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# To Examine The Effects Of The Principals' Invitation Of Mathematics Specialists On Students' Performance In Mathematics In KCSE Examination In Meru County, Kenya

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***Abstract:*** ***Performance in Mathematics in Meru County, Kenya from 2012 to 2016 has consistently been deteriorating. The purpose of this study was an evaluation of how the administrative strategies designed by the principals affected students' performance in the Kenya Certificate of Secondary Education (KCSE) in Meru County. Objectives that directed the study were to evaluate the various attributes on student performance in KCSE examination in Meru County. The objective was to evaluate the effects of Principal's invitation of Mathematics specialists and students' performance, in mathematics. This study used ex post facto design. The research instrument was Mathematics teachers' questionnaire, KCSE document analysis for five years in Meru County and Principal's interview guide. The target population was 299 principals and 836 Mathematics teachers in the County. This study used stratified random sampling with proportional allocation. The sample size was 30% of the total target population translating to 92 principals and 251 Mathematics teachers. Validity was ensured by piloting the instrument. Reliability was ensured by using split half technique. From the findings, majority of Mathematics teachers and principals claimed that they invited Mathematics specialists, team teaching and peer teaching specialists to their schools. However, most of the invitations were done only once a year. Chi-square results showed that invitation of Mathematics specialists (p 0.021), team teaching (p 0.006), peer teaching specialists (p 0.048) and others (p 0.034) all had a significant effects on how students performed. The study recommends that principals should invite more than one Mathematics specialist to their schools to ensure that Mathematics teachers and students are adequately exposed to different kinds of skills and strategies on Mathematics performance in K.C.S.E examination. Principals should also increase the frequency of inviting the external support staff from annually to one or twice per term to ensure that the skills and strategies imparted are reinforced to become a routine practice for the Mathematics teachers and the students. The findings of the study were expected to be useful to the Ministry of Education, teachers and students as well as other stakeholders in the education sector.***

## I. BACKGROUND TO THE STUDY

To improve the performance of a school, it is paramount that the principals exercise leadership and acknowledge the fact that the direction of the school is a vision shared by all the stakeholders and ways to make the schools successful are well managed (Malkus, 2010). This therefore means that ensuring the necessary elements to improve students' performance are availed, are working effectively and are geared towards success of students as one of the key roles of the principal (Hill, 2006). With that, the responsibility of overviewing school systems, its processes and even resources and how all these combine to create the purposed learning outcomes for students is conducted by the principal as the chief architect of the school.

For achieving in academics, clearly defined goals are set by effective school principals. This means they avail resources and gear operations towards the set goals, provision of the

timetable for teaching and routinely check and observe class instructions and even lesson plans. To check the attainment of instructional goals, they monitor progress of students continuously. This will mean they will report back on how the students perform, ensure discipline among students, ensure excellent student performance reinforced, motivate the teachers and capacity build them thus quality teaching-learning processes (Anderson & Nichols, 2007).

To improve student achievement in Mathematics, the teachers and the school administration have to perform evolving instructional administrative roles by applying practitioner-based effective teaching and learning strategies. This means that in order to increase on helping students get it better in Mathematics, one has to understand and select well the different teaching strategies combined, (Mohanty, 2005). The author, Mohanty 2005 continues to add that in schools where multiple changes in learning and activities that affect the daily living of students have shown to have the highest possibility of improving student learning. Such strategies may include introducing training for teachers, use of the learning cycle approach; use of computer simulations; organizing workshops and seminars for Mathematics teachers, organizing remedial classes for week students, encouraging students to conduct discussions and inviting specialists to talk to students on how to enhance academic performance in Mathematics.

According to Campbell and Malkus (2010), inviting Mathematics specialists may have impacts positively on what the students achieve as time progresses. Mathematics seminars and workshops are among strategies used in teacher's professional development (Garet, 2008). There are different studies to state that professional development affect how the students achieve. Scholars Garet 2008 and Wilson 2009 in their experimental study to examine features of high quality professional development found that the increase in the teacher's knowledge increased the desired practices in the classrooms but this did not mean improvement in student outcomes nor any sustainable changes.

Good performance in students is triggered by availing adequate teaching/learning resources which promote the schools' effectiveness. These are both human and non-human that affect the entire students' performance. Gifted and talented students embrace competitions as echoed by Malkus 2010; Davidson & Riley 2007 and the Ministry of Education (2004) add that competitions form a part of the required continuum of different opportunities. Use of small groups in class to perform different tasks presents positive impact on students learning as evidenced within the Mathematics education. Karnes (2003), made a comparison on how students achieve in Mathematics using small groups and using the whole-class setting. Olembo, Wanga and Karangu (1992) argue that schools that perform poorly spend limited resources on the purchase of teaching and learning resources. UNESCO (2000) annual report posits that Excellency in academic pursuit is synonymous with mobilization of resources by school managers. A study by Ayot (2002) in Maseno Division showed that in availability of textbooks in learning institutions resulted in poor performance.

It's a global concern how students perform in Mathematics as evidenced in different studies. There is a study in the USA done by American Institute for Research (AIR) to find out how Mathematics perform on $4^{th}$ and $8^{th}$ grade students in the USA comparing it with the same graders across the world done by National Assessment of Education progress (NAEP) that the Mathematics students' progress of grade 4, 8 and 12. In their findings, Grade four pupils performed below the average mark from 1996-2007 consistently. African countries such as, Egypt, Tunisia, Morocco, Botswana, Ghana and South Africa participated in The International Trends in Mathematics and Science Study (TIMSS) in 2003. Comparison with TIMSS, 1999 indicated that there was no significant difference in Mathematics scores in this period (TIMSS, 2003). The Mathematics performance was poor between 1999 and 2003.

A report by National Education Commission of Tanzania (NECTA), (2013) presented that performance in Mathematics has been going down. This was similarly shown in the nation Form Four examinations of 2014 where the subject performed poorly compared to other subjects (NECTA, 2014). Programs in Education produce qualified teachers of Mathematics for secondary Schools. However, the general performance in Mathematics among secondary schools' students has been poor for many years Kenya National Examination Council (KNEC, 2006). This has the amplifying effect that Kenya may not achieve goal of industrialization as envisaged in the Vision 2030.

One of the greatest challenges faced by the Kenya education community as seen in the Global Literacy Project of 2008 is the continued downward trend in the performance of Mathematics in secondary schools despite the efforts of Kenyan government prioritizing Mathematics achievement and declaring it in her National Development Plan (2008). Some of the contributors of this poor Mathematics performance in Kenya in secondary schools include poor quality of teaching, the classroom environment being harsh and unfriendly, students lost interest and their negative attitudes and also poor management and administrative strategies. (Eshiwani, 1985; Marete, 2008).

Consortium on Strengthening Mathematics and Science Education (SMASE) of (2009) labeled criticism against teachers for the declining standards in Mathematics in the country. This poor performance is in both Kenya Certificate of Primary Education (KCPE) and Kenya Certificate of Secondary Education (KCSE). However, findings from a study in Murang'a County by Mwagiru (2014) on implementation of SMASE showed that adequate learning and teaching resources had not been availed by head teachers for use in science and Mathematics teaching to ensure implementation of SMASE. She also observed that Mathematics and science teacher is overloaded with high number of pupils per class, more than one subject to teach and heavy workload of lessons to cover per week killing their motivation to implement SMASE INSET. Marete (2012) also concurs, that SMASE approach of teaching and learning science and Mathematics has been partially achieved and implemented. He adds that the SMASE approach was encountering several challenges which were hindering full implementation. There has been great concern over the declining performance in Mathematics which has persisted in the last several years and Meru County is not an exception.

Therefore, this study is expected to address the poor performance in Mathematics in Meru County.

An analysis of the county's Mathematics results from the years 2008 to 2015 shows that performance in Mathematics has been below average of 50% (KNEC, 2015). While as other Counties in the country have consistently performed well in the subject, there is strong reason to believe that there is a problem worth researching on in Meru County. According to UNESCO (2015), the school principals being the people responsible for schools' performance are expected to come up with strategies that will enable their schools to boost performance in Mathematics. This study was set to establish the effects of principals' administrative strategies on Mathematics performance in KCSE among students in Meru County, Kenya.

## STATEMENT OF THE PROBLEM

Up to the secondary level of education in Kenya, Mathematics is a core subject which means all the students have to take it up as one of their study subjects. This is because Mathematics forms the basis of other career fields including engineering, commerce, agriculture, medicine, architecture among others.

Despite the government of Kenya providing free secondary funds and prioritizing Mathematics. Mathematics performance at the secondary school level has continued to decline for the last five years in Meru County, from 2012 to 2016. Mathematics scores have been below average (2.8), which is averaged from the mean obtained between 2012 and 2016, an indication of grade D plain on average. However, in neighboring counties of Tharaka-Nithi and Embu had a mean of 4.5 within the same period, which are grade D+ and 4.91 which is grade C- respectively.

Although several studies have been conducted on the contribution of administrative role of school principals on student performance, there is limited information on evaluation of principals' administrative strategies on student performance in Mathematics and especially in Meru County.

## PURPOSE OF THE STUDY

Was an evaluation of effects of principals' administrative strategies on students' performance in Mathematics in Kenya certificate of secondary education in Meru County, Kenya.

## CONCEPTUAL FRAMEWORK

Conceptual frame work showing how the variables in the study interrelate i.e the independent, intervening and dependent variables in the study

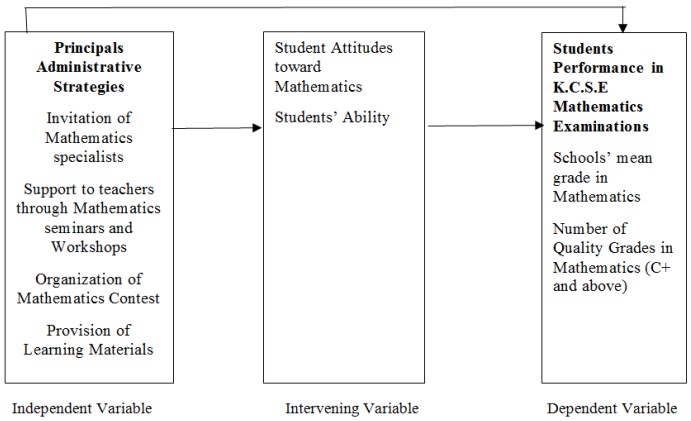


*Figure 2.1: Conceptual Framework on strategies used by principals and student's Mathematical performance*

The researcher's hypothesis was that there existed a relationship between principals' administrative strategies and the students' performance in Mathematics in KCSE examination. However, other variables such as the attitudes of learners towards Mathematics were also likely to affect their performance in KCSE examinations.

The researcher's assumption was that the students' attitudes towards Mathematics as a subject and their ability have no significant effects on the relationship between principals' administrative strategies and students' performance in Mathematics in KCSE examination since those students had performed in their KCPE in order to be admitted to those secondary schools. To control student attitude towards Mathematics, the researcher divided the students into two groups. The experimental and control group. The researcher administered the test to the two groups and manipulated the results of the experimental group. If the results were 40% and below, the researcher rejected the null hypothesis that there was no significant relationship between principals' administrative strategies and students' performance in Mathematics in KCSE examination.

Invitation of Mathematics specialists by principals would have been instrumentals in influencing the beliefs of both teachers and students about Mathematics teaching and learning which may have ultimately affected academic performance of the subject in examinations.

# II. RESEARCH METHODOLOGY

## RESEARCH DESIGN

This study used ex-post facto design because the variables under investigation had already occurred (Creswell, 2013). Therefore, in this study the researcher was not able to manipulate the independent variables in order to get their impact on dependent variables because their effect had already occurred. Additionally, in this case there were no two groups, the control group and the experimental group. .

## TARGET POPULATION

This study targeted a population of 299 principals and 836 Mathematics teachers in secondary schools in Meru County.

In this study, a classification of the schools in terms of gender mixed schools (211), Girls' schools (54) and Boys' schools (34) was done.

## SAMPLE SIZE AND SAMPLING PROCEDURES

On determining the sample size, Mugenda & Mugenda (2003) state that depending on time and resources available, a 10% sample can be used for a large population is studied more than 1000 while for smaller populations, less than 100, 30% sample be used. This study therefore used 30% of 299 principals and 836 Mathematics teachers translating to 92 and 251 sample size, respectively. This will ensure that the number of schools per category are a good representative of the population and hence increase the precision (Creswell, 2013). For selecting schools in the different categories, stratified random sampling with proportional allocation was employed. The method will ensure that the characteristics of the three sub-groups are represented. In each category, the researcher employed simple random sampling to determine the specific school that was visited. The same procedure applied to identification of respondents.

| Mixed Schools | Girls' Schools | Boys Schools | Total Number |
|---|---|---|---|
| 64 | 17 | 11 | 92 |

*Table 3.1: Number of Schools Visited per each Category*

## RESEARCH INSTRUMENTS

The research instruments that aided in conducting this study were:

- ✓ Mathematics Teachers' questionnaire
- ✓ Document analysis
- ✓ Principal's Interview guide

All the instruments were developed by the researcher.

## PILOTING INSTRUMENTS

To ascertain the validity and reliability of the data collection questionnaires, pilot survey was conducted. Pilot test assisted in establishing any flaws, weaknesses and limitations seen in the interview design that were there and gave room for the adjustments to be made before the actual study implementation (Kvale, 2008).

The pilot testing of the data collection tools not only ensured the questions flow or make sense but also to improve the functioning of the tool in general (Creswell, 2003). A selection of 10 schools was chosen to take part in the pilot study for this study, three schools from each of school category. The findings of the piloting of the research instruments was used to fine tune and enhance the efficacy of data collection tools to collect adequate and sufficient data to enable the study to achieve the research objectives exhaustively.

## VALIDITY OF RESEARCH INSTRUMENTS

The degree to which the results analyzed from the data collected actually represent the phenomenon being investigated is called validity, (Orodho, 2009). It describes whether an instrument captures the intended information it was designed for. Expert judgement and review was used to enhance content validity of the data collection tools (Kumar, 2009). The instruments were prepared with close consultation from the supervisors by the researcher in order to ensure that the questionnaires cover all the areas under investigation in all the sections. To ensure the validity of the research instrument the researcher ensured that each specific objective, of study and hypothesis were addressed by items in the questionnaire. Expert judgment was used to enable the researcher identify weaknesses of the instruments and make appropriate adjustments. Two supervisors from Maasai Mara University were asked to give their advice on the questionnaire. After getting the advice views, the researcher edited the instruments accordingly.

The pilot study done to pre-test the instrument and cater for instrument validity. The instruments were administered to the respondents from six public secondary schools that did not participate in the main study giving a total of six respondents. The instruments were then being modified based on the results of the pilot test. Further, the findings from each of the three tools for data collection were triangulated to strengthen the validity of the research findings and the efficacy of the tools in the data collection.

## RELIABILITY OF THE INSTRUMENTS

Reliability refers to the consistency of results on replication of the same study using the same instrument (Bryman, 2012). It is generally understood to be the extent to which a measure is stable or consistent and produces similar result when administered repeatedly (Sushil & Verma, 2010). This study used split-half technique. Creswell (2013) asserts that split-half technique involves dividing research instruments into two, using a scientific sampling procedures. Systematic random method of splitting is advocated by Drost (2011) as the most realistic in ensuring splitting of research instruments do not lead to biased results. The researcher further underscores the need to ensure that before systematic splitting is performed, instruments must not have been arranged in a certain systematic manner.

In this study, the researcher split the instruments into half using systematic method, where two groups were created and two instruments were picked at a time and separated for each group. This continued until all of them were split. After this procedure, data was entered into SPSS and a correlation coefficient obtained for the two groups. A coefficient of 0.7 and above is considered reliable (Creswell, 2013).

## DATA COLLECTION PROCEDURES

The researcher was first to get a clearance letter to carry out research from the Board of Postgraduate Studies of Maasai Mara University. The researcher then sought permit to conduct research from NACOSTI. The researcher then contacted the County Director of Education for permission to do the research in the County.

The researcher made a visit to the sampled schools. The ethical clearance letter was presented that allows the study to be conducted from the ministry of education and a letter of

introduction from the university as well. After the permission was granted to conduct the study, the researcher asked the principal permission to be allowed to give the questionnaire to Mathematics Teachers to fill it. The researcher then requested the principal to give results for the school for the last five years from 2012 to 2016.

The researcher recorded in the document analysis quality of grades C+ and above the grade, which the student ought to obtain in order to qualify for a course of study in the university. These grades were used to examine trends in Mathematics performance. Then the researcher administered to the principal interview guides where the principal was expected to answer questions about administrative strategies he or she had put in place to improve performance in Mathematics in the school. The researcher collected the research instruments after one day.

### DATA ANALYSIS

The process where order, structure and meaning is given and brought to the information collected is known as data analysis (Mugenda & Mugenda, 2003). Chi-square was used to test the Hypotheses to evaluate the relationship between independent and dependent variables. The confidence level of hypotheses testing was 0.05. Once the data was collected, it was post-coded and analyzed using the Statistical Package for Social Sciences (SPSS) with help of computer software. Quantitative data gathered from closed ended questions was summarized and organized into similar themes as per the research questions. It was analyzed using frequency distribution table's percentages. Quantitative data presentation was through tables, percentages and normal distribution tables.

To integrate qualitative data obtained from open ended questions into inferential data. Data was organized and the interpretation of information was done. The qualitative data was reported through narratives and statement of the respondents. For the study to find out the interaction between the invitation of Mathematics specialists by the principals and how the students perform in Mathematics in KCSE examination, Chi-square was used.

To establish the effects of relationship between principals' support to teachers through Mathematics seminars/ workshop and how the students' perform in Mathematics in KCSE examination, Chi-square was used. To establish the effects of relationship between principals' organization of Mathematics contests and students' performance in Mathematics in KCSE examination, Enova was used. To establish the effects of principals' provision of teaching and learning materials on students' performance in Mathematics in K.C.S.E in Meru County, Chi-square was used.

## III. RESULTS AND DISCUSSIONS

### RESPONSE RATE PER SECONDARY SCHOOLS PER CATEGORY

The researcher targeted a representative sample of 92 secondary schools comprising of 64 mixed schools, 17 girls schools and 11 boy's schools were issued with the interview guides. Out of these, the entire 92 principal's filled and returned the interview guides making a response rate of 100.0%. The researcher also targeted 251 Mathematics teachers who were issued with questionnaires. However, only 223 successfully filled and returned the questionnaires making a response rate of 88.8%. These response rates were deemed high and enough to analyze and draw conclusions.

### KCSE PERFORMANCE IN MERU COUNTY FROM 2012 TO 2016

The dependent variable in the study was the student's KCSE performance in Mathematics. In order to obtain the trends in Mathematics performance, the researcher obtained a 5-year data from each of the 92 schools where the principals were interviewed. The results were as displayed in Table 4.1. However, the N value differed in each year as there were some schools that did not have students to sit for the national examinations in the respective years. These were mainly mixed day schools which had been opened recently and just started sitting for KCSE examinations.

| | N | Mean | Std. Deviation |
|---|---|---|---|
| KCSE_2012 | 83 | 4.332 | 1.981 |
| KCSE_2013 | 83 | 4.469 | 2.079 |
| KCSE_2014 | 86 | 4.415 | 1.946 |
| KCSE_2015 | 89 | 4.637 | 2.108 |
| KCSE_2016 | 92 | 3.756 | 2.380 |
| **Average** | **83** | **4.322** | **2.099** |

*Table 4.1: KCSE Performance in Mathematics in Meru County*

From the findings, it was observed that the overall mean average performance of students in the selected schools was 4.322, with a high standard deviation value of 2.099. The total score was based on a 12-point, with 12 being the highest score and 1 being the lowest. Therefore, it was discerned that on average, the average performance of the selected school was D+. The high standard deviation demonstrated the disparity between the schools with high Mathematics performance and those with the lowest performance.

For instance in 2013, the mean score was 4.469 with a high standard deviation of 2.08. It could also be observed that the Mathematics performance in KCSE dropped in 2014 (mean =4.415) and again in 2016 (mean =3.756). This showed that the performance of schools in Mathematics is generally low, but due to the high standard deviation, it is evident that the school performance is not uniform. Rather, some school seem to be performing well while the majority are performing poorly as seen in the low mean score values of less than five.

The table also shows that the performance has not been consistently improving, but rather, it increased between 2012 and 2014 before declining in 2014. In 2015 and 2016, a considerable decline in the performance can be seen. From these findings, it could be seen that there is no steady trend in the student's performance in Mathematics in KCSE. Rather, it was evident that the student's performance remain consistently poor in line with the national results which reveal a poor performance in Mathematics.

MATHEMATICS SPECIALISTS AND STUDENTS PERFORMANCE IN MATHEMATICS

The first objective presented by the study was to evaluate the effects of the principals' invitation of Mathematics specialists on how the students performed in Mathematics in KCSE examination in Meru County.

To meet this objective, the researcher asked the principals to indicate the external support staff (Mathematics specialists) they had invited to their schools, in the last five years (2012 - 2016), to improve student's performance in Mathematics. Their responses are provided in Table 4.2.

| External Staff | N=92 | Yes | No |
|---|---|---|---|
| Math Specialist | F | 20 | 72 |
| | % | 21.7 | 78.3 |
| Team Teaching | F | 12 | 80 |
| | % | 13 | 87 |
| Peer Teaching | F | 16 | 76 |
| | % | 17.4 | 82.6 |
| Others | F | 4 | 88 |
| | % | 4.3 | 95.7 |

*Table 4.2: External staff and student performance in Mathematics*

As displayed in the Table 4.2, only 20 (21.7%) of principals invited Mathematics specialists while the majority 72 (78.3%) did not invite Mathematics specialists. Other staff used by the principals were team teaching 12 (13%). In regards to peer teaching specialists, only 16 (17.4%) principals claimed that they invited peer teachers to their schools. Some principals four (4.3%) also claimed that they did not invite Mathematics specialists to their schools. These principals claimed that their Mathematics teachers serve as Mathematics specialists. This shows that some of the principals invite external Mathematics specialists to interact with their students and offer them advice and teach them.

The new perceptions and instruction methods brought forth by the external Mathematics specialists attending the schools help introduce students to new modes of learning. They also motivate the students by offering their experiences, challenges and best ways of approaching difficulties encountered in the subject. This sentiments are expressed by Campbell and Malkus (2010) who reported that when external Mathematics specialists are invited to schools, they gave students a new positive change on how they perform with time. However, it could be seen that most of the principals in these schools rely on their own Mathematic teacher as Mathematics specialists.

Therefore, the claims by Campbell and Malkus that external specialists and experts change the perceptions of teachers and introduce one way of approaching challenges and instruction is negated in the schools. As such, the benefits derived from having specialists and experts are negated by the principal's preference for internal specialists who, being the same teachers instructing the students, have nothing new and motivational to offer the students. This could, therefore, explain why the performance of students in Mathematics is not improving. As indicated in Table 4.2, the principals are not inviting external experts and Mathematics specialists, but are rather opting to use their own teachers as Mathematics specialists.

The researcher then conducted a chi-square test of independence to determine whether the invitation of an external support staff had an effect on student's performance in KCSE in Mathematics. To conduct the chi-square test, the researcher computed the student's KCSE mean performance and then categorized the average mean values into three where poor (mean=1.00-5.00), average (mean=5.01-7.9) and good (mean>8.00).

| Specialist | KCSE PERFROMANCE | | | | | P=value |
|---|---|---|---|---|---|---|
| | | N=92 | Poor | Average | Good | |
| Mathematics-Specialist | Yes | F | 1 | 15 | 5 | 0.021 |
| | | % | 1.09 | 16.3 | 5.43 | |
| | No | F | 69 | 2 | 0 | |
| | | % | 75.0 | 2.17 | 0 | |
| Team Teaching | Yes | F | 1 | 5 | 6 | 0.0065 |
| | | % | 1.09 | 5.43 | 6.52 | |
| | No | F | 64 | 12 | 4 | |
| | | % | 69.57 | 13.04 | 4.35 | |
| Peer Teaching | Yes | F | 1 | 10 | 5 | 0.048 |
| | | % | 1.09 | 10.9 | 5.43 | |
| | No | F | 70 | 5 | 1 | |
| | | % | 76.09 | 5.43 | 1.09 | |
| Others | Yes | F | 3 | 1 | 0 | 0.034 |
| | | % | 3.26 | 1.09 | 0 | |
| | No | F | 72 | 16 | 0 | |
| | | % | 78.26 | 17.39 | 0 | |

*Table 4.3: Chi Square Results- Specialists and KCSE Performance*

As the Table 4.3 showed, the five (5.43%) schools that performed well were those that invited Mathematics specialists; 15 (16.3%) of the average performers also invited Mathematics specialists. The majority 69 (75%) of schools that did not invite Mathematics specialists performed poorly - they had mean of one to five. These findings implied that inviting Mathematics specialists to schools brought about a positive change in the performance of students in Mathematics.

These findings are supported by the chi-square test of independence, which gave a p value of 0.021<0.05. The chi-square test of independence revealed that there was an association between use of Mathematics specialists and Mathematics performance; therefore, the researcher rejected the null hypothesis, which stated that there is no significant statistical relationship between principals' invitation of Mathematics specialists and students' performance in Mathematics in Meru County.

These findings are similar to Campbell and Malkus (2010) who stated that a positive achievement is seen with time when Mathematics specialists are availed to the students. The specialists in this study influenced the beliefs about Mathematics teaching and learning held by the Mathematics teachers with whom they were highly engaged, increasing a making-sense perspective and diminishing a traditional perspective.

These findings are also supported by Lamon (2005) who found that placing Mathematics specialists in the school has a positive impact on the learning goals of the learners. According to the researcher, specialists impact the school by affecting the teachers and their beliefs on professional and

personal development which in turn has an effect on their teaching.

In this case, inviting specialists leads to improved performance as the teacher's perceptions and attitudes are altered which directly impacts the student's attitudes.

Similarly, the researcher also observed that the majority of the schools that performed well six (6.52%) were those that invited team specialists to their schools while those that performed poorly 64 (69.57%) did not invite team specialists. These findings suggests that inviting team specialists to the schools had a positive impact on how students performed.

These findings are corroborated by the chi-square findings which showed a statistically significant ($p=0.006<0.05$) p value. Therefore, it is evident that inviting team teaching specialists had a significant effect on the performance of students in Mathematics. Lamon, (2005) reaffirms that when specialists work with Mathematics teachers, they address the Mathematical knowledge and instructional strategies of Mathematics teachers, but in so doing, they impacted teachers' beliefs and influence the degree to which Mathematics teachers access other avenues for professional development.

Indeed, there is evidence that Mathematics teachers' perceptions of Mathematics teaching and learning change or persist in concert with their instructional strategies. Similar findings are reported by the NSF (2004) who found that in elementary schools, Mathematics specialists offer the teachers leadership and coaching strategies to utilize when instructing learners in Mathematics.

They offered the teachers new approaches to use when conducting Mathematics lessons and how to use study models and resources effectively to promote learner uptake of content. Therefore, in relation to the findings from this study, it was evident that when schools invited Mathematics specialist to the schools, their teacher and learners stand to benefit from their insights, experiences and knowledge.

However, the majority of these schools did not invite Mathematics specialists which explains why their performance were dismal, while those that invited Mathematics specialists performed better. Similarly, Garet (2008) also reports that Mathematic specialists when invited to schools were invaluable to the teachers and the students. However, he reports that the majority of the schools did not derive benefits from specialists and experts as they do not invite them to their schools.

It was seen that the majority of the schools that performed well five (5.43%) and those that performed averagely 10(10.9%) were those that invited Mathematics peers to teach their students while the majority of the schools that performed poorly in Mathematics 70 (76.09%) were those that did not use peers in their schools.

These findings showed that peer teaching specialists, when invited to schools, had a positive impact on the performance of students. This notion is supported by the statistically significant p value 0.048, which implied that peer teaching specialists had a statistically significant impact on the student's performance in Mathematics. Bright, Frierson, Tarr, and Thomas, (2003) claims that specialist engagement, improved Mathematics teachers' beliefs about Mathematics teaching, and learning and Mathematics teachers' engagement in other forms of professional development. Peer teaching, also, positively impacts students' achievement, as they share the appropriate outcomes for evaluating the effectiveness of Mathematics specialists as a vehicle for school improvement.

Last, it was seen that most of the schools that did not invite Mathematics specialists but used their internal Mathematics teachers as substitutes for external support staff performed poorly three (3.26%) performed poorly while those that did not invite nor used their Mathematics teachers as specialists 72(78.26%) performed poorly.

The findings implied that using internal specialists in the schools had a positive impact on the student's performance. This was supported by the statistically significant p value of 0.034, which showed that performance of students is tied with inviting external support staff.

The majority of schools that performed poorly were those that failed to engage the services of external support staff. For those that used their teachers to fill in the role of external staff, their performance was still poor. This could be linked to the familiarity of the student's to their Mathematics teachers and their approaches to teaching Mathematics.

The respondents were then asked to indicate how often they invited the support staff they selected. Their responses are as indicated in Figure 4.1.

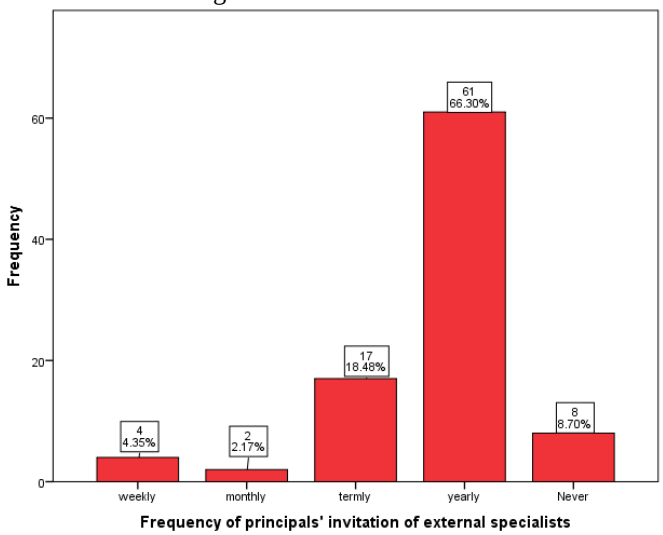


*Figure 4.1: Principals' views on frequency specialist invitation*

As the Figure 4.1 showed, the majority of principals invited external support 61(66.30%) only once a year while 17(18.48%) invited external support staff once a term, two (2.17%) invited them monthly, four (4.35%) invited them weekly while eight (8.70%) never invited external support staff. Similarly, Mathematics teachers were also asked to indicate how often their principals invited Mathematics specialists to their schools and the Figure 4.2 showed their responses.

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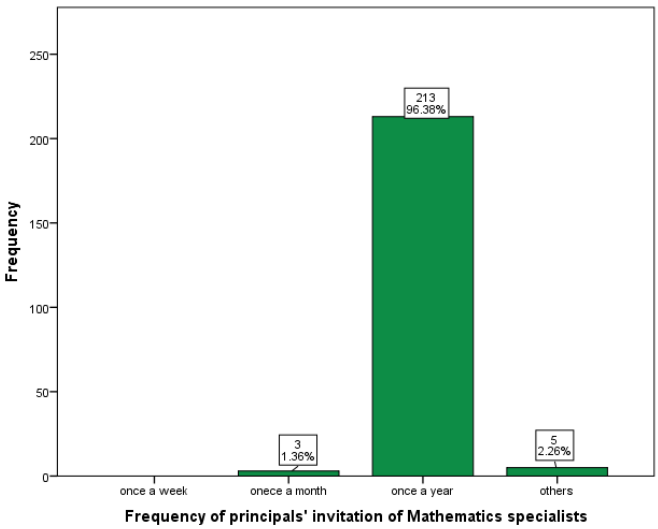


*Figure 4.2: Mathematics teacher's views on frequency of specialist invitation*

The majority of Mathematics teachers 213 (96.38%) claimed that their principals invited external staff once a year, while three (1.36%) invited them once a month and five (2.26%) claimed that their principals never invited Mathematics specialists to their schools. It was found out that schools that did not invite Mathematics specialists frequently had poor performance in Mathematics in KCSE. Most of the schools lacked finances which could have enabled them to invite Mathematics specialists frequently, which could lead to better performance in schools.

The researcher further asked the principals to indicate what follow-up programmes they carried out to ensure their students retained what they gained from the external support staff to improve Mathematics performance. Their responses are as displayed in the Figure 4.3.

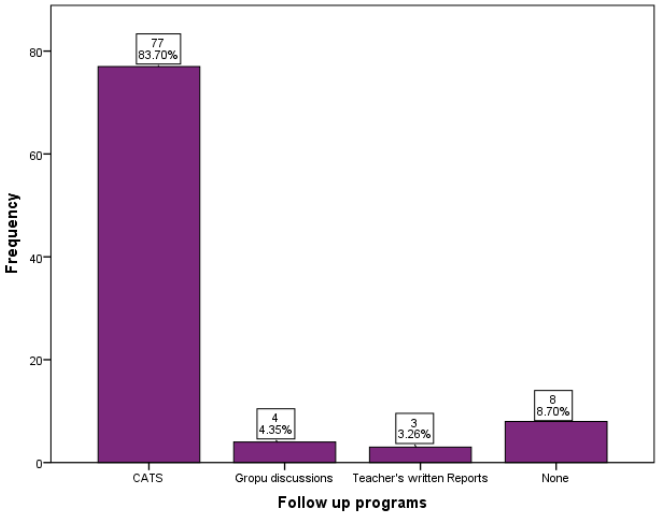


*Figure 4.3: Follow up programmes to ensure students retained what they had learnt after specialists had left*

As displayed in the Figure 4.3, the majority of follow up programmes adopted by the secondary schools were mainly Continuous Assessment Tests (CATS) 77(83.70%) while four (4.35%) used discussions, three (3.26%) used Mathematics teacher's written reports, while eight (8.70%) did not have follow up programmes.

The principals asserted that over the past five years, there had been an improvement in Mathematics performance which was contrary to the KCSE performance which showed a declining trend. This was evidenced by KCSE performance drop in 2014 (mean = 4.415) and again in 2016 (mean = 3.756).

The researcher then deemed it important to determine whether or not the principals monitored the Mathematics performance of learners after the specialists had gone. The Figure 4.4 showed their responses.

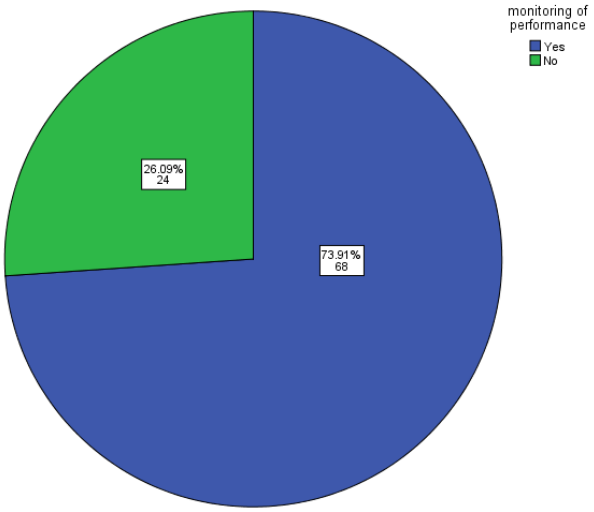


*Figure 4.4: Monitoring of performance after the invited specialist had left*

As displayed in the Figure 4.4, the majority of principals 68 (73.91%) asserted that they monitored performance, while 24 (26.05%) affirmed that they did not monitor performance after the specialist had left. From the interviews' it was also ascertained that monitoring of these strategies was done through CATS. One of the respondent was asked to evaluate their assessment she stated:

*"We use CATS to measure the results and to determine whether the specialists impacted the students. If the students do not perform well, then we repeat the strategy with their subject teachers.'*

Another principals claimed;

'*We use series that are done, marked and analysed then presented to the principal to comment on. In most cases the skills are reflected during the tests.... Overall, I think that the strategies are working wonderfully due to the improved performance in KCSE results.*

Similarly another one claimed;

*'CAT results are presented to me where I meet with members of the Mathematics department for discussion and analysis and then we come up with ways to work on the identified areas that need improvement.'*

These statements were evidences that principals used CATs, marked them and advice their Mathematics teachers on how to improve performance in Mathematics in KCSE.

The principals and Mathematics teachers were also asked to indicate the strategies they used to improve student's performance in their schools. The Figure 4.5 showcases the Mathematics teacher's responses on the strategies used to improve student performance in Mathematics.

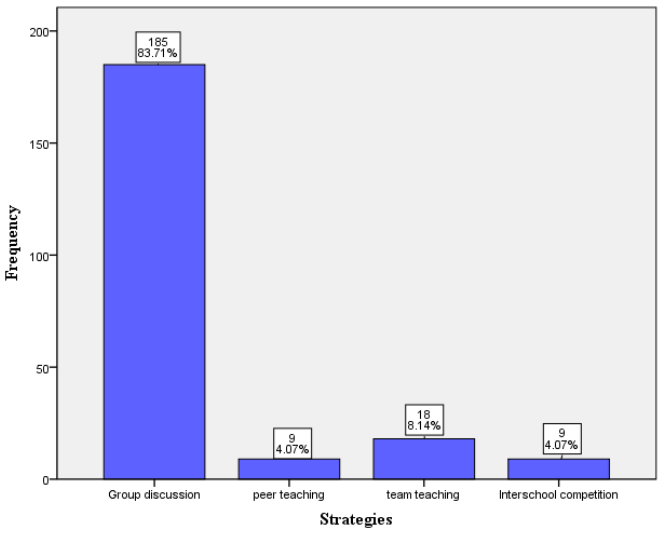


*Figure 4.5: Mathematics teachers' strategies to improve performance in Mathematics*

As displayed in Figure 4.5, the majority of Mathematics teachers 185 (83.71%) indicated that they used group discussions, while a minority 18(8.14%) claimed that they used team teaching. Nine (4.07%) asserted that they used peer teaching and nine (4.07%) indicated that they used inter-school competitions. Based on these findings, it was seen that the majority of Mathematics teachers (83.71%) used group discussions to promote student performance in Mathematics.

The Table 4.4 indicates the principals' responses in regards to the strategies adopted in their schools to improve student's performance in Mathematics.

| Other Strategies | N=92 | Yes | No |
|---|---|---|---|
| Group Discussions | F | 32 | 60 |
| | % | 34.8 | 65.2 |
| CATS | F | 13 | 79 |
| | % | 14.1 | 85.9 |
| Math Contest | F | 9 | 83 |
| | % | 9.8 | 90.2 |
| Symposiums | F | 8 | 84 |
| | % | 8.7 | 91.3 |

*Table 4.4: Other strategies to improve performance in Mathematics*

As displayed in Table 4.4, group discussions were utilized by 32 (34.8%) schools. In regards to CATs, minority 13 (14.1%) of principals asserted that they used it as a strategy to improve performance. Mathematics contests were also cited by only nine (9.8%) of the principals and eight (8.7%) also claimed that they organized symposiums for their students.

From these responses it was discerned that group discussions and CATs were commonly adopted strategies by principals to improve Mathematics performance. Use of Mathematics contests and symposiums were found to be rarely adopted strategies by the schools. Generally, it was seen that most of the schools did not adopt most of the teaching strategies that could enable their students to perform better in Mathematics

A chi-square test of independence was conducted to determine how the adoption of different strategies in the schools affected the performance of students. Other strategies included group discussions, CATs, Mathematics contests and symposiums. The null hypothesis was that there was no significant relationship between Mathematics performance and use of the stated strategies. The findings are presented in Table 4.5.

| Other strategies | | KCSE PERFROMANCE | | | | P=value |
|---|---|---|---|---|---|---|
| | | N=92 | Poor | Average | Good | |
| Group Discussions | Yes | F | 10 | 17 | 5 | 0.006 |
| | | % | 10.87 | 18.48 | 5.43 | |
| | No | F | 60 | 0 | 0 | |
| | | % | 65.22 | 0 | 0 | |
| CATS | Yes | F | 5 | 6 | 2 | 0.003 |
| | | % | 5.43 | 5.52 | 2.17 | |
| | No | F | 65 | 11 | 3 | |
| | | % | 70.65 | 11.96 | 3.26 | |
| Mathematics Contests | Yes | F | 4 | 3 | 2 | 0.022 |
| | | % | 4.35 | 3.26 | 2.17 | |
| | No | F | 66 | 14 | 3 | |
| | | % | 71.74 | 15.22 | 3.26 | |
| Symposiums | Yes | F | 5 | 2 | 1 | 0.544 |
| | | % | 5.43 | 2.17 | 1.09 | |
| | No | F | 65 | 15 | 4 | |
| | | % | 70.65 | 16.30 | 4.35 | |

*Table 4.5: Chi Square Results on Other Strategies and KCSE Performance*

Majority 60 (65.22%) of the schools that did not use discussion groups performed poorly, and the majority 17 (18.48%) of the schools that used discussion groups had an average performance. The chi-square test of independence gave a p value of 0.006, which was statistically significant. The researcher, therefore, rejected the null hypothesis, which stated that there was no significant relationship between the schools which used discussion groups and those which did not. This revealed that there was a relationship between use of discussion groups and student' performance in Mathematics; schools that used discussion groups performed better.

It was established that among the majority of schools that used CATS as a teaching strategy, six (6.52%) were average performers, while the majority of schools that did not use CATS 65 (70.65%) were those that performed poorly.

These findings implied that CATS as a technique to improve performance affects student's performance as evidenced by the statistically significant p value; chi-square test of independence indicated a p value of 0.003. Therefore, we rejected our null hypothesis that there is no association between performance in Mathematics in the schools that used CATs and those which did not use. Therefore, it was deduced that using CATS as a teaching technique could help improve how students performed in Mathematics.

Similarly, the majority of the schools that performed poorly 66 (71.74%) in Mathematics did not conduct Mathematics contests as a teaching strategy to improve performance in Mathematics. Chi-square test of independence to test the relationship between Mathematics contest and students' performance in Mathematics gave a p value of 0.022, which was not statistically significant. Therefore, we rejected our hypothesis that there was no relationship between students' performance in Mathematics and Mathematics contests organized. It was discerned that organizing

Mathematics contests for the students could lead to performance improvement.

Lastly, the table also shows that the majority of schools that performed poorly in Mathematics 65 (70.65%) were those that did not use symposiums as a technique to improve Mathematics performance, while the majority of the schools that performed well 3(3.26%) organized symposiums for their students.

The chi-square test of independence to test the relationship between use of symposiums as a strategy to improve Mathematics performance and students Mathematics performance had a p value of (0.544>0.05), which was statistically significant. Therefore, symposiums, as a strategy to improve students' performance did not have a significant effect on students' performance in Mathematics.

Generally, it was seen that group discussions, CATS, and Mathematics contests were effective strategies adopted by schools to improve Mathematics performance while symposiums did not have a significant effect on performance.

These findings suggested that Mathematics specialists, team teaching or peer teaching positively influenced the performance of students by encouraging adoption of a wide range of strategies. Garet (2008) claims that experienced specialists, when they work closely with classroom Mathematics teachers, they provide full-time support in a school after completing coursework in Mathematics content and in leadership/coaching, as well as study of models, resources, and were the best strategies for Mathematics instruction.

## IV. CONCLUSIONS

From the findings, it could be concluded that most of the schools did not invite external support staff yet it was seen that they had a significant effects on the performance of students in Mathematics. Further, it was seen that team teaching, peer teaching, group discussions, Mathematics contests and CATS as teaching strategies had a significant effects on the student's performance in Mathematics.

## V. RECOMMENDATIONS

- ✓ Principals should invite more than one specialist to the school to ensure that Mathematics teachers and students are exposed to different kinds of skills and strategies on Mathematics performance in K.C.S.E examination
- ✓ Principals should increase the frequency of inviting the external support staff from annually to one or twice per term to ensure that the skills and strategies imparted are reinforced to become a routine practice for the Mathematics teachers and the students.
- ✓ Principals and Mathematics teachers should adopt more than one strategy in teaching their learners.

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