

Teaching/Learning Resources and Academic Performance in Mathematics in Secondary Schools in Bondo District of Kenya

Philias Olatunde Yara PhD

Kampala International University

Kampala, Uganda

Tel: 256-783-104-687 E-mail: yaraphilias@yahoo.com

Kennedy Omondi Otieno

Akoko Secondary School, Kenya

Tel: 254-734-156-584 E-mail: omondik@ymail.com

Abstract

The education system in Kenya is evolving steadily even as it is faced with a number of shortcomings which include inadequate teaching/learning resources in secondary schools due to poor planning and corruption. The study looked at the effect of teaching/learning resources on academic performance in secondary school mathematics in Bondo district of Kenya. The research design for this study was descriptive survey design with a total of 405 senior four students as the population of the study. Two hundred and forty two (242) students were randomly selected from nine schools in the three divisions of Bondo districts out of 24 schools. Intact classes were chosen. The schools were stratified into co-educational day, co-educational boarding, boys boarding and girls boarding. One validated research instrument developed for the study was Student Questionnaire on Performance (SPQ) ($r = 0.437$). Three research questions were answered. The data collected was analyzed using multiple regression analysis. There was a positive correlation among the eight independent variables and the dependent measure – mathematics performance ($R = 0.486$; $F_{(8,241)} = 9.014$; $p < 0.05$). The eight variables accounted for 23.6% of the total variance in the independent measure ($R^2 = 0.236$). Government Financial support ($B = 0.182$, $t = 2.469$; $p < 0.05$), trained teachers ($B = 0.341$, $t = 3.489$; $p < 0.05$), classroom/laboratories ($B = -0.347$, $t = -4.173$; $p < 0.05$) and textbooks/student-ratio ($B = 0.413$, $t = 4.186$; $p < 0.05$) could be used to predict academic performance in mathematics. The study recommends that review of curriculum, in-servicing of trained teachers, recruiting more competent teachers, motivation of learners, improved government support to education, good teaching methods, improved students-book ratio and better remuneration of teachers are factors that the government and all stakeholders should pay more attention to in order to improve performance in mathematics.

Keywords: Teaching/learning resources, Academic performance, Secondary schools, Bondo district in Kenya

Introduction

Education is a fundamental human right (Wolfenson, 2000). The key to sustainable development, peace and stability within and among countries is the provision of education to the populace of such countries. Availability of teaching/learning resources enhances the effectiveness of schools as these are basic things that can bring about good academic performance in the students. Maicibi (2003) opined that all institutions or organization are made up of human beings (workers) and other non-human resources. He further asserts that when the right quantity and quality of human resources is brought together, it can manipulate other resources towards realizing institutional goals and objectives. Consequently, every institution should strive to attract and retain the best of human resource. The implication of these opinions is that well trained teachers in mathematics if well deployed to the secondary schools will bring about well rounded students who will perform academically well in mathematics.

Most Kenyan teachers are trained and have clear goals to guide their teaching, but good teaching and learning materials seem not to be seen in most mathematics lessons. As a result, there has been a public outcry about poor performance in Mathematics at secondary school level. In Kenya, Mathematics is a compulsory subject up to secondary school level. During the last couple of years, performance in Mathematics in National examination has dropped significantly and this has been a major concern for the society. The Kenya National Examination Council (KNEC) has continued to raise concerns over the poor performance in Kenya Certificate of Secondary Education

(KCSE) examination. KNEC (1996) identified coverage of syllabus and practice, inability to master simple and basic concepts as reasons for poor performance. However, a report by the Teacher's Service Commission (TSC) revealed that there is shortage of Mathematics teachers due to high attrition rate than in other subjects. Many teachers have left teaching in public schools for greener pastures in better paying private schools.

The National Development plan of the Republic of Kenya sets the goal of industrialization by the year 2030. However, the education to develop human resources needed is not given much attention. In particular, low quality education in Science and Mathematics is an urgent issue to be addressed. In response to the request of the government of Kenya, the government of Japan began the project for Strengthening Mathematics and Sciences in Secondary Education (SMASSE) in 1998 which provides assistance to Science and Mathematics education through in-service training of teachers. In line with the Kenyan government policy on education, the SMASSE project was launched to enhance Mathematics and Science education in secondary schools in the country with the assistance of Japan International Cooperation Agency (JICA). The project is also tasked with the provision of teaching/learning materials and training of teachers on how to improvise these materials where necessary through Activity, Student, Experiment and Improvisation (ASEI) and Plan, Do, See and Improve (PDSI). ASEI (Activity, Students, Experiments, Improvisation) movement emphasizes student's participation from the start to the end of the lesson. The teaching activity should be student centered, based on experiments and improvisation if necessary. For instance, the teaching/learning of Longitudes and Latitudes in mathematics can be accompanied by improvising a metallic or plastic globe and using it in locating the position of an object along the equator. For the students to participate in the lesson, the teacher must plan the lesson well. Similarly, the teacher must also evaluate every aspect of the lesson during teaching.

PDSI (Plan, Do, See, Improve) approach stresses on the need for the learners to carry out a well planned learning activity that involves seeing for themselves and improving the activity even further for effective learning to take place. This is based on the findings of Yadar (2007) and UNESCO (2008) which postulate that an object well handled practically impresses itself more firmly in the mind than the object merely seen from a distance or in an illustration.

The legacy of colonial education and political economy of post independence Kenya have led to an education that favours the most advantaged students. Students in most public schools are disadvantaged in that the classes are overcrowded and they do not have adequate learning facilities. Consequently, they do not get individual attention from their teachers. In some instances, they lack adequate textbooks and laboratory equipments. As a result, the students may lose hope in performing well in academic work. This is in sharp contrast to private schools where the numbers of students are few as there are adequate facilities and the teachers are willing to go an extra mile to ensure that the students perform well in examination. In regard to this, the government in conjunction with World Bank, International Monetary Fund, together with Japanese government has initiated several approaches namely Strengthening Mathematics and Sciences in Secondary Education (SMASSE) and Constituency Development Fund (CDF) among others. SMASSE project is tasked with the provision of teaching/learning materials in Mathematics and Science by improvisation where necessary besides in-servicing secondary school teachers in the country. Similarly, CDF allocate infrastructural funds to school. The funds are used to purchase teaching/learning materials such as stationeries, laboratories and equipments, teaching aids such as models, blackboard ruler and protractor, construction of classrooms and so on. If these two projects are well managed, teaching/learning materials will be adequately provided to learning institutions. Yadar (2007) opines that no course in Science and Mathematics can be considered as complete without including some practical work. The practical work ought to be carried out by individuals either in Science laboratories or in classes. At school level, practical work is even more important because of the fact that we learn by doing. Scientific practices and applications are thus rendered more meaningful. It is an established truth that an object handled impresses itself more firmly on the mind than the object merely seen from a distance or in an illustration. Thus practical work forms an important feature in any Science and Mathematics Course (UNESCO, 2008).

Secondary education is the level of basic education at which learners are expected to acquire proficiency in both academic and some applied subjects. The students are expected to take the first recognized national examination that will usher them to higher education at various fields of training or direct entry into the world of work (Koech, 2006). The ultimate purpose of this segment is to fulfill objective of providing equal opportunities to every individual up to a minimum of 12 years in school so that at the terminal level of basic education, every individual shall have been exposed to essential education for future life choices. However, the current secondary school curriculum in Kenya is examination oriented with great emphasis laid on passing examination at the expense of acquisition of skills, values and attitudes. The argument is that there is a problem in the way young people are socialized by their parents on one hand and how they are taught at school on the other hand. The parents are not

teaching important life lessons while teachers are over teaching on book knowledge. The implication of this is that there is imbalance in the education and socialization of young people that is causing them to protest either violently in school or by locking themselves in their own world of mobile phones, computers and other electronics that offer games and other forms of entertainment. In response to this, the government through the Ministry of Education in Kenya and other stakeholders proposed the introduction of Life Skills Education in secondary education in the revised curriculum. The curriculum also emphasized that the time set aside for Physical Education (PE) and games should not be used for purpose of covering examinable subjects. According to the Kenyan Institute of Education (KIE, 2008), Life Skills Education is the study of abilities for adaptive and positive behaviour change that enable individuals to deal effectively with the demands and the challenges of everyday life. Teaching of life skills is therefore aimed at equipping the learner with psycho-social competencies that would help him/her make informed decision, solve problems, think creatively and critically, communicate effectively, build healthy relationships, empathize with others and manage his/her life in a healthy and productive manner.

The study was based on Skinner's Motivational Theory of learning (Skinner, 1985), which postulates that students motivation to undertake a task depends on expected reward. Efficient learning will take place when there is strong motivation of learner to learn by the teacher. This motivation may be aroused by either extrinsic or intrinsic stimuli both of which are important in directing and regulating the learner's behaviour towards attainment of the desired goals. Students should therefore be motivated through various ways which may include advising them on career choices, providing the required physical facilities like laboratories and verbal encouragements. This would go a long way in improving the performance in the subject under study.

Obama (2004) asserts that parents have the primary responsibility of instilling an ethic of hard work and educational achievements in their children. He went further to say that if we are to make the investments required to revamp our schools, then we will need to rediscover our faith that every child can learn and none is neither stupid nor impossible but perhaps slow learners. Psacharopoulos and Loxley as cited by Lauglo and Maclean(2005), opined that education should develop moral aesthetic, physical and practical capacities not just cognitive knowledge organized in academic disciplines. They added that practical subjects can have the additional justification because they allow students to learn from more active doing than what is typical in academic subjects. Mathematics as a subject can be made practical and enjoyable if there are mathematics laboratories where some of the theories and theorems in the subject can be made practical. This can be done with the help of the government and parents/guardians who can financially support the schools in realizing this.

Learners from low socio-economic status families tend to value domestic activities more than schooling. Such children are subjected to child labour and they have little time for studies. Financial difficulties and hence poverty in developing countries have been a major barrier to effective undertaking of the major government financed programmes. He indicated that in most developing countries, there are many families whose members despite full days hard labour do not find it possible to make two ends meet. Children of tender age in such families have to work for their living. These coupled with little government financing of education sector makes many families unable to meet the requirements for their children's education thus contributing greatly to their poor performance.

According to World Bank report (2007), in most developing countries, not enough Mathematics teachers are being produced by Universities and Colleges. Therefore, College and Universities graduates are being encouraged to pursue these courses purposely to fill the gap. Recent visits to schools by personnel from Ministry of Education Science and Technology in Kenya revealed that most teachers do not have the expertise in their subjects. One of the consequences of this is that students fail examinations and fewer of them pursue mathematics courses at tertiary level leading to an even greater shortage of Mathematics teachers. The other consequence is low teachers to student ratio especially in most of the public schools. The few teachers on the government payroll are poorly remunerated as a result most of them take up part time employment or private business enterprise in order to make ends meet. This greatly reduces their commitment to the teaching of Mathematics (which demands for sacrifice). However, it may not true that increase in teachers' salary will make them to be totally dedicated to teaching work as advocated by teachers unions. Poor performance is as a result of teachers not being dedicated to their duties. Some of them are traders while others are drunkards. Recent inspection in one of the schools in Bondo District showed that teachers report to duty late, come drunk and utter unprintable words. The various teacher unions should therefore rise to the occasion by not only championing better pay for teachers but also advocating for proper conduct among its members. The purpose of this study therefore was to establish the extent to which teaching/learning resources affects performance of Mathematics in secondary schools in Bondo District.

Research Questions

The study answered the following research questions.

1. What is the composite effect of teaching/learning resources on academic performance in mathematics?
2. What are the relative effects of teaching/learning resources on academic performance in mathematics?
3. Which of the teaching/learning resources will predict academic performance in mathematics?

Method

Research Design

The research design for this study is descriptive survey design. This is because the researchers will not be able to manipulate the variables for the simple reason that they have already occurred.

Population and Sampling Procedure

The research respondents for this study were form four students of the year 2010. A total of 405 senior four students formed the population of the study. The form four students were selected for having chosen optional subjects and also for having sat for their Mock Examination by the end of term two. There were a total of 24 secondary schools in Bondo District, with eight schools in each division – Maranda, Nyang'oma and Usigu. Out of these, three schools in every division were selected using stratified random sampling. The schools were stratified into co-educational day, co-educational boarding, boys boarding and girls boarding. 242 students were randomly selected from one stream in each school chosen.

Instrument

The research instrument was Student Questionnaire on Performance (SQP) designed by the researchers. It has Section A with seven items dealing with profile of the respondents such as gender, age, last grade, income of the family among others. Section B has 43 items that measured availability of teaching/learning materials like classroom/laboratories, stationeries/teaching aids, textbooks/student-ratio, wide scope of subjects being taught, parent/guardian financial ability, lack of trained teacher, attitude of students and government financial support. The respondents were asked to respond to the questions on a four point Likert Scale of strongly agree, agree, disagree and strongly disagree.

Results

The results of the findings are presented according to how the research questions are stated.

Research question one

What is the composite effect of teaching/learning resources (parent/guardian financial support, government financial support, lack of trained teachers, classroom/laboratories, stationeries/teaching aids, textbooks/student-ratio, students' attitude and personal extra time) on academic performance in mathematics? Answers to this research question are obtained from results in Tables 1 and 2.

From Table 1, it could be observed that there is positive multiple correlation ($R = 0.486$) among the eight independent variables and the dependent variable. These variables are parent/guardian financial support, government financial support, lack of trained teachers, classroom/laboratories, stationeries/teaching aids, textbooks/student-ratio, students' attitude and personal extra time and academic performance in mathematics, which is the dependent variable. This implies that the factors are relevant towards the determination of the dependent measure. Also the adjusted R^2 value of 0.236 revealed that the six variables accounted for 23.6% of the total variance in the dependent measure (academic performance in mathematics). The remaining 76.4% could be due to errors and factors that are not considered in this study. The result in the analysis of variance in Table 2 showed that the F-ratio of the regression analysis is significant ($F_{(8,241)} = 9.014$; $p < 0.05$). This shows that the R value is not due to chance.

Research Question Two

What are the relative effects of teaching/learning resources (parent/guardian financial support, government financial support, lack of trained teachers, classroom/laboratories, stationeries/teaching aids, textbooks/student-ratio, students' attitude and personal extra time) on academic performance in mathematics? This question is answered using table 2.

From Table 3 out of the eight factors, classroom/laboratories made the greatest contribution ($\beta = 0.286$). This implies that the provision of classroom/laboratories has positive effect on the academic performance of students or that the provision of more classroom/laboratories does lead to better academic performance of students. Followed closely is stationeries/teaching aids ($\beta = 0.274$). This implies that the more the provision of stationeries/teaching aids to schools the better the academic performance of students. Lack of trained teachers ($\beta = 0.254$) also contributed to the academic performance of students. This result showed that lack of trained teachers affect the

academic performance of students. The fourth in the rank of contribution is Government financial support ($\beta = -0.169$). This result showed that whether there is government financial support or not the academic performance of students are not affected. The fifth and sixth contributions in order of decreasing magnitude are Textbooks/student-ratio ($\beta = 0.132$) and parents/guardian financial support ($\beta = 0.116$). The provision of textbooks and parents/guardian financial support does affect the academic performance of students. Personal extra time ($\beta = 0.056$) and students' attitude ($\beta = -0.088$) made the 7th and 8th contribution in that order. These results showed that students' personal extra time and students' attitude have very little effect on the performance of students in mathematics.

Research Question Three

Which of the teaching/learning resources (parent/guardian financial support, government financial support, lack of trained teachers, classroom/laboratories, stationeries/teaching aids, textbooks/student-ratio, students' attitude and personal extra time) will predict academic performance in mathematics? This question is answered using table 3.

From the results in Table 3, Government Financial support ($B=0.182$, $t=2.469$; $p<0.05$), trained teachers ($B=0.341$, $t=3.489$; $p<0.05$), classroom/laboratories ($B=-0.347$, $t=-4.173$; $p<0.05$) and textbooks/student-ratio ($B=0.413$, $t=4.186$; $p<0.05$) could be used to predict academic performance in mathematics. The other variables like parent/guardian financial support, personal extra time, textbooks/student-ratio and students' attitude cannot be used to predict academic performance in mathematics with respect to this present study.

Discussion of the results

The findings of the study revealed that of the eight variables that were investigated, only four were very significant and can be used to predict academic performance in mathematics. It was further revealed that 23.6% of the total variance in academic performance in mathematics could be accounted for by the eight independent variables when taken together. This figure is significant in the sense that there are many variables that can cause variance in academic performance in mathematics. Much emphasis should be given to these four variables in the teaching and learning of mathematics since they are significant in predicting academic performance in mathematics. The remaining 76.4% difference in variance is due to the influence of other factors not considered in this study such as students' study habit, home background, effect of peer influence, teachers' teaching style, language of mathematics, culture of mathematics learning, motivation, student relationship with teachers, poor students' background in mathematics, cultural bearings of mathematics content, parents' influence on students and so on.

A further look at the results of this study shows that classroom/laboratories and stationeries/teaching aids are significant. These findings are in consonance with the findings of Yadar (2007) and the report by UNESCO (2008) which that opined that teaching/ learning materials such as textbooks, class rooms, teaching aids (chalk, board, ruler and protractor), stationeries and laboratories affect academic performance of the learners. Also the result of the findings agreed with that of Mutai (2006) who asserted that learning is strengthened when there is enough reference materials such as textbooks, exercise books, teaching aids and class rooms while He further asserted that academic achievement illustrates per excellence the correct use of these materials. The implication of this result is that provision of conducive classrooms and laboratories and other teaching/learning resources can positively change teachers' attitude to the teaching of mathematics and make the subject to be very interesting, meaningful and exciting to the students and hence will encourage mathematical exploration and manipulation by students which will keep them alive and thinking and will also help them to realize the applications of mathematics.

Government financial support was also significant. The implication of this finding is that without government financial support to the schools, most of the infrastructures like classroom buildings and other learning materials may not be available for use by the students. It is therefore necessary that the government should increase its support both financially and materially towards support of teaching/learning of mathematics in all schools in Kenya.

Lack of trained teachers was found to be significant. This is in agreement with that of Birgen (2005) who asserted that experience and qualification is the best asset for handling a task. In his findings, teaching is one of the duties that require both qualification and experience for better delivery. Recruitment of competent teachers to improve teacher-student ratio is a necessary measure in improving performance of students in mathematics. The government of Kenya should give adequate attention to training of teachers to enhance performance of students.

Conclusion

The study found out the effect of teaching/learning resources on academic performance in mathematics in Bondo district of Kenya. It found out that of the eight independent variables, only four were significant and could be used to predict academic performance in mathematics. Adequate attention should therefore be placed on these variables

in order to increase performance in mathematics. The government financial support to the schools will go a long way in providing most of these learning/teaching resources that are needed for good performance in mathematics. Even though parent/guardian financial support was not significant, it may not out of place for parents/guardian to support the government financially to provide some of these teaching/learning resources where the need may arise in the area erection of parent/guardian classroom blocks and named after them.

Recommendations

Based on the findings from the study the government is encouraged to give more financial support to schools in order to provide the basic infrastructures like classrooms, laboratories, textbooks. Government should also recruit competent and adequate trained teachers and deploy them to all schools. This will improve teacher-student ratio. Similarly, the government should endeavor to establish more national teachers colleges, improve those that have already been in existence for some time. The in-service of teachers through the government support in relation to SMASSE project should be maintained and teachers pay should be improved so that they can dedicate their efforts towards teaching and teaching alone. This will go a long way in improving the standard of living of teachers thus the students will see them as good role model in the society and not destitute who should not be listened to.

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Table 1. Summary of Regression Analysis on teaching/learning resources

Multiple R	R ²	Adjusted R ²	Standard Error	F ratio
.486	.236	.210	1.39880	9.014

Table 2. Analysis of Variance on teaching/learning resources

Source of Variance	Sum of Squares	Df	Mean Square	F	Sig.
Regression	141.100	8	17.638	9.014	.000
Residual	455.896	233	1.957		
Total	596.996	241			

*sig. at p<0.05

Table 3. Estimate of the Relative Contribution of teaching/learning resources and academic performance in Mathematics

Independent Variables (Predictors)	Unstandardized Coefficients		Standardized Coefficients			
	B	Standard error	Beta	Rank	T	Sig.
Parent/guardfin . Support	-0.170	0.102	0.116	6 th	-1.662	0.098
Govt. Fin. Suport	0.182	0.074	0.169	4 th	2.469	0.014*
Lack of Trained Teachers	0.341	0.098	0.254	3 rd	3.489	0.001*
Classroom/ laboratories	-0.347	0.083	0.286	1 st	-4.173	0.000*
Personal Extra Time	0.059	0.066	0.056	7 th	0.894	0.372
Stationeries/ Teaching Aids	0.413	0.099	0.274	2 nd	4.186	0.000*
Textbook/ Student-ratio	-0.436	0.224	-0.132	5 th	-1.947	0.053
Students' Attitude	-0.092	0.071	-0.088	8 th	-1.292	0.198

*sig. at p<0.05