



Influence of Resources on Students' Academic Performance in Physics at Secondary Schools in Ugenya Sub-County, Siaya County, Kenya

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ABSTRACT

This study sought to investigate resource variables that contribute to poor performance in physics subject among students in secondary schools in Ugenya Sub-County, Siaya County, Kenya. The study employed a cross-sectional research design. Purposive sampling technique was used to select 12 principals, 12 teachers of physics and 204 Form Three students pursuing physics, yielding a sample size of 228 from five schools in the study locale. Data was collected using questionnaires and structured interviews. Statistical Package for Social Sciences (SPSS) was used to analyze quantitative data. The main findings were that inadequate qualified physics teachers and inappropriate laboratory equipment necessary for effective teaching of physics were the main causes for the students' poor performance in the subject. The teachers largely utilized teacher-centered instructional strategies. It was also established that both teachers and students had negative attitudes towards the subject. It was evident that there was acute shortage of appropriate physical resources, especially text books and laboratory equipment. The study concluded that requisite resources and inappropriate instructional techniques were critical in enhancing students' academic performance in physics. It was recommended that the government of Kenya through the Ministry of Education and private school owners should make concerted efforts to ensure that the schools are well equipped with necessary materials, teachers need to undergo in-service training on the use of high impact instructional strategies and students appropriately motivated as a way of sustaining their interest in physics.

1.0 INTRODUCTION

1.1. Background to the Study

Available research evidence indicates that despite previous efforts by many schools to improve the performance of students generally, and performance in science subjects specifically, there is still very poor students' academic performance among secondary school students globally (Alshami,2013; Anderson,2004; Fabio & Laura,2010; KNEC,2016). Kenya has been following the 8:4:4 education system which means eight years of compulsory primary education, four years of secondary education after which students are expected to sit for the Kenya Certificate of Secondary education examination (KCSE) after which students are expected to take at least 4 years to pursue tertiary education institutions for specialization in various professions (Republic of Kenya,2012). Such institutions include universities, technical and vocational institutions, health education colleges, business education institutions and teacher education colleges. The education and training policy emphasizes on the need to promote science and technology education in secondary schools to be able to meet future science and technology challenges and enable the state become a middle-industrialized country by 2030 (Republic of Kenya, 2010).

The essence of teaching is to bring about a positive change in the behavior, attitude and thinking of the learner (Orodho,2017a). However, for curriculum changes to be successful, professional development amongst teachers must be considered (Orodho, 2017a) alongside appropriate instructional strategies. In the Kenyan context, Strengthening Mathematics and Science Education (SMASE) in-service training programme was set up as an intervention measure in 1998 following dwindling quality of teaching and learning in mathematics and sciences (SMASE, 2003). The mean scores for science, particularly physics, and mathematics have remained well below the expected margin in most secondary schools in the country (Kenya National Examinations Council, 2015).

The low school performance in science subjects, particularly Physics, may therefore, have a negative impact on upward mobility of many nationals and households with poor performers. The significant role of science in the attainment of Sustainable Development Goals (SDGs) and the attainment of Vision 2030 has prompted the Government of Kenya's education policy to make it compulsory for each student to specialize in at least two of the three subjects namely physics, chemistry and biology offered at the secondary school level (KNEC,2015). This is against the background that physics performance has been erratic in performance index in the country and Siaya County in particular (KNEC: 2016). It is against this background that this problem was premised.

1.2. Review of related literature

Researches at the international, continental, regional and national levels have made strides in an attempt to understand the factors that are associated with poor students' academic performance (Sutton, 2011;

In the United Kingdom, (Sutton, 2011), teachers are by far the biggest resource in schools. Research has found that teachers are the most important factor within schools that policy makers can directly affect to improve student achievement. Having a very effective rather than an average teacher raises each pupil's attainment by a third of a GCSE grade.

At the continental context, Jerry (2009) carried out a study in Nigeria where the performance in science subjects was very poor in the secondary schools. The findings were in tandem with that of Akinola (2006) which established that among the factors that contributed to students' poor performance were inadequate learning facilities in the secondary schools which include science equipment and laboratories, shortage of qualified and devoted instructors, lack of ability of the scholars to do well in practical and the teaching methodology used by the teachers (Akinola, 2006). Most of the text books used in secondary schools are written by foreign authors who use complex language which is difficult for students to follow.

In Malawi, Dzana (2012) factors that contributed to the decline were; lack of science equipment, lack of enough and quality text books, students' perception that science subjects are hard, student's laziness and too little time allocated to practical lessons. A study on factors associated with high school learner's poor performance (Andile & Moses, 2011) in South Africa where education and training during apartheid was characterized by the underdevelopment of human potential and that of blacks in particular. The teaching and learning of mathematics, science and technology were the hardest hit (Department of Education, 2001). The researchers classified the factors that led to poor performance into two; direct influences which include teaching strategies, content knowledge and understanding, motivation and interest, laboratory usage and syllabus non-completion. The indirect influences include parental roles and language, (Thomas & Pedersen, 2003), argues that a common maxim in the educational profession is that one teaches the way he or she was taught. This suggests that, for example and educator who was educated in an incompetent manner will have learnt bad practice and is likely to use such in teaching others.

Regionally, Tilya(2009) avers that, inadequate qualified teachers to handle science subjects has contributed extensively to the high number of unqualified teachers who teach in schools that lack the basic necessary equipment to impart knowledge to the learners. There has been an acute shortage of qualified mathematics and science teachers in secondary

schools. In Tanzania, for example, inadequate science teachers forced the government to train form six leavers for few months in order to try and cover this gap (Tilya, 2003). Performance of science in Tanzanian education sector starting from the primary sector, secondary sector, tertiary sector and the university, (COSTECH 2008). A study done to learn more about the situation of science teaching in Tanzania revealed that most teachers used transmission (chalk and talk) rather than interactive, learner-centered pedagogy (Tilya, 2003). Teachers were seen to be authoritative, dogmatic and inflexible (Chonjo, Osaki, Posi & Mruti I, 1996). The researchers established that the learning environment includes all the facilities, infrastructure available at the place where the school is located and all that can be found within the school surroundings.

In Tanzania, Siwel and Kizito (2008) investigated the effects of students' preferences in science subjects; does this affect their performance? (Siwel & Kizito, 2008), a case of Udzungwa secondary school, kilolo, Iringa, Tanzania. The study aimed to determine students' preferences for science subjects establish the relationship between students' preference and performance on science subjects, identify the effect of preference on performance then suggest ways to improve such relationship in order to enhance better academic performance and reinforce students' interests or preferences in science subjects. The researchers concluded that, guidance and counseling should be offered to the students particularly to those aspects which affect their future and should not be given too much freedom to opt on the issues that affect their future ,the government should make science subjects compulsory so as to avoid the possibility of losing some potential future scientists who might have dropped optional subjects and schools are to be guaranteed of enough teaching/learning facilities like books, laboratory tools and other facilities to make learning conducive. The problem is furthered by the cultural belief system in which teachers are regarded as elders and are to be respected and not challenged by students. In another study, (Osaki, 1999) found that in many schools, pupils read teachers notes instead of text books, and hence teachers are the main source of information and knowledge. The students may have textbooks, but choose to rely on teachers notes. These notes often encourage rote learning in order to pass examinations. The use of textbooks by pupils for reference and homework is not always effective especially for those in forms one and two (Tilya, 2003).

Although pupils bring textbooks in class, teachers rarely give any task requiring them to make use of the text book during the lesson. Some students may read the text books regularly, but, when reviewing for tests and exams they revert to reading the teachers notes (Osaki, 1999). In the classroom science is usually presented as a rigid body of facts, theories and rules to be memorized and practiced, rather than a way of thinking about and understanding natural phenomena (Tilya, 2003). The situational analysis study (Chonjo et

al,1996) also revealed that science teaching was in a poor state with regard to necessary inputs in the schools for example. books, laboratory supplies, good teachers and teaching and learning processes(classroom presentations, teacher-pupil relations, management of teaching and learning resources and professional development and support). Lack of sufficient resources in addition to poor teaching affected the learning outcomes in terms of student performance in examinations, participation in innovative science activities, Osaki (1999) suggested professional development of the teachers as a temporary measure, while a more long term solution is awaited. Professional development was recommended in order to raise teacher awareness and understanding of a variety of professional skills that are still at a low state. Among these are; the use of textbooks to promote independent learning, the use of learners existing ideas and environmental experience in teaching, effective questioning in classrooms and management of student practical work.

In the Kenyan context, Khatete (2007) and CEMASTE (2012) have also profiled critical challenges in ensuring quality science education to create a competent human resource base. This is clear due to the poor performance of students in examinations, and especially in mathematics and science subjects (National Examinations Council, 2017). The teaching approach that the teacher adopts in order to bring about this positive change is very important. The traditional teacher-centered lecture (chalk and talk) approach, which emphasizes the transfer of knowledge and skills and rewards memorization, is the predominant teaching format in secondary schools in Kenya as well as most of the sub-Saharan countries (Orodho,1996; KNEC,2016). Orodho (1996) writing on correlates of students' academic performance in physical sciences among secondary school students in Kenya established that, most physical science teachers used teacher-centered instructional strategies including chalk and talks most of the time, while a student jots down notes mainly for the purpose of passing exams. This method does not allow much room for critical analysis of issues but rather makes students to duplicate the notes given by teacher (KNEC, 2016; Orodho, 1996; Orodho,2013). In this teaching approach there is very little interaction between the teacher and the students or among the students themselves in the classrooms. Students hardly ask any questions and the teachers rarely provoke students by asking critical questions (KNEC, 2015). Various studies have reported outdated teaching practices and lack of basic content knowledge have resulted in poor teaching standards in secondary schools in Kenya (COSTECH 2008).

1.3 Statement of the problem

Despite the fact that Physics plays an important role in the development of the scientific base necessary to

become industrialized as envisaged in Kenya's Vision 2030, the students' performance in the subject has been on the downward trend in recent years in the study locale (KNEC, 2015). Innumerable efforts in trying to improve the performance of science subjects have been witnessed since independence. The main problem was whether resources could have critical causes of this trend in Ugenya Sub-County, Siaya County, Kenya.

1.4. objectives

To evaluate the availability of teaching and learning materials in secondary schools in Kenya. The related objective was to examine whether the teaching and learning environment is conducive for effective teaching and learning to take place to enable students perform well in national examinations.

1.5. Theoretical framework

The Social constructivism in the classroom, an education theory by Rodrigues (1998) guided this study. While interpreting the Rodrigues (1998) theory, Orodho (2017a) argues that in this theory, the focus tends to shift from the teacher to the student or learner in the constructivist classroom. The constructivist model advocates for the active involvement of the learners when they are involved in their own process of learning. In the constructivist learning scenario, the main activity is the learner solving problems and using methods of inquiry in asking questions and critically investigating a topic by using a variety of available resources to find solutions to the problem. The teacher is seen as a facilitator who attempts to structure an environment in which learners organize meaning at a personal level. In the model, presentations of problems, scenarios and pertinent ideas can be advanced by discussion which would be guided by means of effectively directed questions organized and structured by the teacher. Khatete (2007) also argues that, constructivism brings about the desired outcome of conceptual change by creating a conflict between the students naïve ideas and the accepted scientific ideas. In this context, the role of the teacher is to establish the learners ideas in a given conceptual area and then introduce analogues of accepted scientific concepts, so that the learner can compare their own conceptions with accepted concepts.

In line with constructivism as advanced by Rodrigues (1998), the students need to be exposed in practical activities whereby they are supposed to carry out experiments on their own and draw conclusions. The performance depends with every step in the learning process. If the teachers are not competent enough they will not be able to implement the syllabi, therefore, the content taught may not be what is expected and the methodology will not be appropriate hence the poor performance. It is a two-way process; the wrong interpretation of the syllabus will lead to poor results and if the syllabus is not appropriate to the level of learners, they will not be able to apprehend. Lack of enough

resources and materials including text books and laboratory equipment. Lack of students' exposure to model examination questions contributes a lot to poor performance of science subjects in secondary schools. The constructivist theory by Rodrigues (1998) can also be examined in line with the concept of science. The word science comes from Latin word *Scientia*, which means knowledge; it is a systematic enterprise that builds and organizes knowledge in a form of testable explanations and predictions. In modern usage science often refers to a way of pursuing knowledge itself.

2.0. METHODOLOGY

The study employed a cross-sectional survey research design. The design was considered appropriate since it facilitates in describing the status of phenomena without manipulating it (Orodho, Nzabwirwa, Odundo, Waweru & Ndayambaje, 2016; Orodho, 2017). Purposive sampling was used to select a total of 12 principals, 12 physics teachers and 204 students to yield a sample size of 228 participants from five schools in Ugenya Sub-County were involved. Out of the 12 principals, 4 were physics teachers making a total sample of physics teachers to stand at 15. The study employed a questionnaire for students and teachers and interviews for physics teachers. Questionnaires were pretested to determine their validity and reliability. Quantitative data from questionnaires were analyzed by the aid of the Statistical Package for Social Sciences (SPSS) (Asamoah, 2015; Orodho, Bizimana, Ampofo and Ndayambaje, 2015; Orodho, Khatete & Mugiraneza, 2016). The qualitative data were analyzed manually to generate pertinent themes along the objectives of the study. The data generated were triangulated in order to get appropriate explanations and interpretations of the research findings. The quantitative results were displayed in tabular format while the qualitative data were displayed in narrative form.

3.0 FINDINGS, DISCUSSION AND IMPLICATIONS

One of the objectives of the study was to investigate the adequacy of qualified physics teachers in the study locale of Ugenya Sub-County, Siaya County. The teachers were requested to indicate their highest level of academic qualification and results indicated in Table 1. The data carried in Table 1 indicates that there were 2 out of 16 teachers of physics, constituting 12.5% of the sample, who had no qualifications required to teach the subject. It was also noted that 25% of the physics teachers had Diploma level qualification. This implies that slightly over one third of the teachers had at least a Diploma level of training.

Table 1: Qualification of Physics Teachers in Ugenya Sub-County

	Frequency	Percent	Valid Percent	Cumulative Percent
(BOM) Teacher	2	12.5	12.5	12.5
Valid Diploma Level	4	25.0	25.0	37.5
Degree level	10	62.5	62.5	100.0
Total	16	100.0	100.0	

The results also show that about two thirds, constituting 62.5%, of the teachers of physics had a degree level qualification. A further investigation using interviews indicated that these teachers were actively engaged in teaching other subjects such as Mathematics and some did not qualify to teach physics. It was also revealed that most of these teachers did not have teaching experience beyond five years of teaching physics. Nonetheless, it was encouraging to note that one third of the teachers were national examiner of the subject under the Kenya National Examination Council, (KNEC).

During interview with of the teachers of physics, two of them concurred that:

..teachers qualification and students environment do not influence students poor performance in physics. The causes are many but teachers' methods of teaching influences poor academic performance. ..in addition, the work load and shifting from one subject to the other are also contributory factors.

The citation above seems to strongly suggest that the teachers of physics are overburdened with large teaching load. The interviews with the teachers further confirmed that:

Teaching over 30 periods in a week in different subjects is one of the main causes of poor performance. In fact, the work load is so large that one cannot have time to plan practical approaches to teaching effectively.

The students were asked what they thought about the subject and whether they would recommend other students to pursue the subject. Student's response were that:

Teachers of physics do not make the subject interesting like other subjects. They just make us make a lot of notes and we do not follow. Most of the time, we do not perform any individual practical. The teacher relies on demonstrating as we watch.

The foregoing citation indicates that teacher's methods of teaching and learning materials contributes to poor performance. The teachers of physics are not motivating the learners and it is evident that the attitude towards the subject is not conducive for effective learning of physics.

Interviews with principals indicated that they were in agreement regarding the causes of students' poor performance in physics. It was evident that:

various factors among them negative attitude towards science subjects, lack of exposure of both teachers and students , lack of the necessary materials required during the process of teaching and learning sciences, lack of laboratories and laboratory equipment and well trained laboratory technicians

From the foregoing citation from secondary school principals teaching physics, it is evident that no single factor can be pinned down as being the cause of the observed poor performance in physics.. Discussion of the findings

The findings of this study indicate that poor performance in physics among secondary school students in the study locale in Kenya is due to various factors among them negative attitude towards science subjects, lack of exposure of both teachers and students, lack of the necessary materials required during the process of teaching and learning sciences, lack of laboratories and laboratory equipment and well trained laboratory technicians. Science students are not well equipped with the relevant knowledge they require in order to pass their examinations and even practice science related activities after graduating.

Teachers are by far the biggest resource in schools (Sutton, 2011), improving the teachers' effectiveness would have a major impact on the schools' performance hence increasing the attainment of children across the education system. This is similar to the results of this study where the researcher found that the students fail science subjects due to lack of competent science teachers. A teacher is the most important factor within schools that policy makers can directly affect to improve students' achievement. Schools which have text books, laboratory equipment and other necessary

resources perform much better than schools which do not have these resources (Cyril & Lucas 2010). In this study, the schools which do not have these resources were found to be performing poorer than the schools which had the resources in place.

There are marked differences in the students' interests in science subjects (Siwel & Kizito, 2012; Orodho, Waweru, Ndichu & Thinguri, 2013). Some of the students have a feeling that the science subjects are tough for them hence they shy away and do not select them. In this study, the responses showed that students' negative attitude towards science subjects really affects their performance. They feel that those who take sciences are doomed to fail. Students need to have a positive attitude and this will make them change the perception 49 towards science subjects which will eventually lead to them liking the subjects, devote some extra time for revision and discussions hence better results (Republic of Kenya/UNICEF, 2012).

The study locale being a rural background, their entering behavior of students seem to be low. The findings are consistent with Orodho (1996) study in Kenya. According to his study, student-related factors affecting performance in science subjects, especially biology in the municipality are; primary school science which provides a requisite background for biology at secondary school level, interest in biology (theory and practical) provides a force for learners to participate in the learning process, their ability to carry out the practical effectively and students' ambition and attitude towards biology.

The results similarly are in tandem with those of Andile and Moses (2011) as well as CEMASTE (2012). In their study, they examined instructional resources and the relationship between availability of both human and non-human resources for teaching/ learning and students' academic performance in the science subjects in national examinations. From their findings availability of text books, laboratory chemicals and equipment was higher in the high performing schools than in the low performing schools. The findings demonstrated that in general, schools which had comparatively well-equipped laboratories posted higher academic outcomes than their counterparts with poorly equipped laboratories.

3.2. Implications

The findings of this investigative study imply that a lot has to be done in our secondary schools in order to raise the performance standards of the science subjects, the government, parents and the society at large must ensure that schools are well equipped with the necessary materials that they require for effective implementation of the curriculum. The government should provide incentives to encourage more teachers to train as science teachers. In-service training for teachers should also be carried out regularly throughout the country so as to equip the teachers with modern teaching methodologies and train them how to modify the locally available materials to be used as teaching

aids. Good and well-equipped laboratories should be constructed in all secondary schools. Some schools have opted for alternative to practical due to lack of these facilities.

Science students require knowledge in practical since they are a prerequisite for their future careers. Schools should also establish the office of guidance and counseling to advice the students in order for them to change their attitude towards science subjects. This should be done by a well-trained and qualified counselor.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1. Conclusions

The findings of this study indicate that inadequate instructional resources and trained teachers of physics has a profound effect on students' performance in science subjects, especially in physics. The students' performance in physics in secondary schools in the study locale can be improved if students are involved in practical lessons under the guidance of well trained and qualified personnel. This will increase their motivation hence change their attitude towards science subjects hence raise the performance.

The main conclusions drawn from this study are:

- (i) Availability of teaching and learning materials generally affects the performance of students in science subjects, particularly in Physics. These materials should be made available and they should be of good quality in order for them to produce accurate results during a practical session. Other schools had no equipment at all and they opted for alternative to practical which is not applicable since these students require this knowledge for their future careers as scientists.
- (ii) The teaching and learning environment in some of the secondary schools was found to be unsuitable for physics lessons. Some had no laboratories and the practical lessons were done in the classroom through demonstrations. Parents, the government and the society at large should ensure that the environment is conducive for learning to take place effectively.
- (iii) The findings of this study indicated that one of the major difficulties that the teachers face while teaching physics is the students' negative attitude towards science subjects. They have a perception that the sciences are always very tough compared to other subjects which discourages them hence affecting their performance.

4.2. Recommendations

It is therefore recommended that in this study,

- (i) The low achievement level in science subjects at secondary level demands for revolutionary ideas to motivate students in learning the science subjects. Teachers should use high impact methods of teaching including use of computers in teaching physics in order to motivate and sustain students' interest in sciences as far as possible and in most science topics.
- (ii) The government, parents, school administration and the society in the study locale of Kenya at large should work together to ensure that the teaching and learning environment is conducive to the teachers of physics and students pursuing physics for effective learning to take place. They should give support by providing the necessary materials and equipment required which includes well equipped laboratories.
- (iii) Teachers of physics in the study locale should be more innovative in preparing teaching and learning materials to help them modify their teaching strategies in order to embrace the benefits of interactive teaching, including longer and increased students' conceptual understanding.

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