

# **Teacher -related barriers to effective utilization of science-teaching and learning resources in secondary schools in Kiambu County, Kenya.**

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## **Abstract**

Sciences form an important block of the secondary school curriculum. In fact at K.C.S.E., a candidate must choose at least two science subjects. This is due to the importance attached to the sciences in view of national development and the desire to have Kenya as an industrialized Nation by 2030. Numerous innovations and strategies have been made for the improvement of the quality of the secondary school science in Kenya. Example of the strategies is the provision of the teaching/learning resources by the schools, government and even donors. The Ministry of Education (MoE) in conjunction with the Japanese Government initiated the SMASSE project in 1998 as a project. The mandate of the project mainly focuses on in-servicing science teachers especially in the use of resources while teaching sciences. The Government under targeted programs also provides laboratory equipment in some schools including Thika West Sub County. Despite all this, the sciences continue to be dismally performed in the KCSE exams due to the non-effective utilization of these resources among other causes. To this end the purpose of this study was to examine barriers to effective utilization of resources to the teaching of sciences in selected secondary schools in Thika West Sub County. The study identified purposively eight (8) schools using stratified random sampling technique, basing itself on the school categories such as two national, three provincial and district schools. The data was collected using questionnaires for students and teachers while resource check list was used to investigate available science resources. Descriptive and inferential statistics were employed to analyze and present the data. The study established that students like Chemistry as a subject but they perform dismally; Physics being so unpopular and poorly performed conventionally is performed best in Thika West Sub County. The study recommends that: schools, parents and the community at large should join hands and ensure that schools have adequate resources for science subjects, especially laboratory equipment; the TSC should employ enough science teachers and ensure they are distributed to schools as per the number of students

**Key words:** Science Teaching, Learning resources, effective Utilization, Barriers, sciences.

## **Introduction**

Teaching / learning resources are very crucial in the achievement of institutions educational objectives. Students learn science best when they are provided with opportunities to do science in ways that mirror in authentic practices of scientist, Minstrell & VanZee (2000). Oluoch (1982) noted that schools are established to implement national education curriculum through effective teaching /learning. The quality of implementation is closely related to the nature and quality of resources available and how well they are used. The Republic of Kenya (1976) recommended that the resources be made available to the learners in adequate qualities and quantities and at an affordable cost.

The Government of Japan (JICA) in conjunction with the Kenya Government has worked tirelessly to ensure that the availed resources are being effectively utilized in the science teaching /learning process in the classroom situation, SMASSE (1991) This is being done through implementation of SMASE principles learnt during INSETS (In-service Trainings) of science teachers in the country, and it is hoped that its effectiveness and efficiency will be witnessed with time.

## **Resource utilization in the Teaching/learning of sciences**

Resources help to create situations that make learning interesting or else inhibit learning. They also serve to stimulate learners' imaginations and enhance memory of what is learnt. It encourages learners to use more than one sense, Wright (1976). Instructional materials when used well make learning easier especially when abstract concepts are being learnt Orpwood (2001). Dale (1969) recommended that teachers should learn how to use materials effectively. Orodho (1996) noted that resource availability and their utilization is crucial in achieving good science results. Kathuri (1993) in his study noted that effective utilization of the teaching/learning resources in sciences together with other extrinsic and intrinsic factors determines academic achievement in sciences. In Thika West sub county, there is considerable evidence that resources are not adequately utilized as evidenced in the KCSE exam results. Studies on factors influencing performance in sciences as indicated by: Munyalo (2006), Gichura (1999), Kakonge (2000), Kanguru (1986), have all revealed one common factor, inadequate utilization of resources such as text books, laboratory equipment and apparatus. Orodho (1996) in his study noted that it is more of the effective use made of learning resources such as textbooks, lab equipment and apparatus that result into higher achievement in sciences.

The (*Sessional Paper no.1, 2005*) and *Daily Nation (17<sup>th</sup> September 2010)* noted nationally that the trend in performance in Mathematics and sciences continue to be dismal. Thika West Sub County is not an exceptional in the poor performance in the science subjects as the K.C.S.E. Exam analysis for the last five years below shows;

**Table 1.1 K.C.S.E. Exam analyses for the last five years**

YEAR	CHEMISTRY MEAN SCORE	OPTIMUM SCORE	BIOLOGY MEAN SCORE	OPTIMUM SCORE	PHYSICS MEAN SCORE	OPTIMUM SCORE
2005	3.348	12.0	3.621	12.0	4.932	12.0
2006	3.605	12.0	3.819	12.0	5.095	12.0
2007	3.944	12.0	4.866	12.0	5.132	12.0
2008	3.637	12.0	4.294	12.0	4.835	12.0
2009	3.500	12.0	3.790	12.0	5.183	12.0

**NB. Physics is done by few schools and it's optional**

**Source; Thika district KCSE result analysis file from DEO's office**

From the various works done by other researchers like (Gichuru, 1999; Kinyagia, 1987, Kunguru, 1986) whose work is consulted, Some of the possible causes of the poor performance in sciences includes; negative attitude towards the subject, higher pupil-textbook ratio, shortage of science teachers, high work load due to overburdened program which cause academic and teaching methodology to suffer and lack of adequate resources and their effective use in learning-teaching of science subjects.

Performance and utilization of resources in the teaching and learning of sciences could be affected by teacher related barriers among others. Teacher related factors include- teacher qualifications - to a good extent teacher qualification and experience determine student's performance. A well-qualified and experienced teacher produces good performance, Saha (1983) Teachers' work load also determine performance. If the teacher has few lessons, most likely he/she will be able to give individual attention to the students and consistently evaluate and mark giving feedback immediately. The methods of teaching the teacher uses also determine understanding and consequently performance. According to Schulman (1973), activity oriented method is the best where the learner is highly involved and thus motivated raising interest and curiosity to learn.

Previous studies by Munyalo, (2006) Gichura, (1999) Kakonge, (2000) Kunguru, (1981)) Orodho ,(1996) and from KCSE results from national to district level, including Thika West District as shown in Table 1.1 shows evidence that resources are not adequately utilized. Towards this end, in 1998, the government through the Ministry of Education and the government of Japan through Japan International Co-operation Agency (JICA) started a technical co-operation project as an intervention to the existing problem of performance. The project is known as strengthening of Mathematics and Sciences in Education (SMASE) in Kenya. Its overall national goals are to upgrade the capability of Kenyan teachers in the teaching of mathematics and sciences. This was done by providing learning/teaching resources and other material support. This program stresses the importance of resources for teaching and learning of sciences in the classroom. Despite the training of science teacher in SMASSE activities, for example ASEI/PDSI approach in teaching the expected impact has not been achieved yet.

## **Teacher related barriers**

### **Teacher qualification**

The teacher resource is one of the most important inputs in to the education system thus efficient management and utilization of resources is critical to the quality of learning out- comes *G.O.K, (2005)* The role of a teacher in learning is central. Apart from being conversant with the content he/she also needs to be able to deliver it appropriately by use of a variety of resources. The teachers should be trained in public universities or diploma colleges and it's imperative that the teacher should acquire sufficient subject mastery and pedagogy (Sessional Paper No.1 2005).The teacher's quality is reflected in the teaching methods which involve selection of resources to be utilized during the teaching-learning sessions. Resource selection and utilization is directly related to the teacher knowledge and experience, thus a well-trained teacher is expected to effectively utilize the available resources in the teaching of sciences. Saha (1983) noted that the better trained teacher produces better results. Muhandik (1983) agreed that a professionally trained teacher contribute positively to effective learning than untrained. Thus a well-trained teacher is expected to effectively utilize the teaching-learning resources as he effectively teaches. In a classroom, the teacher ceases from being a teacher but a facilitator, as a manager and no longer the main source of knowledge (Barr & Tagg 1995). Educational innovations make the teachers' job more complex and demand greater skill, Zabel & Zabel (1996).This therefore shows how the teacher needs not only to be available but also need to have the relevant skills to successfully deliver using available resources.

### **Teaching load**

This refers to the number of lessons a teacher teaches per week. If a teacher is handling too many lessons per week no matter how motivated, he/she will be overworked. Most likely the teacher will not be in a position to prepare well. He/she may not even have time to organize for hands- on activities in the laboratory which require pre-arrangement. The Government Policy of freezing of teacher recruitment, continued retirements and resignation has led to an acute shortage of teachers in the country since there is no replacement. This has a direct impact on the teacher's teaching load. Njuguna (2004) while quoting from (the Dairy Nation issue of 18<sup>th</sup> march 2002, p15), observes that even experts were alarmed over shortage of teachers. The article noted that shortage of teachers continued to bite, threatening the provision of quality education. The overloading of science teachers may lead to minimal utilization of resources especially laboratory equipment/ chemicals in teaching of sciences.

### **Class size**

Large class sizes have an adverse impact in teaching and learning of sciences. *Brown, & Harde (1969) & Witich & Schuller (1973)* observe that increased student population work against effective resource usage because availability of resource may not be adequate. *Nieuwenhuis (2000)* noted that many teachers who work in overcrowded classes have low morale and self-esteem. Motivation suffers and classroom teaching methods are restricted to lecturing, thus students will lack the opportunity to discover on their own in hands-on activities with overcrowded classrooms.

### **Teaching methods**

According to SMASSE (1991), there are several instructional methods that teachers apply in the teaching process such as the teacher centered methods and the students centered methods of teaching. Science teaching advocates for the latter where learners are self-directed. Once they are guided, the teacher plans and organizes for learning activities where learners will be fully involved. In sciences, various apparatus and chemical are utilized during the lessons. The teacher's role during the individual practice will be to monitor students' progress i.e. manipulation of the apparatus, observation making technique, and

observation recording and interpretation. This gives the learner autonomy and makes the learning interesting. Therefore utilization of resources depends highly on the instructional method the teacher chooses to apply in the teaching/learning process. For the science teachers, it is imperative that they choose one method that engage learners in various hands on activities.

### **Purpose of the Study**

The purpose of the study was to determine the teacher-related factors that hinder effective utilization of resources in the teaching-learning of sciences in secondary schools in Thika West District.

### **Objectives of the Study**

The study had the following objectives

- (i) To investigate the adequacy of available resources in the teaching-learning of sciences in public secondary schools in Thika West District.
- (ii) To determine the teacher-related barriers that hinder effective utilization of resources in the teaching and learning of sciences in public secondary schools in Thika West District

### **Research Questions**

The study had the following research questions:

- (i) Are resources adequate for the learning-teaching of sciences in the public secondary schools in Thika West District?
- (ii) What teacher related barriers hinder adequate and effective utilization of resources in the teaching of sciences in public secondary schools in Thika West District?

## **METHODOLOGY**

### **3.1 Research design**

Design is a program meant to guide the researcher in collecting, analyzing and interpreting observed facts Orodho (2008). The study adopted a descriptive research design which involved collecting information by administering questionnaires to a sample of individuals, check resources available for teaching sciences by use of checklist and use of classroom observation guide. The design determined and reported the ways things are, further it attempted to describe such things as attitudes, possible behavior values and characteristics. The choice of this design was based upon its ability to get information from a wide sample of respondents

### **3.2 Locale of the study**

The study was undertaken in Thika West District, Kiambu County. The researcher chose this District because after going round in the district with other SMASSE District trainers, monitoring the impact of SMASE in the teaching and learning of sciences, she noted that chemicals and apparatus especially in the laboratories were left lying idle and unpacked suggesting that they are rarely used or never used at all, hence the need to investigate what was hindering their utilization.

### 3.3 Target population

The study targeted all students and all science teachers in public secondary schools in the new Thika West District. The district has 16 public secondary schools which have seventy science teachers teaching chemistry, biology, and physics. Both male and female teachers in sciences were involved including the heads of departments. Students were chosen from form three classes because from their nature of topics in the syllabus, they are supposed to incorporate more practical work during the learning process than any of the other classes.

**Table 3.1: Target population**

Category of schools	Target population	Sample size
National	4	2
Provincial	3	3
District	9	3
<b>Total</b>	<b>16</b>	<b>8</b>

### 3.4 Sampling Procedures

According to Orodho (2008), sampling is the process of selecting a subset of cases, in order to draw conclusions about entire set. Sampling is advantageous in that it saves time and money. It may be the only practical way to collect data. Purposive sampling method was used. It involved selecting samples using set criteria. Out of the fourteen schools, eight (8) were sampled. The researcher chose schools per the categories national, provincial, and district. Both boarding and day schools were considered as well as boys and girls schools. All the categories of schools were represented during sampling. Among the teacher population, thirty two (32) teachers were sampled; four from each of the school. The four were to be science teachers teaching Chemistry, Biology, or Physics from each school. In each school, ten (10) form three students were given the questionnaires. Purposive sampling method was used which intentionally choose subjects so as to ensure representation of all important groups in the research.

### 3.5 Research Instruments

The researcher used questionnaires as the main instrument of data collection. There were two questionnaires used to gather information. One gathered information from teachers of science, while the other gathered information from form three students. Observation guide forms were used to check on the availability and utilization of resources available.

### 3.6 Piloting

This refers to trying out of questionnaires in selected schools to check on its effectiveness. It helps in identifying and correcting major defects before distributing in many schools (Oluoch, 1990). The face

validity of the questionnaire was determined through piloting in two secondary schools in the same area and was not included in the study. The instruments therefore measured what it was meant to measure. The pilot study revealed that the responses in the two tests were consistent therefore the instruments were reliable. Vague questions were revealed and rectified accordingly. Through a Test-retest in piloting, the degree to which same results would be obtained was obtained, that is reliability.

### **3.7 Data Collection Procedures**

The researcher sought permission from the Ministry of Education and from the D.E.O's Office in Thika where a permit (letter) was issued. The researcher then proceeded to schools under study and established a rapport with the principals first and then with the HOD sciences before administering the questionnaires to the science teachers and students. The teachers were given at least five days to fill after which the researcher collected them. In every school the researcher filled the observation guide form, and visited the laboratories to see the facilities and find out how well they were utilized during the learning process or from the laboratory technicians.

### **3.8 Data Analysis Procedure**

Qualitative data was analysed qualitatively using content analysis based on analysis of meanings and implications emanating from respondent information on open-ended questions and comparing responses to documented data on barriers to utilization of resources in the teaching of sciences. Quantitative data was coded and entered into SPSS for analysis. The qualitative data was presented thematically in line with the objectives of the study. Descriptive statistics, frequencies, percentages and measures of central tendencies i.e. mean were used in data analysis and were presented in simple statistics and as pie-charts, graphs, and percentages.

## Results and Discussion

### Adequacy of available resources

**Table 4.5 Adequacy of facilities/resources**

**N=32**

Facilities/resources	Adequate		Inadequate		Not available	
	F	%	F	%	F	%
a) Teachers' reference books	25	78.1	7	21.9	0	0.0
b) Classrooms	19	59.4	13	40.6	0	0.0
c) Staff(lab technicians)	15	46.9	15	46.9	2	6.3
d) Teachers' guide books	15	46.9	16	50.0	1	3.1
e) Lab chemicals	15	46.9	17	53.1	0	0.0
f) Lab apparatus/Equipment	14	43.8	18	56.3	0	0.0
g) Students' text books	11	34.4	21	65.6	0	0.0
h) Improvised apparatus	9	28.1	15	46.9	8	25.0
i) Laboratories	9	28.1	23	71.9	0	0.0
j) Science teachers	8	25.0	24	75.0	0	0.0
k) Teaching aids	8	25.0	22	68.8	2	6.3
l) Library books	5	15.6	22	68.8	5	15.6

Table 4.5 shows that, 78.1% of the teachers responded that, the most adequate resources were teachers' reference books. On the other hand, the most inadequate facilities were science teachers as resources (75.0%) laboratories (71.9%), teaching aids (68.8%), library books (68.8%), students' text books (65.6%) and laboratory chemicals (53.1%). However, 25% teachers reported that improvised apparatus were not available in their school. Another 5(15.6%) teachers also reported that library books were not available. This implies that most of the facilities were inadequate, which may adversely affect the teaching-learning process and finally the performance of students.

### Teacher-related barriers

Table 4.8 shows teacher-related factors that hinder effective utilization of resources.



**Table 4.8 Teacher related factors**

**N=32**

Statement	SD		D		U		A		SA	
	F	%	F	%	F	%	F	%	F	%
a) Sciences are easy subjects to teach	3	9.4	14	43.8	2	6.3	12	37.5	1	3.1
b) Girls are equally capable of excel	0	0.0	0	0.0	1	3.1	23	71.9	8	25.0
c) Science should be optional in form 3and4	7	21.9	3	9.4	1	3.1	17	53.1	4	12.5
d) I believe my students can pass in science	0	0.0	2	6.3	0	0.0	21	65.6	9	28.1
e) responsible for my students' performance	1	3.1	18	56.3	3	9.4	9	28.1	1	3.1
f) Science concepts can't be understood	4	12.5	13	40.6	0	0.0	11	34.4	4	12.5
g) Sciences are difficult to teach	4	12.5	15	46.9	0	0.0	11	34.4	2	6.3
h) Science develop reasoning and are stimulating	0	0.0	4	12.5	0	0.0	12	37.5	16	50.0
i) Classes are too overcrowded therefore equipment is inadequate	7	21.9	3	9.4	1	3.1	17	53.1	4	12.5

**Key:** Strongly Disagree (SD), Disagree (D), Undecided (U), Agree (A), Strongly Agree (SA)

Table 4.8 above shows that a number of teachers agreed that; girls are equally capable of excel (71.9%), science should be optional in form 3 4(53.1%), they believe their students can pass in science (65.6%) and science develop reasoning and are stimulating (50.0%). However some teachers disagreed on statements like; sciences are easy subjects to teach (43.8%), they are responsible for their students' performance (56.3%), science concepts can't be understood (40.6%) and that sciences are difficult to teach (46.9%). This implies that teachers had a positive attitude towards science subjects, which they would likely impact on their students.

In a classroom, the teacher ceases from being a teacher but a facilitator, as a manager and no longer the main source of knowledge, Barr & Tagg (1995). Educational innovations make the teachers' job more complex and demand greater skill Zabel & Zabel, (1996:20).

## Conclusion

Based on the findings of the study as summarized above, it can be concluded that some students had a negative attitude towards science subjects. It emerged from the study that class text books were adequate in most schools, as two students shared a textbook but other textbooks for further work were not available. The study established that teachers supported students appropriately in science subjects despite the fact that most of them had not received training in SMASSE. However, teachers did not involve students more in class activities while teaching which is against SMASSE recommendations in the ASEI/PDSI approach of teaching science. Also teachers did not allow students to evaluate the lessons taught. The study revealed that other areas that require to be addressed by the school or otherwise those that hinder effective utilization of resources in schools were; Shortage of space and facilities, low morale

of teachers and students, Shortage of science teachers, high enrolment of students and unqualified laboratory assistants in the laboratory .

### **Recommendations**

1. Schools, parents and the community at large should join hands and ensure that schools have adequate resources for science subjects, especially laboratory equipment.
2. School heads should motivate teachers by ensuring they are provided with the teaching/learning resources needed for science subjects.
3. The TSC should employ enough science teachers and ensure they are distributed to schools as per the number of students. This will ensure that teachers are not overworked, leading to better performance in sciences by students in the long run.
4. Students should be motivated to have a positive attitude towards science subjects by making learning interesting and rewarding those who perform well. Those who lag behind should also be encouraged to work harder.
5. Teachers should identify areas where students have problems and focus on that. They should also ensure that the syllabus is covered in good time to give students ample time for revision

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