School Factors as Correlates of Secondary Students' Achievement in Mathematics in Bungoma County, Kenya

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Abstract – There is abundant research evidence to support the view that when Mathematics is taught in an enabling environment, a lot of enjoyable learning takes place. But in reality this is not always so, the implication is that students' achievement in this subject still continue to dwindle. This study therefore aimed at finding the extent to which school factors predict secondary school students' achievement in Mathematics. The study adopted the descriptive survey research design of the ex-post facto type and made use of a sample of 206 Mathematics teachers and 206 principals selected through a multi-stage sampling procedure. Instruments were developed and validated for the study. The two validated instruments used were School-based Inventory ($r = 0.89$) and School-Based Factor Questionnaire ($r = 0.92$). Three hypotheses were tested at 0.05 level of significance. Data collected were analyzed using means, standard deviation and multiple regressions. Out of the nine variables, the two variables that contributed significantly to student's achievement in Mathematics are conveniences and instructional materials (ß = 0.130, t = 2.381, $P < 0.05$), (ß = 0.134, t = 2.470; $P < 0.05$) respectively. Findings from the study showed that instructional materials and conveniences (toilets) have been adjudged to have contributed significantly to students' achievement in Mathematics. Therefore, ministry of education and other stakeholders should ensure that schools are provided with effective and adequate toilet facilities. It is also recommended that instructional resources should be provided in schools as the conditions accrued to school factors improve, the performance of students in Mathematics improves. Recommendations were made based on these findings.

*Keywords***:** Leadership, School factors, Supervision, Instructional materials, Quality of Instruction

I. INTRODUCTION

Since the days of the early philosophers there has been a fascination with the beauty of mathematics and many of today's mathematicians believe that mathematics lies at the core of human knowledge. Mathematics continues as a pervading area of learning across the whole curriculum in schools around the world. The subject has a multiplicity of attributes ranging from the development of the person's logical reasoning to the understanding of abstract structures. It promotes logical and rational thinking and enhances one's ability to analyze and to solve problems. Life without mathematics is almost impossibility and it would be difficult to live a normal live in very many parts of the world without it (Cockcroft, 1982,

p.1). Its importance is also highlighted in the document entitled Principles of Standards for Schools Mathematics (NCTM, 2000, p.5) where the following appears: "Those who understand and can do mathematics will have significantly enhanced opportunities and options for shaping their future". The main belief statement in this document is that all students should learn important mathematical concepts and processes with understanding. To achieve the vision for mathematics education described in these documents requires solid mathematics curricula, competent and knowledgeable teachers who can integrate instruction with assessment, and education policies that enhance and support learning, classrooms with ready access to the technology (NCTM, 2000, p.3).

In the 1970s Welsh (1978) observed several mathematics classes in operation. "In all mathematics classes I visited, the sequence of activities was the same. First, answers were given for the previous day's assignment. The more difficult problems were worked on by the teacher or the students at the chalkboard. A brief explanation, sometimes none at all, was given of a new material and the problems assigned for the next day. The remainder of the class was devoted to working on homework while the teachers moved round the room answering questions. The most noticeable thing about math classes was the repetition of this routine" (cited in Romberg, 1991).

Therefore, what can one assume about the teaching and learning of mathematics in classrooms today? Are students still passive receivers of a body of facts to remember and procedures to perform? Do they merely go through a considerable number of exercises in order to fill in the vacuum created by non-understanding of mathematical concepts and relationships? Do they just learn how to answer stereotyped, low cognitive level problems? Or, do pupils learn important mathematics achievement at secondary level in Kenya?

Lioong Pheow Leung Yang (1998) found that in most African countries mathematics was being taught in a transmission, traditional way. Students were memorizing procedures and formulas; they were perfunctorily doing exercises, and lecturing was the most common method of teaching mathematics that they experienced. Importantly, ability differences between students were not addressed. Mathematically capable students among those she studied in Kenya were those who could adapt and respond to the answer-driven, drill- based system of mathematics education and they set the teaching pace in classrooms. As for the others, the less adaptive learners their voices were rarely heard in the classroom, they were late in completing the class work and, often, the teacher was not even aware of their learning problems (Griffiths 1998). Lioong Pheow Leung Yung's Work (1998) pointed to the same problems at primary level in Africa where mathematics plays an important role in social and economic mobility. For example, in job applications, one of the prime criteria for employment that cuts across both the public and private sectors is the applicant's acceptable standard of mathematics and English. In other words, mathematics acts as critical filter whereby the pursuits of an individual can be constricted by a lack of mathematical knowledge.

Scholars have observed the fact that students' academic achievement is an output of educational system which cannot be examined in isolation of the inputs and process. Therefore, IBRD/World Bank (1999) asserted that good quality of education requires

efficient systems that would provide supportive learning environment, motivated staff with mastery of their subject matter, adequate access to resources, and students who are healthy and ready to learn. In view of the great importance given to mathematics in the school curriculum and in the economic and social mobility in the society, this study therefore aimed at finding the extent to which school factors predict secondary school students' achievement in Mathematics in Bungoma County, Kenya.

The fact that students' performance in Mathematics at the secondary school level is low is no longer news. Several researchers (Georgewill, 1990; Alele-Williams, 1988; Edwards & Knight, 1994) have reported the downward trend in the performance of students in Mathematics. Several factors have been reported responsible for this decline in students' performance. The empirical studies have established that there are a number of factors found within the school which could influence students' achievement in Mathematics in secondary schools. However, mathematics has always been concerned with logic and reasoning, numbers sense, problem solving, and a search for relationships, and abstract thinking (Pomerantz. 1997). Therefore, many mathematics educators and scholars were of opinion that there is need for them to earnestly looking beyond the traditional approaches to enhance the teaching and learning process. These opinions, however, had not been empirically proved; hence, the need for this study. It is on this premise that this study investigated the extent to which school factors influence students' academic achievement in Kenyan Certificate of Secondary School Education with special reference to Mathematics in Bungoma County, Kenya.

The purpose of the study was to investigate the extent to which school factors (school leadership, quality of instruction, school library, supervision of instruction, counseling services, health services, convenience, instructional materials and sports facilities) influence students' academic achievement in KCSE Mathematics examination in Bungoma County, Kenya.

A. Hypotheses

The following hypotheses were formulated to guide the study:

Ho1 There is no significant relationship between school-based factors and students' academic achievement in Mathematic in Bungoma County, Kenya.

Ho2 School-based factors have no significant joint effect on students' academic achievement in Mathematics in secondary schools in Mathematics in Bungoma County, Kenya.

Ho3 School-based factors have no significant relative contribution to students' academic achievement in Mathematics in secondary schools in Mathematics in Bungoma County, Kenya

II. METHODOLOGY

The study adopted descriptive survey research design of the *ex-post facto* type. The target population of the study covered principals and teachers in all the public secondary schools in Bungoma County. However, the target population of the study covered principals and teachers in all the public secondary schools in Bungoma. The total number of schools in the Bungoma County as at the time of data collection was 206. The sample for the study was selected through multi-stage sampling procedure. The first stage was sampling of Bungoma County. The total number of schools sampled was 206. The principals of all the selected schools (206) participated in the study while 206 Mathematics teachers were sampled through purposeful sampling technique (that is, teachers that taught Mathematics in Secondary School). Both teachers and principals were 412.

Two research instruments were used for data collection: School-Based Factors Inventory (SBFI) meant for the school principals and School – Based Factor Questionnaire (SBFQ) completed by the Mathematics teachers were face and content validated. The reliability coefficient for School-Based Factors Inventory (SBFI) was 0.89 and that for the School Factor Questionnaire was 0.92 indicating that, the instrument was reliable for the study. The content validity was determined by experts in Educational Management and Test and Measurement who examine the instrument to determine whether or not they measured what they were supposed to measure. Their comments were used to correct items in the instrument before they were administered to the respondent. The data collected were analyzed with multiple regression and hypotheses were considered at 0.05 level of significance.

III. FINDINGS

In order to meet the objective of the study, questionnaire was administered to principals and Mathematics teachers. In this section of the paper we present the analysis of the results of the hypotheses below.

The Results of Testing Research Ho1

The study established the relationship between school-based factors and students' academic achievement in Mathematic in Bungoma County, Kenya. The responses were arranged into nine items of Independent variables and presents in Table 1 below.

Table 1: Pattern of Relationship Between School Factors (Independent Variables) and Students' Achievement in Mathematics in Bungoma County, Kenya

Independent variables	Performance in Mathematics		Remark
	R	Sig	
Supervision of Instruction	.024	.308	Not significant
School Leadership	.067	.081	Not significant
Quality of Instruction	.005	.462	Not significant
Guidance and Counseling	.060	.105	Not significant
Health service	0.06	.120	Not significant
School library	0.06	.305	Not significant
Conveniences(toilet)	.107	.013	Significant
Instructional materials	.116	.008	Significant
Sports facilities	.032	.225	Not significant

Table 1 shows pattern of relationship between schools based improvement factors and student academic achievement in Mathematics. Out of the nine independent variables only two have significant positive relationship with students' academic achievement in Mathematics. These are conveniences (toilet) ($r = .107$; $P < 0.05$) and instructional materials ($r = .116$; $P < 0.05$).

The Results of Testing Research Ho2

The study established the relationship between School-based factors and joint effect on students' academic achievement in Mathematics in secondary schools in Mathematics in Bungoma County, Kenya. The responses were arranged into the effect of Independent variables **on** students' academic achievement in Mathematics presents through ANOVA in Table 2 below.

Table 2: Composite Effect of Independent Variables on Students' Achievement in Mathematics

Multiple R	= .191 R Square		= .037		
Adjusted R Square	= .016 Standard Error		= 50.52		
Analysis of variance					
Source of Variation	SS	Df	MS	F	P
Regression	40743.461	9	4527.051	1.774	0.071
Residual	1072012	420	2552.409		
Total	1112755	429			

From table 3 coefficient of determination (Adjusted R2) = 0.016 and this gives proportion of variance (Adjusted R2 x 100) = 1.6%. This implies that the independent variables accounted for 1.6% of the variance in the dependent variable. The joint effect of school based quality improvement factors is not significant on the students' achievement in Mathematics in Nigeria (F=1.774; df (9,420); P>0.05)

The Results of Testing Research Ho3

The study established the relationship between School-based factors and relative contribution to students' academic achievement in Mathematics in secondary schools in Mathematics in Bungoma County, Kenya. The responses were arranged into nine items of Independent variables and presents in Table 3 below

Table 3: Relative Contribution of School-Based Factors on Students' Achievement in Mathematics in Bungoma County, Kenya

Model	Unstandardized Coefficient		Standardized Coefficient	T	Sig.
	ß	**Std. Error**	**Beta B**		
Constant	-26.444	21.502		-1.230	.219
Supervision of Instruction	-.757	.692	-.065	-1.094	.275
School Leadership	1.226	.680	.103	1.804	.072
Quality of Instruction	-9.76E – 02	.598	.010	-.163	.870
Guidance and Counseling	2.425	2.693	.062	.900	.368
Health service	-2.729	2.662	-.079	-1.025	.306
School library	0.831	1.591	.033	.522	.602
Conveniences(toilet)	6.630	2.869	.130	2.381	.018
Instructional materials	5.696	2.306	.134	2.470	.014
Sports facilities	-1.213	1.740	-.045	-.697	.486

Table 3 shows the relative contribution of independent variables on dependent variable. Out of the nine variables, the two variables that contributed significantly to student's achievement in Mathematics are conveniences and instructional materials (ß = 0.130, t = 2.381, P < 0.05), (ß = 0.134, t = 2.470; P < 0.05) respectively.

IV. CONCLUSION

The findings of the study have demonstrated that instructional materials and conveniences (toilets) are strong school-based factors which have the tendency of

contributing significantly to students' achievement in Mathematics. Therefore, their availability and accessibility by students could result into better achievement in Mathematics and if otherwise, reverse will be the case.

The significant contribution of conveniences shows its importance in students' performance. It implies that, if it was adequate, its contribution might be higher than what was obtained from the findings. However, based on reviewed literature, its inadequacy has a serious implication on students' regularity in schools. A healthy student needs to excrete waste from his/her body. Therefore, non-availability or poor toilet facility repels students' regularity in school. Teachers and other administrative staff too cannot find such school comfortable. Teacher can keep off occasionally when his/her excretory or digestive system is mal-functioning. If this happens on the part of students, important topics missed for such day or days may not be recovered thereby constituting failure in the nearest future. While in the case of teachers, expected topics missed may not be taught again. This may form basis for students' failure since continuity of such subject's content has been broken because of the topic missed when the teacher were absent owing to non-availability of toilet facilities.

V. RECOMMENDATIONS

In view of the above mentioned discussions, implications and conclusions highlighted above, the following recommendations are made for the improvement of student's performance in secondary schools Mathematics using Bungoma County, Kenya:

As identified by motivational theories, toilet facility is one of the physiological (basic) needs. Government should ensure that schools are provided with effective and adequate toilet facilities. As it can be seen that conveniences accounted for significant contribution to student academic achievement, school authorities should sensitize parents and old students about the need for toilet and solicit for their assistance.

It is also recommended that instructional resources should be provided in schools. Instructional materials make teaching real and facilitate learners understanding. Apart from provision by government, teachers should be creative in improvising instructional materials in their different disciplines.

Government and school authorities should through the allocation of funds, materials and apparatus for Mathematics teaching make more adequate for effective implementation for Mathematics curriculum so as to enhance the performance of students.

Mathematics teachers ought to create interesting and non-threatening environments in their Mathematics classroom and model enthusiasm for the teaching and learning of the subject. This may go a long way to help students develop positive attitude towards the subject, learn it without any inhibition and hence improve their performance.

There is the need for teachers to make their lessons captivating to the students by relating Mathematics to the environment of the learner and using appropriate teaching aids to arouse and maintain students' interest in the subject.

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