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Availability and Use of Instructional Resources and Its Influence on Performance in Mathematics in Secondary Schools of Kakamega Central Sub County, Kenya

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Abstract:

Mathematics, which is one of the core subjects in the Kenyan school curriculum, is also a requirement for competitive careers at the university such as medicine, engineering, architecture and many more. Performance at KCSE level however has been disappointing both nationally and in secondary schools of Kakamega central sub county. This study endeavoured to establish the availability and use of instructional resources and its influence on performance in mathematics. Specifically, it sought to establish teachers experience, availability and use of instructional resources and its influence on performance in mathematics. A total of 197 students and 22 teachers of mathematics were selected by simple random sampling while 22 Heads of Departments, 22 Head teachers and 1 Sub county Education Officer were selected using purposive sampling. The study found out that there is a general shortage of instructional resources for teaching of mathematics. However, other instructional resources such as toys, pictures and computers are rarely used. The study found that the availability and use of instructional resources has impact on teaching and learning of mathematics in secondary schools. It is envisaged that the findings of this study will guide stakeholders in policy formulation with regard to use of instructional resources in mathematics to improve the performance of students in the subject.

Keywords: *Instructional resources, performance, mathematics, availability*

1. Background of the Study

Mathematics plays significant roles in the lives of the individual, society, and nation as a whole. According to Stepelman (as cited by Laniba, 2013), among the sciences cultivated by humankind, none has been more useful than mathematics. Mathematics has not only found its usefulness in academic areas such as Science, Medicine, and Engineering but also in the day to day operations of businessmen, sportsmen, and even farmers (Thomaskutty, 2010). History of Mathematics reveals that whenever a society gave the knowledge of mathematics its due significance the society made tremendous progress. Thomaskutty (2010) gives examples of the Egyptian, Mesopotamian, and Greek civilizations, which were advanced alongside Mathematics. Mathematics is not only important for its practical use but also for its aesthetic appeal just like the study of poetry, music, painting, and literature. Simply put, people study mathematics because it is one of the loveliest disciplines known to humankind (Phillips, 2008). The elegance and gracefulness of Mathematical relationships touches our emotions, much like music and art can reach inside the psyche and make one feel truly alive (Thomaskutty, 2010). It is because of the aforementioned reasons and many more that a number of governments have taken deliberate measures to improve on the performance in the subject. According to the Federal government of Nigeria (2004), one of the goals of primary education is the transmission of appropriate mathematical skills and competencies to enable the pupils live in and contribute to the development of their societies and nation at large.

In Kenya, because of the importance of the subject, mathematics has been made a compulsory subject up to secondary school level. However, during the last five years, performance in Mathematics at K.C.S.E has dropped significantly and this has been a major concern for the Kenyan society as shown in Table 1.

YEAR	MEAN MARK
2010	23.04
2011	29.79
2012	28.65
2013	27.58
2014	24.02

*Table 1: Performance in Mathematics at K.C.S.E Nationally in the past five years
Source: Kenya National Examinations Council, 2015*

From Table 1 it can be seen that students have been scoring a mean mark of D+ or below over the years. Olatuon (2010) established that among the human resources in educational institutions, teachers hold the key to schools academic achievement. This is because they are responsible for planning and implementation of the syllabus in preparation for examinations. The results are eventually used by students and schools as achievement indicators. However, Frenzer, Okebukolo and Ojengelee (1992) established that a professionally qualified teacher no matter how well trained would be unable to put their ideas into practice if the school setting lacks the necessary physical instructional resources. Thus adequate textbooks and mathematical-specific instructional resources like geometrical sets are necessary to translate their competency into reality.

Kakamega Central Sub County too has continually posted poor results in mathematics over the years a fact that has caused concern in all stakeholders in education. It is for this reason that this study has been conceived to establish the availability and use of instructional resources and their impact on teaching/learning mathematics in secondary Schools of Kakamega Central Sub-County.

1.1. Statement of the Problem

The significance of mathematics has been noted throughout all generations and all over the world. Historically, mathematics has been known to contribute to the various ancient civilizations while at the same time it has been acknowledged for its aesthetic value (Thomaskutty, 2010). Mathematics similarly, is used as a basic entry requirement into any of the prestigious courses such as medicine, architecture, and engineering among other degree programs at the university.

Mathematics is considered by society as the foundation of scientific and technological knowledge that is vital in social-economic development of any nation (Mbugua et al. 2012). Kenya through vision 2030 hopes to industrialize and mathematics is a key component in achieving this. It is because of this reason that mathematics has been made a compulsory subject at both primary and secondary levels in Kenyan school curriculum.

However the score card in mathematics at K.C.S.E has continued to be disappointing both nationally and in Kakamega Central Sub County as seen in Table 2.

Year	Mean Points
2015	3.707
2014	3.419
2013	3.702
2012	3.601
2011	3.229

*Table 2: Performance in Mathematics at K.C.S.E in Kakamega Central Sub - County
Source: Sub – County Education Office, Kakamega (2016)*

As shown in the Table 2 the mean mark Sub County results in mathematics have ranged from 3.229 to 3.707 which is a mean grade D+. Different reasons have been advanced to explain this type of performance. KNEC (1996) identified low coverage of syllabus, lack of practice and 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 nationally due to high attrition (Nation newspaper, 2009). Different steps have been taken to remedy the situation. Among them is a project started by the government of Kenya and the Japanese international cooperation agency (JICA) of 'Strengthening Mathematics and Science in Secondary Schools Education' (SMASSE), of which Kakamega District was one of the Pilot Districts (M'kiambi, 2013). The main aim of the project was to enhance the teaching of mathematics and sciences by providing in-service training to the teachers of these subjects (Yara, 2010).

Despite the efforts, performance in mathematics has not shown much improvement hence causing concern by the stakeholders of education. Should this trend continue then students from Kakamega central sub county will miss out in courses such medicine, architecture and engineering and that may impact negatively on development in the County. In addition Vision 2030 may not be realized. This leaves scholars and other stakeholders in education to wonder whether availability and teachers' use of resources or lack of the same could be influencing students' achievement in the mathematics. This study therefore sought to establish the availability

and use of instructional resources and its influence on performance in mathematics in secondary schools of Kakamega Central Sub-county.

1.2. Objectives of the Study

This study was guided by the following specific objectives:

- (i) To establish the availability of instructional resources in mathematics in secondary schools in Kakamega Central Sub – County.
- (ii) To assess the extent to which teachers use instructional resources in mathematics in secondary schools in Kakamega Central Sub – County.

1.3. Research Questions

The following are the research questions the research sought to answer:

- (i) What are the available instructional resources in mathematics in secondary schools of Kakamega Central Sub County?
- (ii) Are teachers of mathematics in secondary schools of Kakamega Central Sub County making use of the available instructional resources in mathematics?

1.4. Research Design

In this study, descriptive survey design was adopted. This design was considered appropriate because according to Kathuri (1993), Mugenda and Mugenda (2003) it is effective in assessment and description of situations which is the focus of this study. Similarly, survey approach is selected because according to Kregler (1993), it facilitates acquisition of a wide range of data during evaluation of present activities as basis for future decision-making. On this basis, this study applied survey approach to ascertain the current status of instructional resources with respect to availability and use. This will provided basis for future decisions about instructional resources. The choice of survey design was further based on the fact that it facilitates coverage of large sections of the target population and study area relative to the specific topic under study (Mugenda & Mugenda, 2003).

2. Study Area

This study was carried out in selected secondary schools of Kakamega Central Sub County in Kakamega County, Kenya. Kakamega Central Sub County is one of the eleven sub Counties of Kakamega County. It has a population of 297,234 as per 2009 census (GOK, 2009). The Sub – County borders Kakamega east to the east, Kakamega South to the south, Nabakholo to the North, Butere and Mumias to the West. It hosts the County headquarters. The study focused on availability and use of instructional resources in Secondary schools in Kakamega Central Sub County. The Sub County has two Divisions namely, Municipality and Lurhambi. It was selected for the study because it is one of the Sub Counties in Kakamega County with several established secondary schools that exhibit significant differences in pupils' achievement in mathematics. The study was based on the premise that differences in availability and use of instructional resources among the teachers could be one of the factors influencing the pupils' achievement in mathematics.

3. Use of Instructional Resources in Mathematics

The focus here was on whether the teachers were making use of the different instructional resources during the mathematics lessons. The question was put to the learner to state whether they have seen their teachers using the different instructional resources. The resources in question were chalkboard instruments like rulers, protractors, setsquares, pairs of compasses, the grid, coloured chalk, pictures and toys, three dimensional models, dice coins, playing cards, lap tops projectors and past papers. On the same learner questionnaire an item asked the learner to state how well they were able to use the calculator, geometrical set, mathematical tables and the graph book. On the teachers' questionnaire, they were several items which sought to find out how well the learner utilized textbooks, revision books and past papers.

3.1. Use of Chalkboard Instruments

The study sought to find out whether teachers in Kakamega Central Sub County make use of Chalk board instruments. These instruments are important when teaching the concept of geometrical constructions and loci. The results are shown in Table 3.

Response on Use of chalkboard apparatus	Frequency	Percentage
Yes	91	47.4
No	101	52.6
Total	192	100.0

Table 3: Use of chalkboard Instruments
Source: Field data, 2016

The results for the chalkboard instruments showed that fewer teachers were using the chalk board instruments than those that are using. As seen in Table 3, 91(47.4%) of the respondents said they had seen their teachers use chalkboard instruments while 101(52.6%) said they had not seen their teachers use them.

3.2. Use of Chalkboard Grid

The chalkboard grid is used for demonstrating to the learners the drawing of graphs in different topics and also when teaching other topics like transformation and trigonometry.

The research sought to establish from the learners whether they have seen their teachers using them when teaching such topics. The results are shown in Table 4.

	Response on use of chalkboard grid	Frequency	Percentage
ppp	Yes	99	51.6
	No	93	48.4
	Total	192	100.0

Table 4: Teacher Use of Chalkboard Grid
Source: Field Data 2016

The findings Table 4 show that 99(51.6%) of the sampled teachers use the chalkboard grid when drawing graphs. The remaining 93(48.4%) do not make use of the grid. Some of the teachers however complained that some of the chalkboard grids are such that when used do not make the drawings visible.

3.3. Coloured chalk, pictures and toys

The study sought to find out the usage of coloured chalk, pictures and toys in the teaching of mathematics concepts. This is shown in the Figure 2.

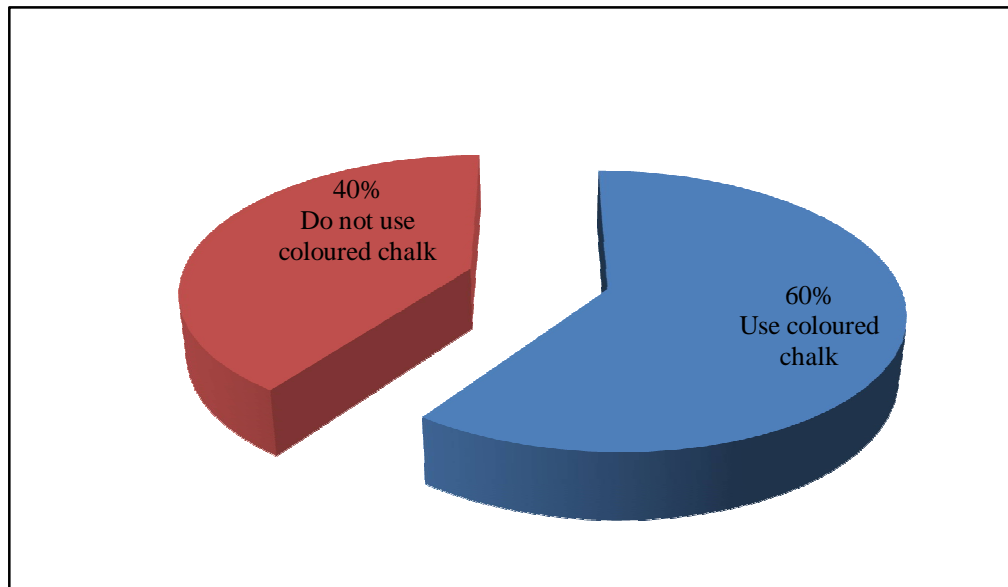


Figure 1: Pie Chart Showing Use of Coloured Chalk in Teaching Mathematics in Secondary Schools of Kakamega Central Sub County
Source: Field Data 2016

The results as shown in Figure 2 indicate that majority of the teachers in the sampled schools used coloured chalk to illustrate concepts on the chalkboard 59.9% of the respondents noted that their teachers use coloured chalk while 40.1% said their teachers do not use them. When asked whether their teachers use pictures and toys to teach mathematics majority(85.4%) said they do not while 14.6% said they use. The results are illustrated in the Figure 2.

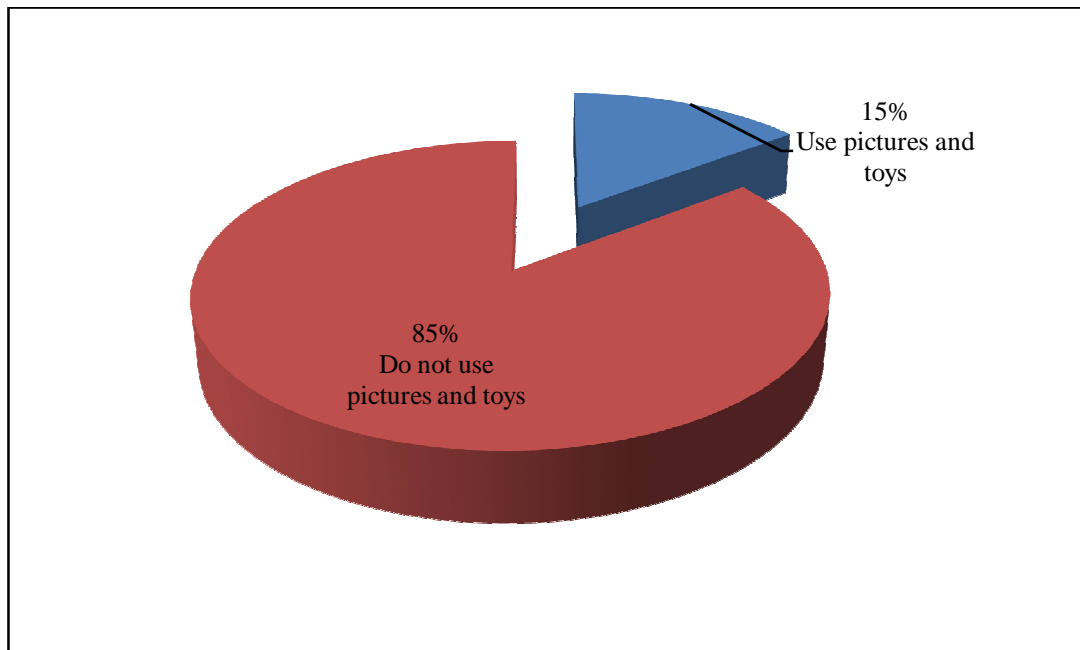


Figure 2: Extent of Use of Pictures and Toys in Mathematics Instruction

Source: Field Data 2016

Despite most teachers not using pictures and toys in teaching mathematical concepts most teachers strongly agreed that use of different types of photographs and model toys enrich the teaching /learning of similarity and enlargement in mathematics. The results are as tabulated in Table 5.

Response	Frequency	Percentage
Strongly agree	25	42.4
Agree	32	54.2
Disagree	1	1.7
Strongly disagree	1	1.7
Total	59	100.0

Table 5: Teacher Opinion on Whether Photographs Enrich the Learning of Similarity and Enlargement

Source: Field Data 2016

3.4. Three Dimension Models

The study found that 42.2% of the teachers used three dimension models while 57.8% of the teachers do not. This is an indication that when topics like common solids in form one, three dimension geometry and longitudes and latitudes in form four, learners are not enabled to visualize the concepts. The results are shown in the Figure 10

Use of 3-Dimensional models	Frequency	Percent
Yes	123	64.1
No	69	35.9
Total	192	100.0

Table 6: Use of 3-Dimensional Models Mathematics Instruction

Source: Field Data 2016

Results in the table reveal that 64.1% of teachers in the sampled schools use three dimension models while 35.9% of the teachers do not use these models. Some of the teachers said they do not use them because the three dimension models are occasionally not adequate especially when two or more teachers are teaching the same concept at the same time. The teachers also found them cumbersome to carry them to class every time they have to use them. However, they seemed to agree that the without the use of the three dimension models the learners found it difficult to visualize planes and intersections of planes with lines. The results are as shown in Figure 4.

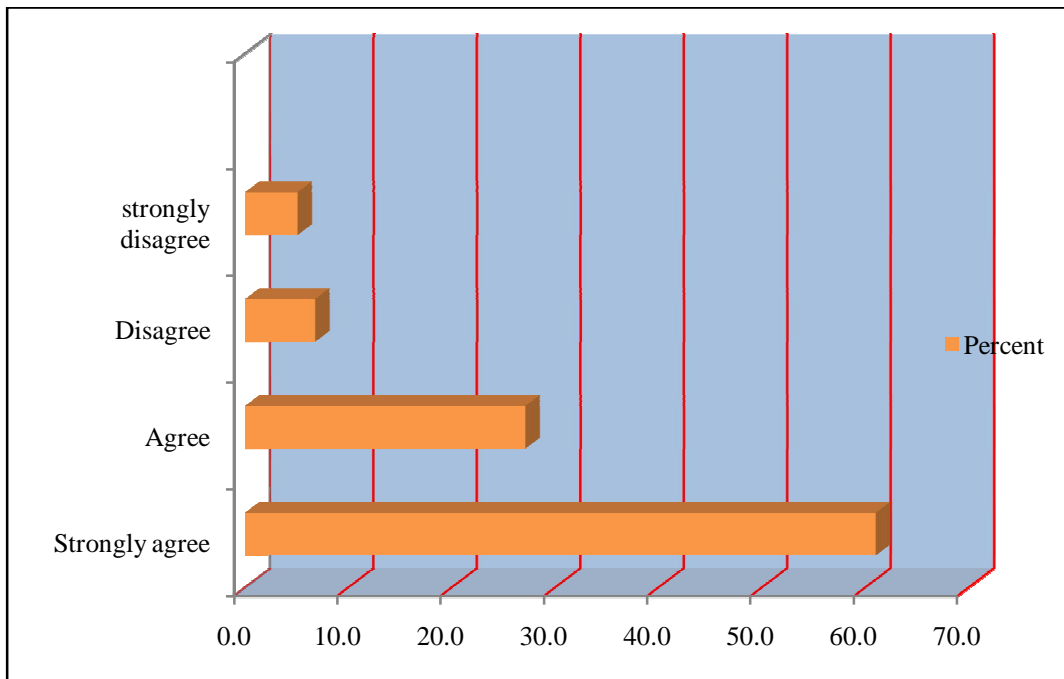


Figure 3: Use of Models and Learner Visualization of Planes and Intersections of Planes with Lines
Source: Field Data 2016

The result in Figure 4 indicate that 61% of the respondents strongly agree that without the three dimension models the learners would find it difficult to visualize planes and intersection between planes and lines. One Principal from one of the sampled schools had the following to say on use of three dimension models;

- “The school not only provides three dimension models for the teaching of mathematics but also encourages the teachers to make use of them during the lessons. Some of the teachers however fail to use them preferring to just use the chalkboard with the excuse that they can help the learners to understand the concepts without using the models”. (A Principal from a sampled school)

3.5. Coins, Dice and Playing cards

Coins, dice and playing cards are crucial resources when teaching and learning of the concept of probability in mathematics. The study sought to find out whether teachers of mathematics are making use of them when teaching probability in their schools. The results are shown in the pie chart in Figure 4

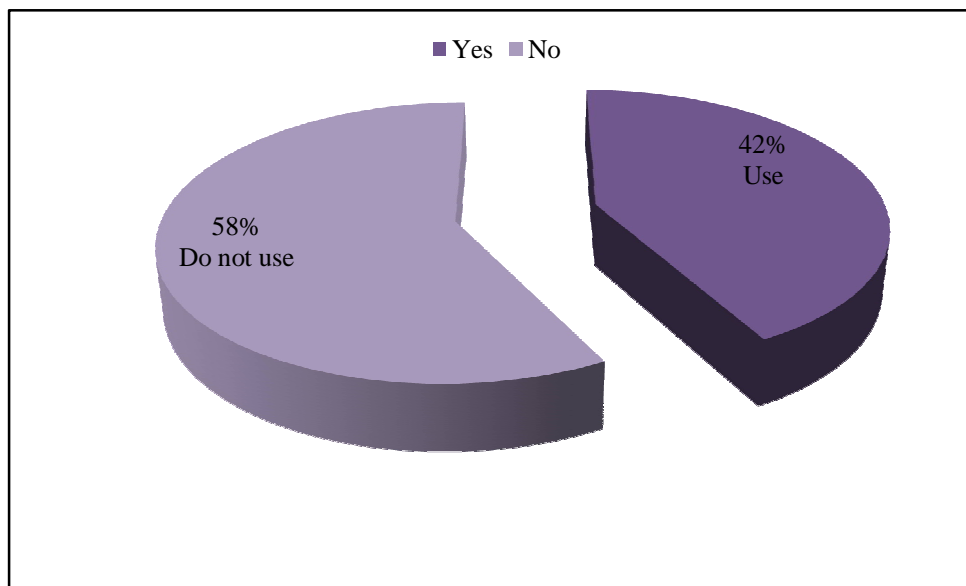


Figure 4: Pie Chart Showing the Use of Coins, Dice and Playing Cards in the Teaching of the topic of Probability in Secondary of Kakamega Central Sub County
Source: Field Data 2016

The results in Figure 5 show that majority of the teachers do not use the coin, dice and playing cards when teaching the topic using of probability. 81 (42.2%) of the respondents said their teachers do use the resources while 111(57.8%) said they do not use them. The findings could explain the poor performance in KCSE mathematics in questions from the topic of probability as stated in the Kenya National Examinations Reports (2006 and 2014)

3.6. Use of Computers in Mathematics Instruction

The study sought to find out whether teachers are using computers in generating interest in the subject. The results are as shown in the Table 7.

Use of Computers	Frequency	Percent
	14	7.3
No	178	92.7
Total	192	100.0

Table 7: Use of Computers in Mathematics Instruction
Source: Field Data 2016

As indicated in Table 7 that majority of the teachers (92.7%) do not use computers in the teaching of mathematics. A smaller group of 7.3% makes use of this resource. The findings are in agreement with Munyoro’s (2013) finding that most schools in the country are yet to integrate the use of computer in teaching and learning of mathematics even though the government has spent colossal amounts of money in stocking schools with computer hardware and software. Some of the teachers said they have no basic knowledge in the use of computer and the projectors. Some however saw it as time consuming as observed by one of interviewed principals:

- “The feeling of some of the teachers of mathematics is that the use of computer technology is time consuming since it takes time to plan for such lessons and set up required gadgets. These teachers complain that the mathematics syllabus is wide and that there is need to finish the syllabus early so that they can embark on revision hence avoiding to use technology such as computer which to them is time consuming. This technology therefore though good in creating learner interest in the subject, has largely been under-utilized in the teaching of mathematics”. (Principal of one of the sampled schools)

However, 48% of the teachers from sampled schools strongly agreed that use of computers in teaching some concepts in mathematics can generate more interest in mathematics and help in positive attitude among the learners. The District Education officer on his part had the following to say on Ministry of Education effort to help teachers integrate computer in teaching of mathematics;

- “The Ministry of Education recognizes the potential of technology in the teaching and learning process in our schools. The Ministry of Education through SMASSE has therefore organized inset trainings during school holidays to empower teachers of mathematics and Science in the use of computers in their teaching. My office has also identified teachers known as ICT champions from both primary and secondary schools as trainers in the schools in the sub county.” (DEO, Kakamega Central Sub County).

3.7. KCSE Past Papers

There was need the study sought to find out whether the teachers in the sampled schools use KCSE past papers in the revision of mathematics. The results as indicated in Figure 6 show that most teachers (83.3%) use past papers in revision while(16.7%) do not. This is shown in the chart in Figure 6

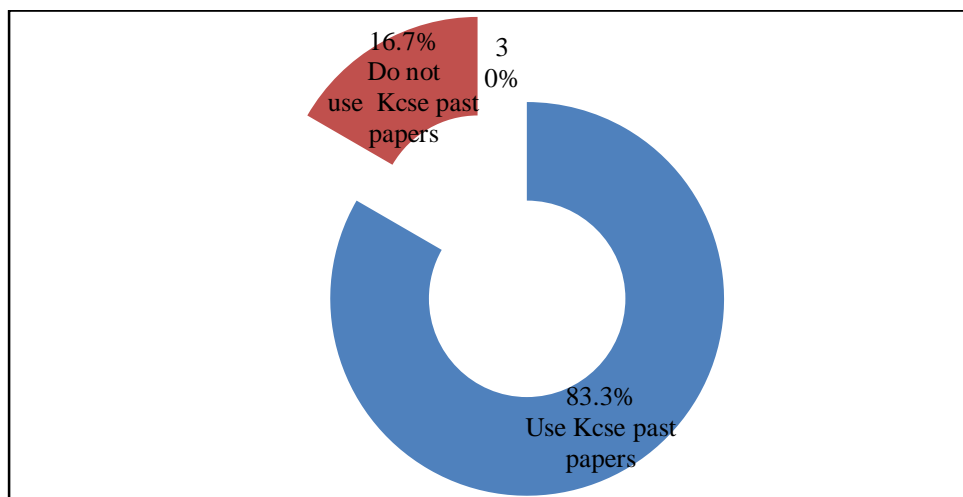


Figure 5: Usage of KCSE Past Papers Mathematics Instruction
Source: Field Data 2016

4. Conclusion and Recommendation

4.1. Use of Instructional Resources in Mathematics

The study sought to establish the use of the pedagogical resources in the secondary schools of Kakamega Central Sub County. The findings showed mixed results. While some resources were frequently used, there were some whose usage was quite rare. Among the resources used more frequently were the three dimension models of which 64% of the respondents said they had seen their teachers using. This is followed by 51.6% of the respondents who said their teachers used chalkboard grid for the drawing of the graphs. 83.3% of the respondents said their teacher use KCSE past papers for revision.

There are three types of resources whose usage was rare in the sampled schools. These were the playing cards and coins, toys, pictures and computers. The responses for whether the teachers use them were 42%, 15% and 7.3% respectively.

4.2. Recommendations

Based on the above findings and conclusions, the study makes the following recommendations.

- (i) The school managements should ensure that there are adequate teaching/learning resources and should make frequent replacements of the resources that are either lost or spoilt.
- (ii) The government should organize for in-service training that encourage the use of pedagogical resources and more so the use of computer in the teaching of mathematics.
- (iii) The teachers training colleges and universities should lay special emphasis on the use of pedagogical resources when training student teachers. There should be courses where they are trained on how to integrate computers in the teaching of mathematics.
- (iv) The quality and standards officers from the Ministry of Education should make frequent visits to schools to ensure the textbook to learner ratio of 1:1 is achieved and that other teaching and learning resources are available in the schools.

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