Effect of Teacher Instructional Practices on Girls' Performance in Mathematics in Public Secondary Schools in Mumias Sub-County, Kenya

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Abstract
Girls' performance in mathematics at the Kenya Certificate of Secondary Education (K.C.S.E) examination has been generally dismal for many years despite the various measures that have been put in place by the government such as in-servicing mathematics teachers through Strengthening of Mathematics and Sciences in Secondary Education (SMASSE), review of mathematics syllabus and provision subsidized secondary education. This paper reports the findings of the multiple regression analysis on the effect of teacher instructional practices on girls' performance in mathematics in public secondary schools in Mumias Sub-County, Kenya from data collected from a random sample of 385 girls using questionnaires. The results revealed that teacher instructional practices were statistically significant in predicting girls' performance in mathematics. There is need for the Ministry of Education to ensure that schools complete syllabus in time, set performance targets, regularize use of mathematics resources, regularize mathematics lesson attendance and frequently mark mathematics assignments to improve chances of girls performing mathematics in Mumias Sub-county.

Keywords: Girls' Performance, teacher instructional practices and girls' performance in mathematics.

1. Introduction

Mathematics as a subject affects all aspects of human life at different degrees. The social, economic, political, geographical, scientific and technological aspects of man are centered on numbers. The inter-relationship between mathematics, development and advancement of humans shows the importance of mathematics in life due to the scientific and technological facets of man's world than to any aspect as it occurs and re-occurs in the physical and natural sciences (Maliki, 2009). Mathematics is also used as basic entry into any of the prestigious courses such as medicine, architecture and engineering among other degree programmes (Mbugua, 2012). Because of this, mathematics is a compulsory subject in Kenya for all students in both primary and secondary schools. Mathematics is indeed the key which opens all the gates of science.

However, the performance of students in mathematics has been a great concern to the society. Despite the important role that mathematics plays in the society, there has always been dismal performance in the subject at national examinations in most of parts of the country with some areas recording perennial mass failures. As a result, there has been a public outcry, given that this subject is important in the attainment of the national goal of industrialization by the year 2030. Top- performing girls continue to lag behind top-performing boys in mathematics and science which mainly result to the underrepresentation of women in science, technology, engineering and math jobs (Klein, 2015). Such dismal performance denies career opportunities to women and deprives society of the benefits of their talents.

Despite the crucial role of mathematics in the technological development of any country, dismal performance by secondary school girls in mathematics still persists. This has serious implications since the pace of industrialization and adoptions of appropriate technologies is a positive indicator to society's level of mathematical attainment. Despite the importance attached to students' mathematics achievement by Kenyan society, performance of secondary school girls continues to deteriorate (Omwenga, 2014). Students' poor performance in mathematics over the years has been attributed to the fact that the subject is difficult. In Kenya, research shows that there has been consistently poor performance in mathematics with girls lagging behind the boys at all levels of education (Ndiragu, 2000; Agesa and Agesa, 2002; Ochieng, 2007). To salvage the situation, the government of Kenya has undertaken a project in conjunction with the government of Japan through the Japanese International Cooperation Agency (JICA) called

Strengthening Mathematics and Science in Secondary Education (SMASSE project, 2001). The programme provides in-service training for teachers of mathematics and science where they are expected to use the Plan, Do, See and Improve (PDSI) and Activity, Student, Experiment and Improvise (ASEI) lesson plan and approaches in the course of teaching-learning process. However, despite this initiative, schools' performance in mathematics and especially for girls remains low (KNEC, 2006).

In Kakamega County, a general overview shows that mathematics was the worst performed subject in the year 2014 with a mean score of 3.4197. Out of the 22,780 candidates, 6,976 scored grade E in mathematics translating to 30.6% (Kakamega County KCSE results analysis, 2014). The situation is worse when it comes to girls' performance in mathematics especially girls' schools in the County. This has adverse effect on girls' career prospects especially in science related courses. Statistics indicate that girls are under enrolled in medicine, engineering, computer science, architecture, just to mention a few, as a result of poor performance in mathematics (Shabaya & Konadu-Agyemang, 2004; Wambua, 2007). This may have serious effects on the realization of Kenyan Vision 2030 and other international obligations.

Mumias Sub County has for a long period of time remained one of the top Sub Counties in KCSE results (KNEC, 2003-2014). The mean score has remained above average since the year 2002 to-date. In fact, it was the best Sub County in Kakamega County in KCSE results of 2014 with a mean of 6.7154 (Kakamega County KCSE Analysis, 2014). However, girls' performance in mathematics in most public secondary schools in the Sub County is wanting. Despite the fact that Mumias Sub County is one of the areas where piloting of the SMASSE project was carried out before being implemented nationally it still posts poor performance in mathematics especially in most of the girls' schools which depicts large gender gaps.

As a result, fewer girls compared to boys qualify to join science and technology related courses (Wambua, 2007). The Constitution of Kenya demands girls to have quality education in order to compete equally for opportunities in the political, economic, social and cultural spheres. The choice of girls in this study is crucial due to the public outcry, with greatest concern in Mumias Sub County among parents and other stakeholders who have raised an alarm especially about the girls' performance in mathematics. Kakamega County has never had its overall mean score reaching six (6) for the last five consecutive years in KCSE. This is highly attributed to the poor

performance in mathematics since it is one of the compulsory subjects in the Kenyan education system. Generally, mathematics was the worst performed subject in the KCSE results in 2014 (Kakamega County KCSE Analysis, 2014). The Kenyan government is ensuring that highly qualified teachers are deployed in public secondary schools and schools are funded through the Free Secondary Education to acquire the necessary teaching-learning materials like the text books, teaching aids and revision books to boost the performance of the students. The qualified teachers are expected to regularly attend to their lesson, give assignments to students, cover the syllabus in the various teaching subjects on time and as a great force behind the students' performance set targets for them. However, even where schools have qualified teachers and adequate materials, students' achievement has not necessarily been high. There are schools with minimum facilities where teachers teach effectively and examination results especially in mathematics have been better; an indicator that achievement of learning is directly linked to what goes on in the classroom (Too, 2007). Tswani (2009), found out that learners and teachers commitment and motivation, learners career prospects, learners perceptions of peers as well as teachers' perception of learners all affect persistence for achievement in mathematics. Overall, application of sound teaching and learning principles fosters an environment where students are motivated to achieve their full potential.

2. Research Method

We utilize purposive, stratified and simple random sampling techniques to draw a sample of 385 form four girls from a target of 1284 form four girls from the four school categories (mixed day school, mixed boarding school, girls' day school and girls' boarding school). A structured questionnaire was used to collected data on mathematics teachers instructional practices relating to when mathematics syllabus were completed, setting of mathematics performance targets, frequency of use of mathematics resources, mathematics lesson attendance and frequency of marking mathematics assignments. We also collected data on girls' performance in mathematics in Kenya Certificate of Secondary Education in 2015. We use this data to test the null hypothesis that teacher instructional practices have no statistically significant effect on girls' performance in mathematics in public secondary schools in Mumias Sub County using multiple linear regression analysis at $p = 0.05$ on a two tailed test.

3. Discussion of Findings

A variety of variables account for variations in girls performance in mathematics. The independent variable (teacher instructional practices) was categorized into five constructs namely: syllabus coverage, lesson attendance, frequency of marking assignment, performance targets and use of mathematics resources. The outcome variable (girls' performance in mathematics) as measured by the girls means score in mathematics was at interval scale. The MLRA was therefore used to predict the variation in girls' performance in mathematics given a variety of independent variables. The results are presented in Table 1.

Table 1: Multiple Linear Regression Coefficients of the Effect of Teacher Instruction Practices on Girls' Performance in Mathematics

	Sum of Squares	df	Mean Square	F	Sig.
Regression	90.564	2	90.564	234.23	.000[b]
Residual	148.09	383	0.387		
Total	238.65	385			

Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	1.436	0.243		5.905	0.000
Syllabus Coverage	0.759	0.034	0.662	16.711	0.008
Performance targets	0.637	0.043	0.596	14.293	0.000
Mathematics resources	0.628	0.047	0.536	9.387	0.009
Lesson attendance	0.577	0.042	0.504	5.501	0.001
Frequency of marking Mathematics assignment	0.513	0.024	0.469	4.712	0.000

R	R Square	Adjusted R^2	SEM
.616[a]	0.379	0.378	0.622

a. Dependent Variable: Performance in mathematics

b. Predictors: (Constant), Teacher Instructional Practices
SEM=Standard Error of Mean
Source: Field Data, 2016

The results of the multiple regression model in Table 1 showed that the constant of regression was significant at p=0.05, an indication that the model captured all the pertinent variables that explained the variations in girls' performance in mathematics in public secondary schools in Mumias Sub-County. The F-statistic (F (2, 383) =234.23, p<0.001) indicated that the R^2 for the model was significantly different from zero at p=0.05. These implied that all the coefficients in the model were significantly different from zero and were important in explaining the variation in girls' performance in mathematics in Mumias Sub-County. Therefore, we rejected the null hypothesis that teacher instructional practices have no statistically significant effect on girls' performance in mathematics in public secondary schools in Mumias Sub County. The results of the MLRA showed that indeed teacher instructional practices had a statistically significant effect on girls' performance in mathematics in public secondary schools in Mumias Sub County. The variable explained 37.8% (Adjusted R^2) of the variations in girls' performance in mathematics in public secondary schools in Mumias Sub County other factors held constant.

The results in Table 1 showed that all the constructs of teacher instructional practices were statistically significant in predicting girls' performance in mathematics in public secondary schools in Mumias Sub County at p=0.05. The results showed that teachers who were able to complete mathematics syllabus in good time improved girls performance in mathematics by 66.2% unlike those who did not. Many schools grapple with the fact that teachers take long to complete the syllabus a factor that has been associated with poor performance in mathematics. Girls in the sampled schools responded affirmatively that most of the teachers completed the syllabus in good time. The findings are similar to those of Amadalo, Shikuku and Wasike (2012) Pearson's Product Moment Correlation Coefficient (PPMCC) and one way Analysis of Variance (ANOVA) results that revealed syllabus coverage has a statistically significant effect on student performance in mathematics at KCSE level.

Table 1 results also revealed that teachers who had set performance targets; used regularly mathematics resources like three dimensional teaching aids; frequently attended mathematics lessons; and frequently marked mathematics assignments improved girls' performance in

mathematics by 59.6; 53.6; 50.4; and 46.9 percentage points respectively. This clearly shows the important role these constructs play in girls' performance in mathematics. The results also showed that the greatest variation in girls' performance in mathematics was as a result of completing mathematics syllabus and teachers use of mathematics resources respectively. The findings reinforce those of Migosi (2013) that mathematics resources and syllabus completion significantly determines girls' performance. The finding of Migosi (2013) also posits that girls perform well in mathematics with adequate mathematics teaching-learning resources materials.

We modeled girls' performance in mathematics as a function of teacher instructional practices using the regression equation: $y_i = \beta_0 + \beta_{1i}x_{1i}, \ldots, \beta_{ki}x_{ki} + \varepsilon_i$; such that;

$y = 1.436 + 0.662x_1 + 0.596x_2 + 0.536x_3 + 0.504x_4 + 0.469x_5 + 0.62181$ for $i = 1 \ldots n$; and y_i = mathematics performance of i^{th} student; β_0= the intercept (constant); β_{1i} = the slope (Beta coefficient) for x_{1i} ;x_{1i} = the first explanatory variable that is explaining the variance in y for the i^{th} girl; $\beta_{ki}x_{ki}$ = the k^{th} slope for the k^{th} explanatory variable for the i^{th} girl. ε_i = error term for individual girls assuming that the variance is constant and is independent of covariates (explanatory variables).

Conclusion and Policy Recommendation

The results clearly showed that teacher instructional practices were statistically significant in predicting girls' performance in mathematics. This clearly suggests that the variations in girls performance in mathematics highly depends on when mathematics syllabus was completed; whether mathematics performance targets were set; the frequency use of mathematics resources; the frequency of mathematics lesson attendance; and the frequency of marking mathematics assignments. The Ministry of Education, County Education Office, Quality Assurance Office, secondary schools Board of Management and secondary school principals should ensure that teachers: cover mathematics syllabuses in good time; set targets in mathematics; use mathematics resources regularly; attend mathematics lessons daily; and mark mathematics assignments regularly in in order to enhance chances of quality grades in mathematics by girls in Mumias Sub-County

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