subjects and the students. Bassey (2003) has appreciated the contribution of mathematics to physics and views calculations as very important in expressing physics knowledge.

Table 5: Sex differences on attitude towards physics

Sex	**Negative Attitude**		**Neutral**		**Positive Attitude**		**Total**
	Freq	**%**	**Freq**	**%**	**Freq**	**%**	
Boys	14	23.33	8	13.33	38	63.33	60
Girls	28	46.67	7	11.67	25	41.67	60
Total	42	35.00	15	12.50	63	52.50	120

Source: Survey, 2011

Sex differences on students' attitude towards physics: The research findings on student' attitude were analysed for each of the sexes (table 5). The findings reveal that 63.33% of the boys have a positive attitude and 23.33% have negative attitude towards physics. In general, boys have a positive attitude towards the subject. In comparison, 41.67% of the girls had positive attitude while 46.67% had negative attitude towards it. Thus girls have a negative attitude towards physics. With positive attitude at 63.33% for boys and 41.67% for girls, the researcher concluded that there exists a significant sex difference on attitude towards physics. Similar findings have been made by Twoli in Waititu (2004) who found that boys and girls differ in attitude towards physics and this affected teachers' expectations of each of the sexes. Murithi (1996) has similar observations and attributes the difference to social settings and expectations in the growth process.

The findings differ with those obtained by Kungania (2006) on his research study on the attitude of teacher trainees towards mathematics and science. A possible explanation for this is the fact that diploma teacher trainees are mostly in the training by choice hence Kungania must have researched on a sample that wholly consisted of subjects with a positive attitude towards physics. The research study yielded the following findings:

1. Secondary school students have positive attitude towards physics.
2. Mathematical calculations influence students' attitude towards physics negatively.
3. Availability of equipped laboratories has a positive influence on students' attitude towards physics.

4. Students have a positive attitude towards their physics teachers in Imenti South District and this has contributed positively to their attitude towards physics.
5. There are significant sex differences in students' attitude towards physics in secondary schools.

That students have positive attitude towards physics implies that factors other than attitude lead students into rejecting physics as a science subject of choice in schools. The assumption was that negative attitude directs students against physics. The findings have shown that students have a positive attitude towards physics hence the assumption cannot be sustained. This goes against Waititu (2004) who assert that favourable attitude particularly like for and interest in a subject leads to greater achievement. With the positive attitude towards physics, it may be that there is inadequate career guidance during subject selection. Students opt against physics irrespective of their affection for it and its everyday applications and many career alternatives. The findings have the implication that industrial careers such as those on engineering may continue being dominated by men since girls have less interest in physics, which is key to these courses.

CONCLUSION AND RECOMMENDATIONS

Equipping of laboratories is crucial just like teachers play an important role in influencing students' attitude towards physics. This implies that teachers should be sensitized about their role in the academic and career development of the learners. It also means that when there is need to influence students towards a given attitudinal object, teachers are best placed to carry out the task. This includes issues related to psychological guidance. The overlap of content between physics and mathematics works against study and advancement of physics. The observation by Bassey (2003) that mathematical concepts and processes do provide a background and a high utilitarian value in understanding physics is not supported by the research findings. Rather, the findings imply that the overlapping of the two subjects' content blocks many students from having affection for the subject and from studying it.

Based on the findings of this study the following recommendations are made.

i. Effort should be made to raise the levels of students' attitude towards physics. Psychologists should be in close contact with the students so as to help them achieve positive attitude towards physics. The school environment should also be conducive for students to express themselves without fear so that their concerns are understood and attended to promptly and adequately.
ii. Physics laboratories should be adequately equipped. Upon equipping of the laboratories, physics teachers should strive to teach physics by doing rather than theoretically. This will improve the students' hands-on ability and experience besides triggering an inquisitive and analytical mind.
iii. Teachers teaching physics should constantly consult and work closely with

mathematics teachers. This will help in identifying and solving problems that arise as a result of the overlap of content between the two subjects. Guidance should also be provided to the students on the significance of mathematics as an instrument of communication. This will lead to appreciation of mathematical calculations in physics and thus raise the students' attitude towards physics.

iv. Ladies who have excelled in physics should be invited and given opportunities to speak and interact with the students, especially girls. These will act as role models and help in bridging the gap that exist between boys and girls in attitude towards physics.

REFERENCES

Bassey, M. (2003). *School Science for Tomorrow's Citizen.* New York: Pergamon Press.

Eshiwani, G. S. (1983). Factors Affecting Performance among Primary and Secondary School Pupils in Western Province of Kenya. Nairobi:

Grahams, J. (1985). *The Role of Science and Technology in Developing Countries.* London: OUP.

Kenya National Examinations Council (2008). 2007 KCSE Examination Report. Nairobi: KNEC.

Knecht, W. (1965). *Teaching Physics Today.* Paris: OECD

Kungania, M. (2006). Factors Influencing Attitude of Diploma Teachers Trainees towards Mathematics and Science in Kenya, Nairobi. Unpublished Masters Thesis, Kenyatta University.

Maina, K. D. (2004). A Study of the Factors Responsible for Poor Performance in Chemistry Among Secondary School Students in Temeke District, Dar-es-Salaam, Tanzania. Unpublished Masters Thesis, Kenyatta University.

Murithi, E. M. (1996). Expectation of Handicapped Students and their Teachers in Learning and Teaching of Science Subjects in Kenya Special Secondary School for the Physically Handicapped. Unpublished Masters Thesis, Kenyatta University.

Squares, G. L. (1993). *Practical Physics.* Crutchely: LKW

Wadsworth, B. J. (1998). *Piaget for the Classroom Teachers.* New York: Longman.

Waititu, M. (2004). Exploring and Students Perception of Difficulty in Topics Areas of the Kenya Secondary School Physics Syllabus. Unpublished Masters Thesis, Kenyatta University.