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The Relationship between Availability of Teaching/Learning Resources and Performance in Secondary School Science Subjects in Eldoret Municipality, Kenya

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Abstract
This paper examines the relationship between availability of both human and non-human resources for teaching/learning and performance in the Science subjects in the Kenya Certificate of Secondary Education (KCSE) examination. The study was conducted in Eldoret Municipality, Kenya. Stratified random sampling was used to draw a sample of 14 head teachers, 56 teachers and 308 Form Three students, based on the schools' performance in KCSE science subjects for the period 2001-2005, from 7 low performing schools and 7 high performing schools. The purpose of the study was to establish if availability and utilization of teaching and learning resources is among factors that influence performance in science subjects in Eldoret Municipality. The study was significant as performance in science subjects in Eldoret Municipality had been poor for a long time, hence the need to find out the causes. Data was collected using three questionnaires administered to the head teachers, teachers and students. Descriptive statistics were used to analyse and summarise the data. T-test was used to ascertain the significant differences between means of low performing and high performing schools. Correlation was used to show relationships between performance and the research variables. From the findings, availability of textbooks, revision books, lab chemicals and equipment was higher in the high performing schools than in the low performing schools. The findings show that 2 out of the 7 low performing schools did not have a laboratory. All the 5 low performing schools that had a laboratory lacked laboratory technicians and only one of them was fully equipped. Moreover, none of the low performing schools had a library, and all the high performing schools had more than one laboratory. As such, there were differences in availability of teaching/learning resources between the high performing schools and low performing schools. Therefore, the Ministry of Education should initiate more training programmes on provision, improvisation and utilization of teaching/learning resources. It should also help enhance the ongoing programmes like SMASSE among others. The study has practical implications for learners, teachers, school administrators, parents and educational officials in relation to provision and use of teaching/learning resources. Importance of the study to scholars, readers and the general public lies in the fact that science is the foundation of industrial, technological and economic development. Hence the need for awareness of all factors that affect performance and means of alleviating poor performance. In addition, when ranking schools' performance, factors such as schools' endowment with both human and non-human resources need to be considered.

Keywords: relationship, availability, teaching, learning resources, performance, secondary school science subjects, Eldoret municipality, Kenya.

INTRODUCTION

The problem of poor performance in science subjects is global as indicated by studies done by Valverde and Schmidt (1997) in USA, Landry (1998) in Canada, Fonseca and Conboy (2006). This problem is made worse in developing countries by the existing digital divide, poverty and other problems unique to the third world. A study by Kizito (1986) in Kenya attributes poor performance in KCSE science subjects mainly to poor teaching of the subject at primary level. This concurs with the findings of a study by Atieno (2000) on factors affecting performance in KCPE science paper in Bondo Division. Kizito (ibid.) gives other causes of poor performance as poorly trained teachers, negative attitude and a big workload. In Eldoret Municipality, performance in KCSE science subjects is very poor as majority of the students score C- (Minus) (RoK, 2006b). This is a poor grade as it bars learners from entry into science- based degree and diploma courses. This problem has persisted for a long time leading to very low district mean grades in these subjects. With all these in mind, the author examined the relationship between availability of teaching/learning resources and performance in the Science subjects.

Staff Availability and Utilization

There should be optimum use of the available teachers if good performance is to be achieved (RoK, 2005). Ngala (1997) says that where teachers are scarce, head teachers blame poor performance on this. But according to Good (as cited in Ngala, 1997),

it is clear that utilization of the resources available is more important than the quantity of resources. Ngala (ibid.) further cites Fuller (1982) saying that the length of schooldays time spent on particular curriculum areas, and efficient use of instructional time within the classrooms, is more strongly determined by management practice than by material parameters. To this he adds what Mbiti (1974) says, that it is necessary to firmly enforce working hours in order to enhance productivity and avoid idling.

Wekesa (as cited in Ngala, 1997) says that the length of instructional day is positively related to performance. This is very crucial for science as evidenced by the allocation of more lessons for science in the Kenya Institute of Education (KIE) syllabus. Thus the head-teacher should ensure that the lessons are fully used. Santiago (as cited in Kizito, 1986) says that some teachers have formed a habit of reading novels, newspapers and discussing current affairs during working hours. The head teacher needs to ensure that the length of the instructional day is as planned in the school routine for all teachers.

Obwocha (2005, October 6) describes a certain school as "the sick man of the national schools" as it is usually ranked at the bottom of the national schools in KCSE in spite of possessing adequate facilities and 74 teachers. Several Provincial and District schools trounce it. On the same note, Munyori (2006, March 9) says some national schools are a national shame. This is in reference to the poor performance of three schools that tailed in 2005 KCSE exam in the national schools category according to the results published in the *Daily Nation* and the *Standard* newspapers of March 2nd 2006. There cannot be a better example of the importance of optimum utilization of resources than that of the national schools that perform poorly. The poor performance illustrates the fact that it is not just what a school has that brings success, but also, how the resources are used. Commenting on the issue, a new head teacher in one of the schools has blamed the poor performance on lack of effective teaching and learning. He says that teachers and learners have been lax. He planned to end poor performance by in-servicing the teachers. Where teacher shortage exists in science subjects, the head teacher and Board of Governors should hire on temporary basis, as there are very many trained but unemployed teachers.

Availability of Non-human Resources

The necessary resources include human resource such as teachers and support staff and, physical facilities such as laboratories, libraries, classrooms and dormitories. Mbiti (1974) says that a head teacher needs to see that the necessary equipment and monetary resources are available for school use. In relation to science, he says that it must be taught through actual experiment with real objects. All scientific truths must be discovered through observation and experiment, not through telling. *Reader's Digest* (2007, March) reports:

> Words alone don't teach people... nor do they guide us with experience. Words alone aren't nearly enough. That's why we are doing things like organizing science expos, experimental workshops and teacher training, as well as providing books and science equipment.

This was in reference to South African schools. Unfortunately, in some schools in Kenya, Eldoret Municipality included, science is taught through talking and chalking, not through doing, due to absence of experimental objects (Wachira, 2005). Mbiti (1974) further states that when school equipment and supplies are delayed, teachers cannot be expected to do their work properly. Poor teaching will lead to poor performance by pupils in public exams. Thus poor administration procedure in supplying equipment results in poor quality work.

Fonseca and Conboy (2006) posit that the physical conditions and organization of schools facilitate or inhibit construction of a culture of success. They note that reasonable laboratory conditions and even class decoration can be an important element in improving student interest and achievement in science. In addition, they argue that positive images of science through posters, news, stories, video presentations, projects and awards that present science careers as attainable and science knowledge as gateway to a better life could do the trick. Little (as cited in Ngala, 1997) says that in effective schools, teachers and administrators plan, design, research, evaluate and prepare teaching materials together and administrators allocate time and resources consistent with the priorities that have been announced. The Kenya Education Sector Support Programme (2005-2010) cites mobilization, prioritization and utilization of resources as some of the problems facing mathematics and science subjects in secondary schools. Fuller (1986) has reported the same on studies in Uganda and Peru while Indoshi (1993) argues that the use of text books among other materials raises academic standards and efficiency of a school system. Eshiwani (1990) has found the same results. The need for course books and revision books in the ratio of 1:1 cannot be overemphasized if learners are to do extra work on their own. *The Standard* (2005) states that in the learning process, teaching and learning materials rank above uniforms, buses and buildings. A recent study in sub-Saharan Africa shows that poor performance is due to lack of core textbooks (ibid.).

Facilities such as dormitories and staff houses are also significant because if both learners and teachers reside in the school compound, lateness and missing of lessons is minimized. In addition, it is possible to arrange for extra and remedial lessons (MOE, 2003). Atieno (2000) has found out that one of the factors causing poor performance in KCPE science in Bondo

District was lack of transport which causes frequent absenteeism. This leads to less contact hours between teachers and learners. The Kenya Education Sector Support Programme (2005-2010) posits that boarding schools be established in arid and semi arid areas to improve access and performance in education. By extension, this also applies to performance in science. Since science practical lessons require extra time, boarding schools make it possible to extend learning time to include evenings and weekends. Although resources are of great significance, Woessman (2001) says that though the international variation in student performance levels in mathematics and science is a fact, it is generally accepted that differences in the amount of resources does not fully explain why performance levels vary. Availability of adequate teachers and support staff is very essential. According to the Kenya Education Sector Support Programme (KESSP) of 2005-2010, teacher resource is one of the most important inputs into the education system. Fonseca and Conboy (2006) while quoting Ballone-Dura *et al*. (2005) say that the science teacher has been found to be the most important factor in improving student achievement. Due to poor performance in science subjects, more Arts students than science students enrol into teacher training colleges and universities, leading to a shortage of science teachers (RoK, 2005).

Eshiwani (as quoted in Kizito, 1986) says that the supply of science students for further training continues to remain inadequate with adverse effects upon manpower situation in science-based jobs. Shiundu and Omulando (1992) state that young and better trained teachers opt for better paying jobs elsewhere, hence the best of their effort cannot be realised. It is imperative that schools are adequately financed and funded in order to do well in science subjects. This is because the teaching of science is expensive due to the need to establish laboratories, the cost of apparatus, training of teachers and hiring of support staff. Schools, therefore, need a sound financial base.
The findings of the 'Third International Mathematics and Science Study' as reported by Woessman (2001) state that the level at which schools are funded affects performance. More responsibility for purchasing educational resources at national and local levels, leads to lower student achievement. Students performed better when responsibility for purchasing resources resided at an intermediate level. This is because an authority that is close enough to local schools to understand their needs, yet far away enough to avoid collusion between local officials and school employees is the best place to rest responsibility for funding education.

LIMITATIONS OF THE STUDY

The topic was sensitive, especially in the low performing schools, where one could be mistaken as being on a fault finding mission. This is because it required probing for inner details about schools, which could be misconstrued as witch-hunting. To overcome this, the author did not just post questionnaires but visited the schools physically and asked for the principals' permission to conduct the research in their schools. The author explained about the research to the principals' and in the process developed rapport, hence opening a way for the principals to be interviewed. Some head teachers and teachers' also showed reluctance to avail records and offer support during interviews or observation of facilities. This, together with the failure by some respondents to return questionnaires, was taken care of by having two extra schools included in the sample. This increased the response rate.

MATERIALS AND METHODS

The study was conducted in Eldoret Municipality in Uasin Gishu County which is the Rift Valley Province of Kenya. The town is 310 kilometres north-west of Nairobi. The author employed the ex-post facto survey design. Both non-probability sampling and probability sampling techniques were employed. There were twenty-one secondary schools that were presenting students for KCSE at the time of research in the municipality. Of these, eleven (11) were private while ten (10) were public schools. The author purposively selected the top seven (7) and bottom seven (7) schools in the municipality based on the 2005 KCSE results ranking. All the Head teachers of the fourteen (14) schools were selected. Four science teachers were selected at random in each school as well as twenty two (22) pupils from each school to give a sample size of 56 teachers and 308 students. Observations, questionnaires and content analysis were the methods of data collection. The author observed the available physical facilities for teaching/learning science subjects. The questionnaire was generated and involved closed-ended and open ended questions. Some of the closed-ended questions were scored on a Likert scale of 1 to 5 for responses such as strongly disagree to strongly agree. Basic demographic data was also collected on the teachers' age, experience, and qualification and teaching subject. Questionnaires were given to head teachers, teachers and students. The document analysis involved sourcing secondary data on results of KCSE for the period 2001-2005 which were obtained from the DEO's office in Uasin Gishu and analyzed with regard to performance in the science.

The author used descriptive statistics as well as inferential statistical methods. The descriptive statistics involved computation of frequencies and means. The inferential statistics used were t-test and correlation. T-test was used to show if there were significant differences between the means of the low performing schools and the high performing schools. Correlation was used to find out if any relationship existed between performance in KCSE sciences results

and the research independent variables at $p<0.05$ level of significance.

RESULTS AND DISCUSSION

Relationship between Resources and Performance in Science Subjects

The study sought to determine the influence of the availability of human and non-human resources for teaching science subjects on performance in sciences within Eldoret Municipality.

Physical Resources

The student respondents were asked to state the availability of various teaching and learning resources in their schools and the data is presented in Table 1.

Table 1: Students Responses on Availability of Resources for Sciences

	Texts available	Revision Books	Labs Adequate	Lab stocked Chemicals	Lab stocked Equipment
N Valid	273	268	272	269	270
Missing	10	15	11	14	13
Mean	3.16	2.50	3.31	3.36	3.33
Std. Deviation	1.488	1.378	1.621	1.473	1.486

On a Likert scale of 1=strongly disagree to 5=strongly agree, students were generally undecided on the availability of textbooks, labs, laboratory chemicals and lab equipment. However, on the issue of revision books they were generally inadequate (M = 2.50), suggesting inadequate usage of revision books. This necessitated an investigation of differences in availability of resources among the high and low performing schools and the data is shown in Table 2. From the findings, there were differences in availability of resources based on students' responses. Availability of textbooks, revision books, lab chemicals and equipment was higher in the high performing schools than in the low performing schools. Independent t-tests were conducted to explore the statistical significance of the differences between the high and low performing schools.

Since the Levene's test of equality of variance was significant as the value was less than 0.05, equal variance was not assumed. The significance levels of the t-test were all less than 0.05 ($p<0.05$) hence the t-test values obtained were significant implying that there were significant differences in the variables under test. The data suggests that there were significant differences in availability of textbooks, revision books, adequacy of laboratories, and the stocking of laboratories with chemicals and equipment. The largest t value was for adequacy of laboratories ($t_{(233.53)}$=-10.750, $p<0.05$), followed by lab chemicals ($t_{(228.11)}$=-7.522, $p<0.05$), lab equipment ($t_{(244.86)}$= -5.780,$p< 0.05$), text books ($t_{(260.67).}$ = -5.126, $p < 0.05$) while the lowest value was for revision books ($t_{(265.95)}$=-2.669, $p<0.05$). This implies that the difference in performance in science between the two categories of schools could be as a result of the difference in adequacy of resources between them. The statistical significant difference in the high and low performing schools was also evident in that the lower and upper 95% Confidence Interval of the Difference did not cross zero line. Similar data from teachers was collected on the availability of teaching and learning resources and the data is presented in Table 2 below.

Based on a Likert scale, teachers generally agreed that resources were available. The availability of a laboratory assistant scored lowest (M=3.12) while availability of chemicals scored the highest (M=4.00). The 3.12 mean for lab assistant availability implies that there were some schools lacking this vital resource. This lowers performance because even if all the other resources are available, the teachers' ability to arrange for practical frequently is limited. Cross-tabulation using performance as a criteria provided further results for analysis.

The data suggests that there were differences in availability of teaching/learning resources between the high performing schools and low performing schools. Teachers in high performing schools generally agreed (M=4 and above except for lab assistant whose mean was 3.83) that resources were adequate. On the other hand, teachers in low performing schools either disagreed (M=2) or were undecided (M=3). This necessitated exploring for the statistical significance of the implied differences. The data suggests that there were significant differences in availability of textbooks ($t_{(36.262)}$ = -4.663, $p< 0.05$), revision books ($t_{(38.902)}$ =-3.147, $p<0.05$) adequacy of laboratories ($t_{(38.994)}$ = -3.688, $p<o.o5$), availability of laboratory assistants ($t_{(39)}$ = -2.314, $p<0.05$) the stocking of laboratories with chemicals ($t_{(28.257)}$ =-4.110, $p=0.05$) and equipment ($t_{(35.876)}$ =-4.861, $p=0.05$) between the high performing schools and the low performing schools .

Table 2: Teachers' Data on Availability of Resources

	Laboratories available	Lab chemicals available	Lab Equipment available	Lab Assistant available	Reference Books available	Revision Books available
N Valid	41	38	41	41	41	41
Missing	8	11	8	8	8	8
Mean	3.63	4.00	3.76	3.12	3.73	3.73
Std. Deviation	1.670	1.356	1.496	1.720	1.484	1.342

This data was used in correlation analysis to establish if there was any significant correlation between KCSE performance in sciences and the availability of physical and human resources from the teachers' responses. The findings suggest that there were significant correlations between KCSE performance in Sciences and availability of laboratories ($r=.478$, $p<0.05$), availability of chemicals ($r=.462$, $p<0.05$), availability of laboratory equipment ($r=.436$, $p<0.05$) and availability of reference books. This agrees with the earlier findings where there was a relationship between availability of resources and achievement in science (Fonseca & Conboy, 2006; Orodho, 1996).
Availability of revision books ($r=0.286$, $p>0.05$) and availability of lab assistant ($r=0.134$, $p>0.0.5$) were not correlated with performance in sciences. This contradicts the finding of Indoshi (1993) who states that the use of text books among other materials raises academic standards. The contradiction is probably due to my small sample size

Human Resources

Human resources that were considered were laboratory assistants and teaching staff. Availability of laboratory assistants was dealt with in Table 3 which shows responses of teachers to the question on availability of resources. On a Likert scale, availability of laboratory assistants scored the lowers t(m=3.12). On this scale, 3=undecided. This can be interpreted to mean that some schools had laboratory assistants while others did not. On the basis of low and high performing schools, the mean for low performing schools was 2.639 (between disagree and undecided) while that for high performing schools was m=3.82 (between undecided and agree).

Table 3: Teachers' Responses on Availability of Resources

	Laboratories available	Lab chemicals available	Lab Equipment available	Lab Assistant available	Reference Books available	Revision Books available
N Valid	41	38	41	41	41	41
Missing	8	11	8	8	8	8
Mean	3.63	4.00	3.76	3.12	3.73	3.73
Std. Deviation	1.670	1.356	1.496	1.720	1.484	1.342

This generally means more high performing schools had laboratory assistants than low performing schools. This could translate to greater ease and higher frequency of performing experiments in the higher performing schools than in the low performing schools. The findings show that 2 out of the 7 low performing schools did not have a laboratory. All the 5 low performing schools that had a laboratory lacked laboratory technicians and only one of them was fully equipped. In addition, none of the low performing schools had a library. On the other hand, all the high performing schools had more than one laboratory. The laboratories were fully equipped and there was at least one laboratory technician. All the 7 schools in this category had a well stocked library.

Head teachers were also asked if they considered the staff establishment adequate for the sciences. Their responses are given in the table below.

Table 4: Adequacy of Teaching Staff

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	3	21.4	25.0	25.0
	Yes	9	64.3	75.0	100.0
	Total	12	85.7	100.0	
Missing System		2	14.3		
Total		**14**	**100.0**		

The table shows that most schools, 9(75%) had adequate staff to teach science subjects effectively. Thus the poor performance in the municipality must be due to other factors other than inadequacy of staff. The author sought to find out adequacy of staff among low performing and high performing schools and obtained the information in the table below.

Table 5: Adequacy of Staff in the Low and High Performing Schools

	Adequate	Inadequate	Total
Low	6	1	7
High	3	2	5
Total	9	3	12

The table shows that out of the 7 low performing schools, only one had inadequate teachers, confirming that proper utilisation of the resources available is more important than the quantity of resources (Ngala, 1997; Kizito, 1986). On the other hand, 2 out of the 5 high performing schools reported inadequacy of science teachers. The two head teachers were asked how they coped with the shortage to produce good results. They said they hire BOG teachers and ensure that the available teachers work extra time to meet the set targets. This therefore means that adequacy and proper utilisation of staff is essential for good performance in since. This concurs with the findings of Ballone-Duran *et al*. (2005) (as cited in Fnseca & Conboy, 2006) who state that the teacher has been found to be the most important factor in improving student achievement.

CONCLUSION AND RECOMMENDATIONS

The role of availability of human and physical resources in influencing the performance of schools in KCSE sciences was investigated. The availability of human resources was not a significant factor as most schools had basically the same type of teachers in terms of their educational level and teaching experience. The most important factor was the availability of laboratories. There were significant differences in the availability of science teaching resources between the low performing schools and the high performing schools. Schools with adequate resources were found to perform better than those without. Students in low performing schools were thus disadvantaged. In addition, the author found out that most of the low performing schools were located in the low socio-economic neighbourhoods and were all day schools. Due to the low economic status of the home backgrounds of the learners, it can be implied that the schools lack of learning resources is as a result of lack of funds due to poor fees payment by the learners. One head teacher of such a school reported that the economic situation of the parents has been worsened by the prevalence of HIV/AIDS such that the little money available goes to health care, so that learners cannot attend school. This affects performance in a dual way as the learners stay away from schools and in addition, the schools do not have money to buy the learning resources.

The findings of the study and the discussion held in this paper have potential implications for science educators and other educational leaders regarding the teaching and learning of secondary level science. Apart from the need to provide adequate human and non-human resources for teaching and/or learning, teachers and school administrators need to be encouraged to utilize the resources provided to maximize performance in the science subjects. In this regard, the Ministry of Education officials should conduct a school audits on the availability and actual use of laboratories. This should be coupled with efforts to standardize the provision of basic science resources in schools sciences. The defunct Kenya School Equipment Scheme (or a similar organization) should be revived with the express aim of providing basic science resources. Private schools should also be compelled to equip their schools adequately before they are licensed.

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