PRINCIPALS' ADMINISTRATIVE STRATEGIES AND STUDENTS' PERFORMANCE IN MATHEMATICS IN KENYA CERTIFICATE OF SECONDARY EDUCATION IN MERU COUNTY, KENYA

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THESIS SUBMITTED TO THE SCHOOL OF EDUCATION IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY IN EDUCATIONAL ADMINISTRATION OF MAASAI MARA UNIVERSITY

OCTOBER, 2021

DECLARATION

This thesis is my original work and has not been presented for the academic award in this or any other university.

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Supervisors' Approval

This thesis has been submitted for the examination with our approval as university supervisors.

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In memory of my late father Francis M'Kirikua and my late mother Zipporah Ciobaitimitu. My beloved wife Angelica Mwathimba Maingi and my children Mugambi, Kirimi, and Koome.

ACKNOWLEDGMENTS

I would like to thank the almighty God who has helped me reach this far. My sincere gratitude also goes to my supervisors Prof. Paul Maithya and Dr. Alexander Ronoh, the Dean School of Education, all the lecturers in the School of Education who greatly advised me during my departmental and school defenses. I would also like to pass my sincere gratitude to Meru County commissioner, Meru County Director of Education, Principals' and Mathematics teachers in the County, who gave me permission and authority to collect data and valuable information which enabled me to complete my research work.

LIST OF ABBREVIATIONS AND ACRONYMS

CDE	County Director of Education
QASO	Quality Assurance and Standards Officer
HOD	Head of Department
KCSE	Kenya Certificate of Secondary Education
KEMI	Kenya Education Management Institute
KNEC	Kenya National Examinations Council
KSSHA	Kenya Secondary School Heads Association
MOEST	Ministry of Education Science and Technology
SCEO	Sub-County Education Officer
SPSS	Statistical Package for Social Sciences
USA	United States of America

ABSTRACT

Performance in Mathematics in Meru County, Kenya from 2012 to 2016 has consistently been deteriorating. The purpose of this study was to examine the effects of how the administrative strategies designed by the principals on students' Mathematics performance in the Kenya Certificate of Secondary Education (KCSE) in Meru County. Objectives that directed the study were to examine the effects of various attributes on students' performance in the KCSE examination in Meru County. The objectives were to examine the effects of the Principal's invitation of Mathematics specialists, establish Principals' support to teachers through Mathematics seminars, and determine the effects of principals' organization of Mathematics contests and evaluate the effects of Principals' provision of materials for learning and teaching. This study used *ex post fact* research design because of the effects of independent variables on dependent variables. The research instrument was a Mathematics teachers' questionnaire and the 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 insured by piloting the instrument. Reliability was insured by using the split-half technique. From the findings, the majority ofMathematics teachers and principals claimed that they invited Mathematics specialists and used 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 the invitation of Mathematics specialists (p 0.021), team teaching (p 0.0065), peer teaching specialists (p 0.048), and others (p 0.034) all had a significant effect on how students performed. Findings further revealed that principals were not sponsoring Mathematics teachers to attend seminars with the majority having never attended Mathematics contests in the last two years. The principals cited a lack of resources and budgetary allocation to the low number of Mathematics teachers attending seminars. It was also revealed that most principals did not organize Mathematics contests, and the majority of schools never organized Mathematics contests. The ANOVA results showed a significant association between the mean performance in Mathematics and the number of Mathematics contests organized by the principals ($p=0.000<0.05$). In regards to teaching resources, the majority of schools had satisfactory Mathematics syllabus provision, adequate departmental teaching and revision materials, and adequate textbooks. However, marking and checking schemes of work were not satisfactory to the majority of the respondents. In regards to learning resources, the majority of respondents affirmed that teaching aids were satisfactorily provided, but schools were not financially stable, which was evidenced by the low organization of Mathematics contests externally as compared to high organizations internally. 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 the 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. The researchers also concluded that attendance of seminars was minimal or non-existent in the majority of the schools, it was also concluded that schools in Meru County did not generally organize external Mathematics contests. The study also concluded that the provision of teaching and learning resources affected school performance in mathematics.

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CHAPTER ONE

INTRODUCTION

1.1 Overview

This chapter looks at the background of the study, problem statement, purpose of the study, Objectives of the study, hypotheses of the study, significance of the study, limitations of the study, delimitations of the study, assumptions of the study, and operational definition of terms.

1.2Background to the Study

Education across the world is viewed as presented as a tool to impact how the nation develops. This is evident in the amount of investment that nations across the world have put in the sector (UNESCO, 2015). As reported in 2015 by the United Nations Education Scientific and Cultural Organization (UNESCO, 2015), education is one of the largest sectors that nations have greatly invested in. Secondary education is a crucial phase in the system of education. It is at this stage that valuable skills and the necessary knowledge are equipped to the students required by them to contribute to the economic growth of their country (World Bank, 2011).

The quality of any education system is the guiding principle that the system should not rise above. According to UNESCO (2015), the role of the principal is crucial in determining the performance of the school. The principal's performance is mainly measured in terms of student performance. This is especially so because good performance is necessary for the selection and placement of students in institutions of higher learning and jobs in various firms and organizations. In most cases, the number of students who perform well at national examinations has been a measure of the quality of education (World Bank, 2011).

As a sure way of improving 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 the success of students as one of the key roles of the principal (Hill, 2006). With that, the responsibility of over viewing school systems, their processes, and even resources and how all these combine to create the purposed learning outcomes for students are 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 the 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 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.

It's a global concern how students perform in Mathematics as evidenced in different studies. There is a study in the USA done by the 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 the 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 2009-2007 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, 2005 indicated that there was no significant difference in Mathematics scores in this period (TIMSS, 2003). The Mathematics performance was poor between 2005 and 2003.

A report by the National Education Commission of Tanzania (NECTA), (2017) 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 performances in Mathematics among secondary schools students have been poor for many years Kenya National Examination Council (KNEC, 2006). This has the amplifying effect that Kenya may not achieve the goal of industrialization as envisaged in 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 the Kenyan government prioritizing Mathematics achievement and declaring it in her National Development Plan (2008). Some of the contributors to 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 the 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 teachers are overloaded with a high number of pupils per class, more than one subject to teach, and a 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 from 2012 to 2016 in 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 2012 to 2016 shows that performance in Mathematics has been below average (KNEC, 2017).While 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 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.

1.3 Statement of the Problem

In 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 (Table 1.1).Mathematics scores have been below average (3.5706), 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 the administrative role of school principals on student performance, there is limited information on the evaluation of principals' administrative strategies on student performance in Mathematics and especially in Meru County.

1.4 Purpose of the Study

The purpose of the study was to examines the effects of principals' administrative strategies in students' Mathematics Performance in the Kenya Certificate of Secondary Education in Meru County, Kenya.

1.5 Objectives of the Study

The study was guided by the following objectives:

i. To Examine the effects of the principals' invitation of Mathematics specialists on students' performance in Mathematics in KCSE in Meru County.
ii. To Establish the effects of principals' support to teachers through Mathematics seminars on students' performance in Mathematics in KCSE in Meru County.
iii. To Determine the effects of principals' organization of Mathematics contests on students' performance in Mathematics in KCSE in Meru County.
iv. To Evaluate the effects of principals' provision of Mathematics teaching and learning materials on students' performance in Mathematics in K.C.S.E in Meru County.

1.6 Study Hypothesis

i. H_0: There are no significant statistical effects of principals' invitation of Mathematics specialists and students' performance in Mathematics in KCSE in Meru County.
ii. H_0: There are no significant statistical effects of the principals' support to teachers through Mathematics seminars and students' performance in Mathematics in KCSE Meru County.

iii. H_0: There are no significant statistical effects of principals' organization of Mathematics contests and students' performance in Mathematics in KCSE Meru County.

iv. H_0: There are no significant statistical effects of principals' provision of Mathematics teaching and learning materials and students' performance in Mathematics in K.C.S.E in Meru County.

1.7 Justification for the Study

Nationally, Meru County was ranked at position 28th out of the 47 counties in Kenya in 2015 in Mathematics performance. Contrary, its neighbors Tharaka Nithi and Embu were ranked eighteenth and ninth respectively. Overall, Meru County had a mean average grade of D Plain. So, due to its poor performance, there was a need to evaluate the effects of principals' strategies of administration and students' performance in Mathematics in KCSE in the county. Therefore, because of this poor performance in Meru County, the researcher was justified to carry out a study to see the reason for the poor performance in Mathematics from 2012 to 2016.

1.8 Significance of the Study

The study findings were expected to be useful to the Ministry of Education, policy makers, teachers, students, and other education stakeholders in the county when formulating strategies based on academic performance in Mathematics in schools. The study is expected to assist the Quality Assurance and Standard Officers, both at the County and the national levels to improve the quality of teaching in secondary schools, to give more advice and guidance to Mathematics teachers. This was expected to improve on their teaching approaches and methods. It is expected to help Kenya Education Management Institute (KEMI) when carrying out induction courses on the principals' best administrative strategies to improve

Mathematics performance in secondary schools. It is expected to help policy makers in education and other stakeholders when developing new education policies in education based on administrative strategies for better performance in schools. It is hoped that the findings of the study may also benefit principals, teachers, and students on the best administrative strategies to better performance academically in the schools in Kenya and Meru County in particular. It was also expected that the study could contribute to the literature that may be useful in future studies.

1.9 Limitations of the Study

The following limitations underpinned the study:

i. The Willingness of the respondents to provide accurate data. However, during the face-to-face encounter with respondents, the researcher reassured them of confidentially so that the respondents would provide the required data without any reservations. This made the respondents give the information to the researcher without fear. Furthermore, respondents were informed that the study findings would only be used for academic purposes and that they would be kept as confidential as possible.

ii. The remote location of some schools. Some schools in Meru County were remotely located in places with little or no network coverage as well as poor roads. This made it difficult for the researcher to connect with the respondents. to address this limitation, the researcher allocated adequate time for data collection where physical visiting were made to plan with the respondents. Physical meetings were effective in the whole process of data collection though a lot of time and cost was incurred even on matters that could be addressed over the phone or other convenient means of communication. For instance, their times when the researcher had to visit the same schools more than three times due to the unavailability of respondents and lack of convenient methods of scheduling time without actual visits. All in all, the researcher was able to achieve the requirements of the study.

iii. The researcher further faced limitations associated with the scheduling of interviews. While there was not much problem with data collection using questionnaires, there was a serious challenge to schedule interviews with the principals. Some of them kept postponing the actual date even in the eleventh hour. Sometimes the researcher would wait for long to no avail. However, the researcher persevered such inconveniences to ensure the study had adequate representation.

1.10 Delimitation of the Study

This research work was confined to Meru County. Therefore the researcher collected data on sampled secondary school in Meru County. The researcher did not collect data of secondary schools outside Meru County for these were not within its scope.

1.11 Assumptions of the Study

The assumptions of the study were made to ensure that the study results were accurate and reliable. The assumptions were as follows:

i. It is assumed that most of the Principals are trained and certified persons in the management of the school curriculum
ii. That most of the Principals ensure that the resources are available and efficiently used for teaching supervise, and provides for academic and professional guidance to the Mathematics teachers.
iii. That Mathematics performance is recognized by most of the principals as below expectation in their respective schools.
iv. That most of the principals practice some administrative strategies meant to improve Mathematics performance in their respective secondary schools.

1.13 Operational Definition of Terms

Quality grades	The assurance of excellence is the grade that one can attain to be taken for a program or subject of study in the university for instance C+ and above.
Principals' administrative strategies:	Refers to collaborative attempts that principals do to create a supportive environment.
Principals' provision of learners materials:	This is where the principal buys relevant teaching and learning materials and other Mathematics equipment to facilitate teaching Mathematics. Principals' organization of Mathematics contests this whereby the principal facilitates Mathematics teachers with funds to organize internal contests or external contests.
Principals'	Refers to persons appointed by the Teachers Service Commission to manage secondary schools education on behalf of the ministry of education and another stakeholder in Kenya.

Students' Performance	Means achievement accomplishment as the student goes through their course of study from form one to form four and undertakes K.C.S.E examination and attain grades and mean score for placement in university courses in different areas of study.
Invitation of Mathematics specialists:	Refers to principals' practice of organizing special sessions where Mathematics specialists are invited to talk to students and motivate them.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The literature review section examines global Mathematics performance, invitation of Mathematics specialists and students' performance in Mathematics, how principals support the development of teachers and how it affects the performance of students, principals' organization of Mathematics contests and students' performance in Mathematics, and principals' dedication to providing educational resources and effects on the performance of students. It then summarizes the literature review and provides a conceptual and theoretical framework.

2.2 Overview of Global Mathematics Performance

From the results carried out in international surveys and other research, it is seen that the low performance in mathematics is quite a complex matter (Mwagiru, 2014; OECD, 2009b; Marete, 2012; Nyabwa, 2008). From 2008/09, in Ireland, the poor performance seen in English reading and mathematics was linked to the unemployment of parents, coming from a large-sized or lone-parent family, and speaking the vernacular language instead of the instruction language, as seen in the findings of the 2009 National Assessments of Mathematics and English Reading. Positive contributors to the test scores included availing books and educational resources at home. The 2003 International Trends in Mathematics and Science Studies (TIMSS) brought together many African countries, including South Africa, Botswana, Morocco, Tunisia, and Egypt. A similar TIMSS test was held in 2005, and the statistics provided an insignificant score in mathematics during the two periods (TIMSS, 2003).

Comparison with TIMSS 2005 indicated that there was no significant difference in mathematics scores in this period (TIMSS, 2003). A report by the National Education Commission of Tanzania (NECTA) in Tanzania indicated that basic mathematics performance in the subject has been going down (NECTA, 2017). NECTA's (2014) report on form four national examination performances also indicates that students performed poorly in mathematics as compared to other subjects. The Kenya National Examination Council (2006) notes that the statistical trend in Mathematics indicates a dismal performance among students for years despite the educational programs to ensure secondary schools have qualified Mathematics teachers. Going by the performance statistics in mathematics, it is unlikely that Kenya will achieve its industrialization goals as contained in the Vision 2030 development strategy.

2.3 Concept of the Principal's Administrative Strategies

According to Igwe (2001), administrative strategies mean the roles played by school principals to ensure that goals are met within the set standards by directing, supervising, and guiding every activity within their mandate. Olembo (2014), as cited by Muriithi (2012), views administrative practices as an intervention to improve work standards. Thus, the school's administrative strategies refer to the interventions taken by the school's principals based on their knowledge and experiences to ensure proper coordination of learning and teaching resources, provide guidance, and perform oversight roles in the improvement of teaching and learning activities. This is achieved by ensuring that teachers, learners, and support staff follow all the procedures, regulations, and principles that have been set to control the relationship and interaction among these parties. It is only through this that principles can ensure the effective implementation of educational goals and objectives.

In a school, the administration responsibility entails doing an assessment, maintaining discipline, curriculum administration and teaching, giving examinations and evaluations, management, allocating resources, appraising staff, creating a good relationship with the community, giving pastoral care, costing and planning forward, and using skills for making decisions, negotiating, bargaining, solving conflicts and running meetings and communicating among others (Owojori & Asaolu, 2010). A summary of the above is organizing, directing, planning, and evaluation of the school system and the principal has to ensure are geared towards effective learning and teaching in the school for quality results to be produced.

As implied in the roles above, it means the principal becomes the controller, coordinator, planner, problem-solver, adviser, and organizer of the school, (Maduabum, 2012). He/she is the one who shoulders the administrative functions and holds the failure or success of the school. Uyanga (2008) noted that it is the duty of the principal to make sure that the staff in the school are assigned responsibilities in line with their area of expertise and specialization and that institutional goals and objectives tally with the national objectives (Uyanga, 2007).

Some of the administrative tasks that school principals perform include managing school finances. The responsibility of revenue control and ensuring it is well utilized by the PTA levy is done by the principal as the executive chief and accounting officer (Chiriswa, 2012). Funds can be raised by the school to add up to what the government offers when the principal has a good rapport with the Old Students' Association, the non-governmental organization sector, the Parents Teachers Association, and the Board of Management (BoM). These groups can have fundraising activities, provide and maintain facilities in the school and the principal must be concerned about the school's facilities (Wanyonyi, 2014).

This includes taking note of dilapidated buildings, any projects abandoned, roofs leaking, lawns and trees overgrown, and dark and dingy buildings that demoralize people, more so adolescents (Uganya, 2007). Therefore, the principal ensures all are in great condition. Despite the limited resources the school has, the principal has a duty to avail educational resources which are essential for learning to take place (Babayemi, 2008).

Another task is that of motivation. The principal is a motivator. In their study, Ajayi and Oguntoye (2006), stated that a principal should have the right expertise that enables them to exercise guidance and effective control of administration based on his exemplary administrative skills. He/she has to motivate staff and change their attitudes so that they are better positioned to offer a leading educational process to meet their individual, school, and national educational goals.

Job performance is enhanced through motivation and the principal is deemed a supervisor for the curriculum and instructions (Ajayi & Oguntoye, 2006). Getting and making available teachers for educational purposes, visiting classrooms to see what teachers are teaching, review of lesson plans, registers, notes, diaries, and other teaching aids for the teachers, and giving advice accordingly for improvement are some of the supervisory roles of the principal. The school principal is also a change facilitator. He/she is an important element in the efforts to bring change to the school. According to Akinsolu (2011), reforms in the school are possible through the principal, who pivots them for change and reforms in the entire society to be realized. Therefore, principals must execute managerial roles to adapt to these changes and ensure they occur in the school system.

2.3.1 Invitation of Mathematics Specialists and Students' Performance

Campbell and Malkus (2010) in their study to assess the impact of elementary mathematics specialists on student achievement among grades 3, 4, and 5 in schools across Virginia found that these mathematics specialists brought a positive change in how the students perform with time. To get the results, a three-year randomized control study design was used. Overall, the positive impact of the specialists was only possible when the administrative and instructional staff worked together, as seen in the experience gained by the specialists. It was seen in their study that a change in the beliefs about how to teach and learn mathematics by the teachers who were highly engaged was influenced, leading to an increased sense of the new attitudes and diminishing the traditional way of teaching. In addition, the schools that had an elementary specialist in comparison to the control schools found that their teachers were more engaged in professional development available more than in control schools (Campbell & Malkus, 2010). The study, though significant in its use of a randomized control study to determine the influence of a math specialist over time on students' performance, targeted primary school learners; hence the findings may be limited by its target population as this study's target population was secondary school students.

The aim of having mathematics specialists in a school is to improve students' test scores. Another measure of how these specialists impact a school is how they affect the beliefs of teachers and their participation in forums of professional development that address mathematics content and pedagogy (Lamon, 2005). It is seen that the impact brought by specialists working with teachers addresses the strategies used by the teachers to instruct and boost their knowledge, and also has an influence on their beliefs, thus changing the teacher's access to avenues of professional development.

There is enough evidence to back up the fact that the perceptions held by teachers of mathematics in teaching and learning change as they embrace the instructional strategies as aided by the specialists (Lamon, 2005; Bright, Frierson, Tarr, & Thomas, 2003). This, therefore, means that when evaluating the possible outcomes impacted by Mathematics specialists in a school improvement manner, a look at the beliefs of Mathematics teachers on how they teach and learn Mathematics, how the students achieve in the subject, and teacher engagement in professional development forums are ways to evaluate such.

According to Campbell and Malkus (2010), inviting mathematics specialists may have a positive impact on what the students achieve as time progresses. Mathematics seminars and workshops are among the strategies used in teachers' professional development (Garet, 2008). There are different studies to state that professional development affects how 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.

In Virginia in the year 2004, the National Science Foundation (NSF) funded a collaborative project that set out to find out the role played by Mathematics specialists in elementary schools in a randomized control-treatment design that sampled five school districts and four universities which were done in three years. The specialists were selected among experienced teachers after they completed coursework on Mathematics content from the school district under study and had to give full-time help and support in the assigned schools. This involved offering leadership and coaching, provide the best strategies to instruct Mathematics lessons, and use of study models and resources (Garet, 2008). These studies were conducted in elementary school and not a secondary school.

This study would therefore aim to investigate the effect of Mathematics specialists on students' performance in KCSE examinations in Meru County. The study was, however, a randomized control study, whereas the current study was an ex-post study design; hence the findings may not be replicable to the current context.

2.3.2 Principals' Support to Teachers and Students' Performance

The mathematics teaching seminars are about innovations and projects that are underway in teaching mathematics. Seminars and workshops are among the strategies used in teachers' professional development (Liebowits & Porter, 2019; Garet, 2008). Research is underway to understand how the concept of professional development affects how students achieve. In an experimental study conducted by some scholars, their findings stated that high professional development boosted the teachers' knowledge and improved their desired practices in the classrooms but did not impact on the desired students' outcomes nor any sustainable changes as time progressed (Garet, 2008; Wilson, 2009).

There was yet another study in 2017 by a scholar Yoon which reviewed 1300 studies done on professional development in the US Department of Education's What Works Clearinghouse. In his findings, he discovered that only 9 researchers had met the rigorous standards set by the department (Yoon, 2017; Gates, Baird, Master, & Chavez-Herrerias, 2019). He also found out that teachers who had received just a 'substantial' level of professional development, i.e., 49 hours, could see their students improve by 21% in their achievement (Yoon, 2017; Gates, Baird, Master, & Chavez-Herrerias, 2019). The study was conducted in the U.S., which has different social and economic factors that may affect the role of specialists in schools. Therefore, the current study used local information and data to determine whether the invitation of math specialists influenced students' performance.

Another study done by Grissom, Egalite, and Lindsay, (2021) reviewed how the professional development programs were designed and translated to a significant improvement in how the students achieved in mathematics and science. In their design, these programs had some common features that included: assisting in the implementation process, supporting teachers in terms of mentoring and colleagues in the schools, and strongly recommending that teachers reinforce learning through follow-up and specialization of teachers on specific pedagogical and learning content (Blank & Alas, 2009). The needs of new teachers in any school are met by them undergoing an induction program that is focused on their professional development. The programs have components of orientation sessions, a formative assessment used, mentorship, and even classroom observations (Berry, Hopkins-Thompson, & Hoke, 2002; Isenberg, 2009).According to the South Africa Department of Education (2008), professional development symbolizes all the goings-on in learning and teaching aimed at empowering teachers to accomplish their duties more competently and successfully towards achieving improved learner achievement. It is concerned with enabling learners to receive learning by providing teachers with quality teaching skills and subject knowledge to enable them to impart knowledge to the learners. Additionally, it is specified that teaching involves experts being well-informed of new developments in order to be imaginative and passionate educators so that students can perform well.

The Department of Education (2008) further stresses schools need to conduct professional development programs for the staff for them to attain endurance in professional development. The purpose of professional development is to ensure that clarification of learners' achievement is done and this must be understood by the principal who is the instructional leader. It therefore means that staff development is a tool to help in achieving better results, improving the school's efficacy, and creating active learning and teaching environments.

To improve the performance of students in mathematics, professional development of teachers should focus on making improvements in instructional practice that give teachers new knowledge and ways to evaluate learning (Wei et al., 2009). Without the knowledge and the dream of improving students' outcomes, a principal cannot be an instructional leader, and it is only through the facilitation of the process in rising teachers' aptitudes through professional development that makes principals effective (Fink & Resnick, 2001; Lashway, 2002). In summary, staff development improves the professional skills of teachers and their aptitudes.

Gumus and Akcaoglu (2017) argue that since teachers are the ones who implement the curriculum in the classroom setting, the need for the principal to help them develop professionally is important for the quality of classroom content to be achieved. According to Niyazi (2009), principals have a duty to exercise their leadership role in education to help teachers develop their self-esteem so they can exploit their leadership capabilities and pass it to their peers. The principal should also create an environment that allows continuous learning so that they can continue developing their skills.

According to Gumus and Akcaoglu (2017), principals have essential instructional tasks which include leading in support of professional development programmes. These tasks, directly or indirectly, point to the fact that the principal is mandated to support the teachers' growth. It can also be said that two significant behaviors of effective principals who absolutely affect learners' education talk with teachers, model, give feed-back and provide professional development opportunities.

The principals must have knowledge of the instruction for them to monitor, assess, direct, and even advise the teachers. The principal as the instructional leader is supposed to make sure that teachers formulate challenging programs through their attendance of developmental

workshops. Apart from being the leader instructionally, the principal should also engage his staff in planning for their development programs for them to have a feel of ownership of the same.

Niyazi (2009) advances the idea that the principal should be ready to help in the teachers' learning programmes. An environment where teachers can train, polish, even reflect and make improvements to their training must be created by the principal, who is also supposed to advocate and organize the avenue for professional learning. The leadership deliberations of school heads are founded on their strong desire to cultivate values education for all learners. The principals also serve as mentors for beginner teachers and facilitate professional development events as master teachers.

Despres (2008) data from studies on educational improvement advocate that teacher stability is vital to sustained positive students' achievement. In schools where staff remained steady and where they participated in staff development progression in training and implementation, there was high quality teaching and delivery in teacher practices that led to advanced learner achievement gains.

Payne and Wolfson (2000) pointed out that the principal, as a role model, played an ultimate role in teacher professional development for continual learning. The principal is the frontrunner of the learning organization, motivates and supports the teachers and learners, is the provider of the resources, and the initiator of staff professional development programmes. Staff development is significant for the principals as it is for the teachers they lead.

Academic performance of students can be significantly improved through support of professional development of teachers, making it critical for learning (Glanz, 2006). However, most of the teacher development programs lack content, are occasional, and irrelevant to the teachers' needs. Regrettably, staff development occasionally is not useful for a teacher or groups of teachers' specific situations because it comes in a top-down form. Blasé and Blasé's (2000) resolution to these weaknesses suggests that the supervision process changes towards the self-directed method of teacher-reflection by means of peer-coaching or action research. This can assist teachers in gaining applicable staff development.

Glickman (2002) argues that the change towards self-directed supervision and staff development would assist in handling teachers as professionals who hold a body of knowledge, abilities, and practices that must be repeatedly tried and elevated amongst other teachers. The fundamental aim of staff development is to enable teachers to identify their individual strengths and weaknesses, thus making them adjust to realize the goals and objectives of teaching. Through staff development, teachers acquire the right attitudes, skills, and knowledge that are very essential tools in educational practice.

When the principals give information to the teachers about any available opportunities, it can be through activities that focus on professional development done in the school. It is important to have administrators support the adoption of new teaching practices and sustained usage of them. It is a prerequisite for teachers to be involved in influencing professional development to enable them to meet the targets that the school has set. Apart from the above components, teachers are tasked with repeatedly and in a formative manner, evaluating the learning of students and themselves (Wei et al., 2009).

In their study in 2006, Desimone, Smith & Ueno stated that an increase in how teachers perform in classroom instruction is brought by staff development. This can significantly

improve the quality of service offered by school teachers, resulting in improved educational outcomes (Desimone, 2011). It is the responsibility of the managers of secondary schools to facilitate the teachers for them to attain professional development of high quality.

According to Blank and Alas (2009), programs of professional development that have shown great impact tend to have common features in their designs, such as emphasizing that teachers learn a specific subject have the follow-up reinforcement of learning, pedagogical content, assisting teachers to implement what they have learnt, and mentorship support from external experts and fellow teachers. Traditional programs for developing teacher professionalism have been deemed unfavorable for improving the instructional practices of teachers (Desimone, 2009; Kwakman, 2003). The underlying reason is provided by Fullan and Mascal (2000), who maintain that the method does not encourage active engagement and planning of teaching, which are key elements of improvement in educational practices. This declaration is maintained by other authors who suggest that professional development is essential since it provides teachers with the opportunity to become dynamic learners and further their skills, knowledge, and attitudes. (Harris & Sass, 2011; Villegas-Reimers, 2003).

According to (Helmer, Bartlett, Wolgemuth & Lea, 2011), research on teachers' professional development concludes that the most effective form in changing teaching practices is reform-type professional development. Teachers are encouraged to develop ways through which they can understand their students' capabilities and level of know-how in terms. Thus, there is a need to develop new skills, pedagogy, and methodologies for evaluating learners in the classroom and translating these newly acquired concepts into their professional practices.

Scholars who have studied teachers' professional development basically agree that professional development is viewed as acquisition of new learning and attitudes (Desimone,

Smith & Ueno, 2006; Garet, Cronen, Eaton, Kurki, Ledwig, & Jones, 2001; Timperley, Wilson, Barrar & Fung, 2007).

Fishman, Marx, Best, and Tal (2003) argue that the professional development of teachers should emphasize improving students' learning and performance by building knowledge, attitudes, and beliefs among teachers. Fishman et al. (2003) divide the professional development of teachers into two categories: teachers' comprehension ability and professionalism. Comprehension refers to the content mastery and understanding of the teaching profession in general. For instance, teachers should be able to organize a classroom and guide learners during their learning process. Professionalism relates to the ability to conduct oneself before the students and address issues in a way that shows ethicality and understanding. The authors explain that the teachers' comprehensive assessment abilities make it likely for them to make continuous modification of their teaching practice so that it can be more effective. Subsequently, the most significant evidence of the significance of development programs is the ability of a teacher to demonstrate good mastery of content and the ability to transfer the knowledge to the learners.

According to Borko (2004), content mastery should be the main focus of staff development programs as it complements the experience. By engaging in such development programs, instructors develop new skills, enabling them to improve their professionalism in content delivery.

Current research studies suggest that for the effectiveness of teacher professional development, the design model should focus on improving the knowledge of teachers, provide for collaboration on pressing educational and classroom matters, and are able to demonstrate the need to spend enough time developing new knowledge, skills, and attitudes. (*Wei et al.,* 2009; Penuel, Fishman, Yamaguchi & Gallagher, 2007).

There is a need to change our approach when we think about professional development. Professional development should not be thought of as a quick effort but instead be thought of as learning which takes time to occur (Wei *et al.,* 2009). There may be a challenge to creating and integrating everything in the school programme, including enough time. However, teachers will be in a better position to acquire new skills and significantly improve performance. Although learning is a continuous process, there is a need to specify the time through which new learning must take place. (Supovitz and Turner, 2000). Nevertheless, by including job-embedded time and through making professional development efforts align with the school goals, then it is possible to have improved learning outcomes.

A survey study conducted by Hattie (2009) in the United States established that student's learning outcomes and professional development. He also added that the performance of students is enhanced through mechanisms of professional development that focus on classroom instruction on matters content and pedagogy. The students' learning is the basis upon which research is done to give the teachers knowledge to effectively and skillfully engage in learning. There is an assumption that what determines the success of learners is the quality of instruction given to them and therefore there's a need to conduct a study on how the role of the principal in promoting professional development of teachers affects academic attainment of students.

The school leaders and teachers are supposed to have the skills and develop them on what really makes a powerful instruction for exceptional learning and teaching outcomes.

The effectiveness of professional development can be felt most especially if it has an impact on aspects of practice methods, teachers' newly acquired knowledge, skills, and attitudes, and the learning of students, as illustrated by Loucks-Horsley et al. (2003). This therefore means that the importance of professional development is seen when the school advances. It is

therefore correct to say that creating an enabling environment for the principal to enable staff to develop professionally is one of his/her critical roles in ensuring the objectives and goals of the school are realized.

The school principal has a key role in ensuring that the readiness and capability of the teachers are developed for them to have a change in their skilled practices, their understanding of the school and the views they hold about the same. It therefore means that the principals play a role in motivating the teachers to gain more knowledge and skills, and also recognizing the efforts they put in to tackle challenges that come their way. Records need to be collected on how staff development is influenced so that these initiatives are sustainable among the staff, and thus the leader or principal should be able to congratulate the staff on their efforts. The strategies that were used in professional development as seen in a study by Blasé and Blasé (2005) about effective instructional leadership included; providing efforts that foster collaboration among teachers; having a coaching session among the teachers; encouraging and giving support to restructure the school programs; applying the principles used in adult learning; emphasizing on teaching and learning study; ensuring that growth is seen in all stages of staff development and implementing action research so that updates on the instructional choices are made among the teachers.

Education researchers, including Evans in 2002, have an argument that professional development among teachers is not yet clearly researched. In his argument, Evans (2002) also contends that even those seen as the leading writers only describe the concept of professional development and do not really clarify what it means. Saxe, Gearheart, and Nasir (2001) study in the USA provides suggestions that compile the knowledge of the teacher, the continued students' assessment, and the usefulness of professional development, and the chance for teachers to work collectively.

The research involved a comparison of Collegial Support concerned with provision of means for teachers to collaborate on improved contents of the curriculum and Integrated Mathematics Assessment (IMA) using three groups of students. IMA programme also comprises of emphasis on focus in knowledge for the teachers, pedagogy, and the thinking of students. The study established students under IMA teachers benefitted more than their counterparts under teachers of Collegiate Support, which calls for developers to emphasize on learning opportunities focused on approaches to knowledge dispensation by teachers and the knowledge comprehension (Saxe, Gear & Nasir, 2001).

From the discussions, it is specific that a method to ensure professional development is provided effectively to have a positive influence on students is through assimilating fresh teachers' understanding of instruction, content, and time to collaborate with each other in a more guided and effective way. A way to foster any success in the education reforms is through developing teachers' professional skills, as echoed by several authors (Desimone, 2009; Desimone, Porter, Garet, Yoon, & Birman, 2002; Fishman, Marx, Best, & Tal, 2003; Guskey, 2002). The above assertion is also backed up by Fullan and Mascall (2002) in their study, who reaffirm that professional development, is significant for any change program to be successful, as long as it is associated with having individuals continuously learn and the progress of the school taken into account.

Graczewski, Knudson, and Holtzman (2009) also established a correlation in the positive among the leaders instructionally, i.e., the principals (as instructional leaders) since they created a comprehensible school-wide image and engaged in the improvement of instruction focused on content, curriculum, and effective professional development. It is believed that teachers are the greatest beneficiaries when they participate in professional development. However, challenging issues arise that question the effectiveness of professional development

programs. The issues of negative attitude presented by some teachers on developing professionally see it as a point of endurance and should be dropped out of their way without them paying keen interest in skill acquisition Key,2000). Several factors that contributed to such negativity were identified and they included the teachers' understanding of professional development.

Conventionally, development of teachers professionally has been assumed as a chain of unconnected workshops done within a short time and demonstrations that have little or no follow-up plans or direction for application key,2000). Since teachers have limited opportunity to choose a topic of discussion in a one-time workshops as the topics are decided by the event organizers, such programs have shown little productivity when it comes to professional development of teachers.

Furthermore, this approach to professional development has received objections that external specialists may fail to recognize experiences from the classroom and teachers' judgments (Fulani, 2007). Despite its prevalence, the implication of this in terms of learner achievement, how the model of the workshop changes how the teachers practice and how the students achieve is awful, as these short-term workshops often don't make any changes in the practice of teachers and therefore have no positive effect on how the students achieve (Yoon, Duncan, Lee, Scar loss & Shapley, 2007).

Teachers often feel that their professional development is deemed wasteful and worthless as it is interpreted as a series of activities that are not connected with the engagement in the classroom (Gus, 2000). Since many times, teachers do not form part of the consultative forums on their needs for professional development, they repeatedly allege that their experiences are considered unnecessary in the improvement of instructional practice.

Therefore, teachers find it hard to integrate this new learning from professional development programs into teaching and processes.

According to Graf and Werlinich (2003), there are three phases in which the development of teachers in their profession affects the achievement of students as listed; first, the advancement of their profession makes the teachers' knowledge and skills increase, and this is observed by the school administrators who directly work with the teachers and conduct clinical conferences and observations of the same; secondly, growth and responsibility professionally have a design to favor teachers who are competent and who focus on the improvement of learning and teaching. As such, this phase is stipulated out for collaborative teachers since better knowledge and skills improve classroom teaching.

According to Graf and Werlinich (2003), in the third level of professional development, a focus on conferences in the colleges and projects, teachers engaging professionally with the communities is expected of the teachers who are ready to foster and develop in their own professional life. Apart from the above phases, the teachers are able to have a support system for their peers who need any help to improve the teaching outcomes and thus lead to students achieving better. In short, it means that a miss in any of the above links would mean better learning outcomes among learners, which may be difficult to realize. A practical example is given that if a teacher does not apply what he/she has acquired from the professional development session to their classroom practice, then the professional development will not benefit the students in any way.

The need for professional development can be explained from the growing concern among various institutions of learning since focus has shifted to increasing knowledge, skills and technical rationality.

According to Louise (2008), the need to develop professionally is crucial due to the academic work force needed to maintain the status quo and for the status quo to survive, one must be able to utilize the skills and knowledge acquired. Therefore, motivating and stimulating the knowledge of teachers implies that a new approach to human resource development is refined.

In another development, Adesina (2004) mentions that professional development focuses on those with teaching responsibilities developing a viewpoint focused on effectively and efficiently delivering and implementing the designed curriculum through emphasis on the professional capabilities of team members. Quality and competency is built into the learning system by embarking on professional development of teachers. This allows individuals to have improved productivity in specialization and consistently contribute to the growth of the system as well as professional capabilities.

Ihunda (2004) states that it makes sense to train and develop the academic staff not only because of gains in productivity, work quality, employee morale, waste reduction but also because an organization that fails to develop its present employees seriously jeopardizes the future of the organization. A positive correlation has been found between stimulating the development of teachers professionally as a leadership role shown by the principal and the classroom way of teachers giving instructions as seen by researchers (DeSimone et al. 2002; Johnsen et al. 2002). Little empirical studies have been conducted to find out ways through which schools do to support the teachers in participating in high quality professional development that looks at concepts of comprehensibility, continuous, shared and insightful despite the knowledge on how professional development is that is comprehensible, continued, shared, and insightful (Wei et al., 2009; Wayne et al., 2008; Elmore, 2002; Desimone, 2009; Fonzi, 2002; Borasi, 2003.

There are more perceptions in some systematic review sessions that have been done to investigate how students' achievements impact the professional development of teachers. It was established that programs that had a focus on changing the behavior of teachers bore little influence on how the students learnt, compared to programs that focused on the curriculum being implemented, teachers' level of understanding of the subject and the students' learning, as seen in the review of professional development programs in mathematics and science in the USA (Yoon et al., 2007).

Pinto (2018) claimed that principal leadership is an influential factor determining student learning next to classroom teaching. Principals' leadership provides information which can be applied in creating, supporting, and sustaining learning. The researchers then set out to investigate the factors as well as conditions which influence the leadership practices of the principals and how they influence student learning. The researcher focused on students from Tripura in Northeast India. The researchers adopted simple random sampling to select the respondents who were also issued with open-ended questionnaires and in-depth interviews for data collection purposes.

Focus group discussions were also done. Several themes were identified by the researcher, including the principals' support of the teachers through professional development processes. The findings showed that principals who ensure their teachers undergo professional development through seminars and workshops tended to improve the performance of their students. The study supports the existing literature on the principal's role in developing teachers professionally to improve students' learning. However, the study focused on the overall performance of students, whereas the current study sought to examine the performance of students in mathematics as impacted by the principals' support of teachers' professional development.

In another study, Ahmed (2018) set out to assess the perceptions of principals' factors that result in poor performance among students from Wajir in chemistry. The researchers cited the poor performance of students in chemistry on a national level despite the ongoing interventions. To meet its objectives, the researchers adopted a descriptive survey study design where questionnaires, interviews and FGDs were used to collect data from the randomly sampled public secondary school teachers and principals.

The study found established many reasons to explain why students' poor performance in certain subjects in secondary schools. Generally, the findings showed that teachers' attitudes were negative and this was attributed to the lack of professional development and growth programs like symposiums, workshops and seminars to help bolster the attitudes of teachers and keep them up to date with current instructional approaches that would help improve the student's performance. However, this study focused on the performance of students in chemistry, as opposed to the current study, which focuses on the relationship between students' performance in mathematics and the professional development of teachers.

The skills and knowledge passed through in the professional development programs that are currently available, i.e. the conferences, are for possible use in the future and, as such, have little impact on the practice of teachers (Planning and Evaluation Service, 2000; King & Newman, 2000). Teachers have little exposure to other professional development methods than the traditional workshop sessions that have been the norm where almost 90% of them have taken part (Darling *at al.*, 2009). This method overlooks the idea that growth and learning professionally is a process throughout life where skills, knowledge, and previous experience are built up, which cannot be achieved through a one-time program.

In their research, Colbert et al. (2008) and Ryan and Cooper (2008) state that workshop-based development programs are conducted by the organizers instead of teachers and that teachers

have little involvement in such programs. Nonetheless, current research supports the relationship between the support given by principals in development professionally and how students achieve, and reiterates the need to involve the staff in the programs for development (Sanzo et al. 2011; Crum & Sherman, 2008; Borko et al. 2003). Certainly, developing a relationship between students' performance and professional development is filled with difficult challenges. (McCutchen, Abbott, Green, Beretvas, Potter & Gray, 2002; Saxe, Gearhart & Nasir, 2001).

Like the situation in most African countries, Kenyans have been cited as lacking curriculum support, and they join the profession when they're incompetently prepared, and those already practicing lack support for professional development (UNESCO, 2015). According to Hardman et al. (2011), a study conducted in three countries involving Uganda, Tanzania, and Kenya on teacher education's systematic approaches called for on-going professional development and national in-service education and training (INSET) to be developed.

The started also concluded that the development programs should also be channeled to improve the quality of education and general outcomes of learning. (O'Sullivan 2006; Hardman et al. 2009).

Bruggencate, Luyten, Scheerens and Sleegers (2012) also set out to examine the means by which principals can positively impact student performance. The researchers used structural equation modeling in Netherlands. Data was collected from 97 private and public schools. The findings showed that the school leadership practices are crucial for the performance of students. However, the students' performance was also found to be directly influenced by the teacher's professional development. Sadly, the results revealed that in the majority of public secondary schools, principals do not support their teacher's professional development and growth. The principals in some instances were found to hinder the teachers' professional

development. The study was however, done in Netherlands which as different social, economic and political factors from Kenya; hence the findings may not be generalizable to the Kenyan secondary schools.

In a Nigerian study, Essien, Akpan, and Obot (2016) also set to investigate how educational performance among students is influenced by teachers' workshops attendance, seminars attendance, and in-service training with focus on social studies as a subject. The researcher adopted an ex post facto researcher study where five hundred teachers and students were selected. Questionnaires were used to measure the attendance of in-service training, workshops, and seminars and the impact of such training on learners. Using person correlation, the study established that a teacher's in-service training, workshop and seminar attendance positively correlated with the students' performance in social studies.

The researchers recommended that the school administration and government agencies encourage teachers' professional development to improve student performance.

The study was, however, focused on the teacher's in-service training and workshop attendance for social studies subjects, whereas the current study will be done in reference to mathematical performance.

The Education ministry rolled out a school-based development program for classroom teachers that involved training of primary school teachers in Kenya. The outcome indicated the INSET program enhances teacher competencies and calls for the abandonment of ad-hoc provisions and the adoption of a wide-scale engagement of teachers in well-organized INSET to enhance their professional development (UNESCO 2010). Besides, the study established that teachers need to be engaged through consultation regarding the principal's support of

their professional development since they are the center of focus and their inputs can significantly help improve professional development services designed for them.

2.3.3 Principals' Organization of Mathematics Contests and Students' Performance in Mathematics

Talented and gifted students are the reason for the introduction of competitions in education provision (Renzulli, 2004; Riley & Karnes, 2007), which is a requirement for differentiated opportunities (Education Ministry, 2000). In 2004, a national review was conducted in 809 schools where 66.4% of them reported that competitions are crucial for gifted and talented students across all areas of ability (Riley et al., 2004). They are used as a means of multiple identification. They are an avenue for students to compare themselves with others and crave for personal achievements. It means they are a way where a conducive environment is created for gifted students to excel, compete and honor their abilities (Asian, Alyuz, Tanriover, Mete, Okur, D'Mello, &Arslan, 2019).

A sense of autonomy and self-directed learning skills are enhanced through competitions (Karnes & Riley, 2006). Mathematics competitions motivate, excite interest in the subject and furnish parents and schools with information about able students. The results, however, discriminate against the students' ability at a participant level but measure their ability in mathematics. Ridge &Renzulli (2001) note that little is said about slow and logical mathematical ability, but only one type of mathematical talent is shown in competition success.

There is the outward role of competition as seen in awarding certificates, being selected for other competitions, and prestige as stated by Bicknell and Riley (2012). There is a need for gifted students to be taught how to deal with competition constructively, especially in the

face of In a separate literature, it is found that there are fewer negative perceptions of a competition as compared to the opportunities that can be tapped and showcased in Kiwi talent competitions (Riley & Karnes, 2001).

The feelings of stress and failure arising from too much completion are some of the negative outcomes highlighted by Davis et al. (2011). In his study, Ruscyk (2012) cautioned that if a competition only sharpened the memory and speed of students, then it would lead them to memorization and thus not insist on their ability to think and find a solution to challenging tasks. It means that students do not need to be given problems that extend beyond their ability, which discourages them.

Teachers should have insight and be resourceful in whatever methods they use. Classroom organization is very important in this case, SMASSE (2005). Practical work, investigations, group experiments, and individual assignments are required more frequently than the usual 40 or 80-minute lessons of lecturing.

Once these activities are through, it is hoped that overall objectives of attitudes and personal social development will be achieved. We must give prominence to the students' participation in class discussions. This could be done by allowing one student to demonstrate a concept and others to pay attention to what is said. It can also be done by trying to correct or improve upon the statements made.

Kendorov (2017) also found that mathematical competitions and the people and organizations who engage in them form an immense network. He claims that these networks serve many roles and that taking part in these competitions helps identify students who possess higher abilities in mathematics. Through them, students are motivated to hone their talents as well as seek professional realization in the sciences. Additionally, competitions can significantly

impact the education of the students. The network keeps elementary mathematical knowledge alive, preserves it, and develops it through the network of competitions and their related activities.

Thorvaldsen, and Vavik, (2012) investigated the factors contributing to high achievements in Mathematics and how the success factors and qualities can be described. The researchers forced on Mathematic teachers from Norway and found that schools where teachers invested their time and efforts in organizing Mathematic contests performed better than those that failed to engage or plan these contests for their students. They found that through Mathematics contests, schools can motivate their students to push their limits and strive to not only fasten their speed when dealing with Mathematics challenges, but to also strive to be creative in dealing with Mathematics concepts.

According to Wambui (2002), Mathematics is a complex social activity in the context of the society. He distinguishes between relational and instrumental understanding as far as Mathematics is concerned. Relational understanding includes all descriptions, classifications and understanding the relationship which help to explain the social phenomena. Mathematics is a difficult subject to learn as well as to teach SMASSE (2005). This is because Mathematics is a hierarchical subject since the new work depends on the previous one. Students learn at different speeds, therefore some will get the concept in one period and others will get it after a long time. As such, the subject requires hard work and practice. If teaching is too fast, understanding is not developed. On the other hand, if the pace is slow, the students became bored, particularly the fast learners. Whatever the level of attainment, students should not be allowed to experience repeated failures.

Effective teaching of mathematics should pay attention to the following, according to Watson (2003): Facts and skills: facts in this case are a complete set of information with zero

biasness, which are essential for understanding something. Examples include conventions, rotations, conversions and factors. Skills include the ability to use numbers and computations. It encompasses approaches and procedures guiding skill decisions and the conceptual structure describing a set of knowledge.

A study carried out by SMASSE (2012) also indicated that most teachers lacked a clear vision of the set objectives in mathematics and the sciences. The perception of the teachers towards objectives may affect the level of the achievement of a lesson that is being presented in class. This is supported by Kemp (2016), who asserts that rational curriculum planning begins with the definition of precise, reliable, and attainable goals and objectives, followed by an analysis of the goals to come up with an implementation plan, the contents to be delivered, and the techniques to be used to achieve the defined goals and objectives. Since the curriculum is implemented by teachers, they ought to be clear on what to expect at the end of the lesson.

The role of competition in exploiting the cognitive, emotional, and social needs of academically-gifted and talented learners has not been adequately researched. Campbell et al. (2000) state the need for such studies but give a warning due to the role of sponsorship in these competitions. Their research gave little focus on younger learners, but instead much of their focus was on Mathematics Olympiad students and another focused on the role played by competitions in younger high school students (Campbell et al., 2000). Thus, this study aims to discover how the support provided by principals through organized mathematics contests impacts the performance of students in mathematics on the Meru County KCSE examinations.

2.3.4 Principal's Monitoring of Students' Progress through Invitation of Mathematics Specialist Assessment Tests

The process that is used by teachers to assess their success in teaching and to make better informed choices on instructions by use of the data on the performance of students is called progress monitoring of students (Safer &Fleischman, 2005; Irungu, Kagema, & Gachahi, 2019). Progress supervision of learners provides teachers with data on how the students achieve, allowing them to evaluate how effective their method of instruction is and make any necessary changes to their performance pedagogically. This is important as the teacher is able to set the goals for the achievement of students and thus tap the greater student learning perspective.

Teachers who use progress monitoring for their students are able to understand the strengths and weaknesses of their students and have an informed point of reference on the needed instructional variations. Basically put, academic progress of students can be said to be measurable students learning. Characteristically, the academic progress of students can be explained as academic gain and can include a variety of genuine opportunities which are school-related.

According to a research study by Lezotte (2010), which he referred to as "effective school correlates." According to the model, among the seven correlates was a strong instructional leadership and frequent monitoring of students' progress. Student progress was seen as crucial as it incorporates regular monitoring and evaluation of learning outcomes.

The findings from the evaluations aid in increasing student specific learning behaviors and performances and lead to improvement in the entire curriculum (Lezotte, 2001; Sebastian, Huang, & Allensworth, 2017). Stecker, Fuchs, and Fuchs (2005) pointed out that teachers

realized a substantial growth in the learning of students upon instruction modification as seen in the data on the progress monitoring of the students. Classroom assessment was commonly used as an effective technique to monitor and measure the progress of students.

Teachers administered repeated assessments in order to communicate to the students that there were numerous chances to achieve better. Teachers reported that they could consistently respond to students when there were frequent assessments of their progress. In addition, schools that confirmed the greatest improvement in their achievement were those that monitored their learners through collective assessments (Reeves, 2003).

Each student has an opportunity to learn and become responsible, so an early stage intervention in learning yields success in students' academics. This can be done through providing systematic and clear instruction to quicken growth in areas of identified needs (Kaggwa, 2003). The realistic implementation of students' progress monitoring provides the interventions that are pegged on effective information about the current performance of the learner (Kaggwa, 2003). Students' learning needs should be scrutinized and platforms should be considered to address the needs. Of more significance is that intervention approaches should not be applied because they are common or stimulating but because they should be able to focus on the students' needs' in their institution as schools operate in different settings.

According to Lezotte (2001), in effective schools, learner progress in academics is frequently assessed and measured, and the obtained results are used in the improvement of individual student achievement. After what is referred to as the first generation, where teachers regularly monitor the academic progress of students, has been completed, schools are required to move to the next generation, which involves technological adoption and application for effective monitoring and tracking of the academic progression of students. Technology use will also

allow monitoring of students' learning and even make corrections to their own learning behaviors. Capacity to get instant results on assignments and see correct explanations settled on the screen guarantees students' learning (Lezotte, 2001).

Hattie (2009) found an appositive correlation between the impact felt on student learning and how they achieve and the monitoring of the effectiveness of school practices as seen in the synthesis of over 800 research studies. Frequent assessment enabled teachers to provide a more reliable and timely response to students, which served to be essential to the performance progress of the students. In another research study conducted by Schmoker (2001), it was found that high performing schools indicated reliable goals with high expectations, which was backed by continuous assessments and reliable progress data. Effective teachers not only stress students' obligations and responsibility for striving to meet academic expectations, but they also give clarification and expression on the progress of students' achievement.

In the separate classrooms, there is a clear connection between the academic achievement of students and the defined goals and expectations of teachers. This is because the high expectations signify total alignment towards advancement and growth in the classroom demonstrated by achieving the school target (Stronge, 2002).

Empirical research shows that good teachers certainly affect students' academic progress through monitoring (Safer & Fleischman, 2005). Teachers who are effective not only monitor the academic progress of their students systematically and logically but also positively impact on their students' progress.

Monitoring of the academic progress of students through continuous assessments implies that students' progress is not the final outcome but a justified way of influencing the final

outcome of learning through reformulation of strategies to meet the goals and objectives. The teachers are able to assess how successful their teaching is by using the data on the students' progress monitoring and are thus able to make more knowledgeable instructional choices.

It is a duty of the principals to make sure that systematic procedures are used to monitor the progress of students (Cotton 2003). Taking caution on the students' progress monitoring is very important in determining how the learner achieves academically. The behavior of the principal and his/her degree to ensure teachers monitor the progress of students are the components of progress monitoring. The principals are able to monitor students' progress at all levels through short rapid examinations to measure growth towards the aims required and to make a regulation on the instruction delivered (Cotton, 2003).

Therefore, rich data is based on the learning results of the students (Virginia Department of Education, 2007). Constant progress should form part of school values, as is purposed by instructional decision-making based on data.

Based on the information provided by The Education Trust-West (2005) in California, USA, key areas identified as having low and high impact on high schools were: the school culture; the academic essentials and support for all students; teachers; and the organization of instruction. The schools under study accessed the data on assessment while those high performing had their principals meet with teachers to have a discussion on how students' progress. In these high-performing schools, their leadership entailed coordination of the curriculum vertically led by the principal to develop progress in the objectives of teaching amongst the learners (Robinson, 2007).

Leithwood et al. (2004) found that a characteristic of academically effective school districts was the use of student data testing systematically and thus in schools where teachers were involved in detailed analysis of assessment results showed higher achievement in the learners.

Effective leadership in the school, according to Marzano, Waters, and McNulty (2005), looked at the monitoring of the school curriculum, the instructions, and practices of assessment. Hamilton et al. (2009) found that students using data on their personal achievement aided by the instruction for progress monitoring attained a high level of inspiration.

The Education Trust-West (2005) in the USA found a greater effort to foster improvement in the curriculum and instruction more formally in the high-performing schools. While the literature suggests that instructors are able to know the meaning of data and its application if their capacity is built, then the role of the school principal is central, as the significance of school principals' using data for students' progress monitoring and giving instruction is made clear (Deike, 2009). Wayman, Cho, Jimerson, and Spikes (2012) write that architects who support principals who use data support both informal and formal structures. Informal structures refer to the responsible use of data in a way that encourages collaboration and provides guidance to students in a way that they do not feel threatened. Formal structure entails existing and newly formed structures, like the adoption of data centers in measurement of goals.

The two ways for principals to inspire school-wide discussions about students' improvement include; (a) having a data team created in order to develop data to be used by teachers, and (b) having structures built for discussing students' performance frequently (Boudett &

Moody, 2005). The current performance of students is discussed by teachers looking at the skills set for the students to learn followed by the goals to be met.

This can be measured through continuous examinations given to students after a month, two weeks or a week as proposed by Friend and Cook (2010). Measuring and monitoring of progress may not be enough, but there is a need to make use of the findings for improvements in programmes of instruction in schools.

Weak students are helped by strategies set by principals with activities that give focus to classroom arrangement and instructions (Levine & Levine 2000). The progress of learners in their behavior and performance in the effective schools was seen upon frequent monitoring of the objectives. Results obtained from the assessment of students' progress were used to improve the curriculum (Lezotte, 2010).

Hayes (2008) wrote that in the USA, schools that had high standards in the constant evaluation of improvement of students focused on strongly attaining an increase in their outcomes and exceeding the legal requirements.

In North Carolina, high-performing poor schools relied heavily on these student evaluations and utilized the data reports on the progress of students as given by the teachers.

There were testing programs initiated across the district and the participating schools got involved in giving their students tests at the school level (Hayes, 2008). This was also the approach adopted by the schools that were successful in Texas on how to assess their students. The processes of monitoring the progress of students used by teachers included the data obtained from the evaluation, record reading, and the evidence obtained from the programs involved earlier.

The use of data reports on the progress of students' impacts positively on their achievement as this drives how the schools' performance is evaluated as presented by Bambrick-Santoyo (2010) in Jossey in the USA. The principals of schools that made advance gains and were improved in their performance, the principals had a responsibility to ensure that the progress data on the students' reports was continuously being utilized and was used in analysis of the progress.

In these schools, the students were made to understand their weaknesses, strengths, the expectations they had and even aspirations. Teachers are aware that the provision of meaningful student learning is the basis upon which lesson planning, conducting team meetings with teachers, opportunities for developing professionally, and coming up with interventions that are vigorous to cater for weak students are used. This yields positive results as seen in the experimental and other field studies conducted in which teachers referred to the progress of students' overtime. (Good, Simmons & Kameenui, 2001; Fuch & Fuchs, 2002; Deno, 2003).

There was an analysis of research on the monitoring of the progress of students, but it was only experimental and controlled studies by Fuchs and Fuchs (2002). These researchers concluded that the systematic monitoring of progress by teachers for tracking their students was important in the identification of any different needs in addition to the varied forms of instruction and that teachers were able to design stronger instructional programs, and their students achieved better.

In a research done in the California elementary schools by Williams et al. in 2005, there was established a very correlation in the schools that had utilized the data on assessment to make improvements on the learning and instruction given to the students, to come up with strategies for follow up of the progress of the students selected and formed a basis for the

principals to evaluate the achievement of the students (Day, Gu, & Sammons, 2016). Students mustn't form ideas of the intended work for them to perform well as the learning goals should be set and tracking of the students as they work towards achieving the set academic goals in their learning process which is transparent. Students are helped by their teachers on how they can track their progress and build individual confidence throughout the learning process.

From the previous pieces of literature, tracking the students' progress in the quest for their goals proves to be a more effective method of learning than comparing with the progress of their peers. In the comparison to peers approach, the weak students are made to believe that they are not capable of achieving high grades which makes them lose self-confidence in the learning curve (EPPI, 2002; Rheinberg & Krug, 2005; Köller, 2001; CERI/OECD, 2005).

In Kenya, KCSE forms the basis of the assessment of secondary schools, which is a national examination that aims at measuring students' performance (the Republic of Kenya, 2012). Oduor (2006) nonetheless states that national examination does not have a systematic approach and integration of monitoring systems that can be used to advance students' academic attainment. The study indicates a low mean grade of (D+), showing poor performance in Tharaka-Nithi and Meru counties. Schools have come up with various strategies that 65 include extra supplementary tuition and even forced grade repetition among others to improve learners' achievement. In the meantime, some of the approaches employed by schools are not research-based and, more often than not, have been shown to be counterproductive (Bray, 2007).

Data is used to monitor how students' progress and should be used by the principal as one key school leadership aspect to assess the effectiveness of the school's practices for instruction and assessment (Robinson 2007). In schools that perform highly, the principals

have an emphasis on using data to improve programs for monitoring student progress. However, there is little research to analyze the connection between the principal taking a watch on students' progress and their subsequent achievement.

2.3.5 Availability of Educational Resources And Performance Of Learners

Good performance among learners can be triggered by the availability of adequate educational resources in schools for the effectiveness of schools which are both human and non-human to cater to the overall outcome of students. Institutions are made up of human beings or workers and non-humans that are manipulated to achieve set goals (Maicibi 2003). The nature of mathematics needs to be broken down through practical teaching and learning methods, i.e. relevant textbooks, laboratories/classrooms, demonstrations, teaching aids, and available trained teachers (Yara & Otieno 2010). Ineffective teaching can be handled using a mathematics laboratory that has adequate teaching and revision materials.

Schools' physical facilities form an integral part of the learning environment, which can significantly influence the outcome of the learning process. Academic performance is impacted by enough resources to teach and learn. Classrooms, administrative offices, stores, libraries, and even playgrounds are facilities in a school. Wanjiru, Kitainge, and Samikwo (2021) reckon that learning resources are used to advance opportunities for students' learning, thus improving their academic performance. 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), adding that competitions form a part of the required continuum of different opportunities. The use of small groups in class to perform different tasks has a positive impact on students' learning, as evidenced within mathematics education.

Karnes (2003) made a comparison between how students achieve in mathematics using small groups and in the whole-class setting. Olembo, Wanga, and Karangu (2014) argue that schools that perform poorly spend limited resources on the purchase of teaching and learning resources. UNESCO's (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 the unavailability of textbooks in learning institutions resulted in poor performance. The study was, however, done in the Maseno Division, whereas the current study targeted learners in secondary schools across Meru County.

According to Anandu (2009), learning has to take place within a defined environment and leaders must avail enough physical facilities to avoid the frustration of learners and teachers during the learning process. The lessons conducted by teachers can only be effective and efficient if the physical facilities are availed and this can significantly influence learning outcomes. A study conducted by Avalos (2001) established a positive correlation between the availability of teaching resources and the quality of learning measured through assessments and evaluation. It, therefore, follows that without these materials, the quality of learning is negatively affected, leading to low performance.

The access to learning and teaching by students is a determinant of how much they learn as reported by The Global Monitoring Report on Education (GMRE) for All (UNESCO 2008). A study was carried out by Mwamwenda and Mwamwenda (2013) to find out how the availability of physical resources would affect how the students perform in Botswana. It was revealed that these facilities are directly linked to the quality of education offered and thus the performance of students. It, therefore, means that Principals need to ensure schools have the needed resources to teach and learn for the good academic performance of the students. Hou, Cui, and Zhang (2019) argue that collaboration is the foundation of good outcomes in

any organization. These positive outcomes are not excluded from educational outcomes. They posit that for schools to enjoy the positive outcomes of the learning process, the collaboration between all the stakeholders is paramount.

These findings imply that in schools, the demand for collaboration between the school and its teachers is paramount. The study, was, however, conducted in Botswana which has different social and economic factors from the local ones; hence this study was conducted to fill the gap in local literature.

Wanjiru, Kitainge, and Samikwo, (2021) stress that instructional resources must be made available. He states that: There is no sense in having a demanding curriculum without the necessary resources, both human and physical. They called for students and teachers to join the private sectors and the government in supporting educational innovation of teaching and learning resources. A study by Jepchumba (2010) showed that a lot of material resources were lacking and those available were not properly managed. Just like in the present study, insufficient funding was cited as a major hindrance to the acquisition of these resources.

Atieno (2014) claims that education is a fundamental right, but over the years, students' performance has been dismal, compromising this right. It is against this backdrop that the researchers set out to determine how the availability of educational resources impacts the performance of students in KCSE in Embakasi, Kenya. She conducted survey research in which 240 learners participated plus 6 principals and 18 teachers. The study adopted questionnaires and interviews as a method of data collection and descriptive statistics to analyze the data.

The analysis of data showed that the availability of educational materials has a positive impact on academic grade attainment among KECSE examination candidates. These

materials include resources used to give instructions in class, such as pieces of chalk, charts, laboratories, whiteboards, and other physical resources. The study also showed that these services are provided in limited quantities, despite the positive correlation between these statistical findings.

However, the study differs from our research in that it focuses on the general performance of the students in the KCSE examination while the scope of this study is on the performance of students in Mathematics. Furthermore, the limitation of this study is that it fails to specify whose role is to provide these educational resources while the current study examines how the principal's ability to avail the educational resources can affect the performance of students.

Similarly, Mugambi (2015) conducted a study to find out the roles of principals in promoting the performance of students. They affirm that the reason for the attribution of the school's failure or success is due to their roles as persons in charge of every detail of managing the school on both administrative and academic fronts. They affirm that if the principals' leadership is exceptional, then the student performance is expected to be high. It is against this background that the researchers set out to determine why there is persistently poor performance in Meru County in KCSE in Mathematics.

The researcher focused on the principal's instructional supervision and how it can affect the student's performance. Through the descriptive survey research design, the researcher found that there was a positive association between the principals' instructional supervision strategies and student's performance. The study, however, found that the principals' roles were challenged by the lack of adequate science laboratories, lack of time, inadequate educational resources, and irregular fee payment.

In a study by Luvisia (2003) titled "Availability and use of instructional resources in teaching Kiswahili Grammar in selected schools in Bungoma District', the researcher argues that teachers who hold a positive attitude towards the use of instructional resources are most likely to adopt their use if they are made available in adequate quantities. He also recommended their use during instruction.

In his investigation of language learning in 2014, Okwako stated that availing of reading materials was important in learning the language. He stated: "For a student to read widely, he or she needs to have the ability to willingly do the reading without difficulty." Materials required are not only those that cover vocabulary but also meet the age demands of the student (Okwako, 2014).

Too (2009) surveyed secondary schools within Nandi District to establish the usage of media resources to improve learning and the availability of such resources. The study investigator found out that books recommended by (KIE) were not available, and where the books were found to be available, they were not effectively used by teachers. Although this study focused on Nandi District, its findings are of great help in the present study, since both research studies focused on mathematics performance among students. It gives the state of instructional resources in Kenyan secondary schools.

Bennars and Njoroge (2014) observe that educational resources are important ingredients in the successful dispensation of knowledge, skills, attitudes, and beliefs. They state that: "Teaching aids are a basic component for teaching successfully. Making use of simple yet sophisticated teaching aids is required for students at college and university (Bennars and Njoroge 2014: 225). Based on their study on a sample of 57 schools in England and Wales, Brundett and Smith (2003) observed that the influence of principals' leadership on students'

outcomes is indirectly mediated through a range of complex issues such as teacher effectiveness and availability of resources

The present study has emphasized the importance of instructional resources and how they could be utilized to improve academic performance. In their latest inspection report, the then province quality assurance team lamented that the dismal performance by many schools in Meru County could be attributed to insufficient learning and teaching materials in many schools. The report further pointed out that many Principals were engaged in the construction and improvement of physical facilities at the expense of instructional resources (Government of Kenya, 2009).

These sentiments are in agreement with those of Mwiria (1985). The researcher asserts that the quality teaching and learning resources affect how students perform as those in schools with enough facilities such as laboratories have a higher opportunity to do well in examinations in comparison to those in schools poorly equipped. Maundu (2013) agrees with this and suggests each school being furnished with relevant textbooks to improve their performance academically.

A study by Eshiwani (2013) found that schools that mainly appeared in the top ten categories in the national performance ranking had adequate textbooks. This indicates that the availability and use of textbooks among other resources affects students' performance positively. Eshiwani (2013) concluded that dismal performance in mathematics by students can be attributed to an inadequate supply of science equipment. He observes that materials for instruction such as textbooks and other resources for students and teachers are significant variables for students' learning and academic achievement at the secondary school level.

A study conducted by Olel (2000) was founded on the effective use of resources for education in Kisumu District schools. It was seen in the study revealed that five laboratories were in very few schools. The inadequate laboratories meant that the schools could not offer enough teaching services and hence concluded that poor performance in KCSE was affected by the lack of laboratory facilities as practical subject questions could not be answered.

This study differs from the current one as it was only confined to instructional resources in the science subjects and their impact on academic performance. In the present study, the researcher investigated the effects of several independent variables on students' performance.

Ajayi (2005) used 250 participants to investigate how the availability of educational resources can impact academic achievement among schools in Nigeria. The study finding of the study showed that there is no correlation between the availability of physical facilities and the performance of students in Nigerian schools, which contradicts the previous studies in Kenya by Olel (2000). Puyate (2006) built on Ajayi's study and established that most of the physical resources within the schools such as laboratory equipment and tools were broken or damaged and there were no replacements or renovations on damaged/broken equipment and facilities.

Ndege (2018) reiterated that the education system in Kenya has been characterized by poor student performance in annual results. Some schools have managed to retain good performance, but others continue to perform poorly. The difference in performance between the schools can be attributed to several factors and one of them is principals' practices. The main purpose of Ndege's (2018) survey was to determine how the administrative practices on the student affect the performance of students in KCSE in the Butere sub-county.

The emphasis of the research is on the principals' provision of education materials, class visitation, facilitation of teacher's development, and ensuring there is a working environment for the students. The researchers sampled 474 respondents comprising of school heads, teachers, and learners. Questionnaires were issued to the respondents and the findings revealed that the principals' provision of instructional materials significantly affected the academic achievements of students. The principals reported that the schools lack adequate textbooks, playgrounds, libraries, and laboratories. Additionally, textbooks and other learning resources like revision books were found to be inadequate contributing to the poor performance among the students.

Smit (2001) maintains that an insufficient educational resource is a key barrier to curriculum implementation in the classroom. Textbooks and learners' writing materials are necessary for facilitating successful learning in the classroom. Lunenburg (2010) highlights that teacher need to have access to teacher guides and textbooks. The significance of educational resources cannot be understated.

Jacobs, Vakalisa, and Gawe (2011) uphold that a requirement for positive knowledge dispensation is the accessibility of the specific teaching materials. This means that before learners acquire new skills, knowledge, and attitudes from instructors in a school, the resources for the same should be provided first. The resources and equipment allow students to gain appropriate experiences as required from the school. Comprehensive learning and teaching culture are founded on carefully and effectively controlling the equipment in school. A role in resource management by the principal being an instructional leader involves acquiring, allocating, utilizing, and preserving the materials. The principal is tasked with proper management of resources and their effective utilization to achieve the targets in the school (Pollard, 2002).

Effective Mathematics lessons are possible if the needed resources are provided. These could be computers, textbooks, time, and personnel. For better quality of education, it is not just by providing the necessary resources but also have time for teacher-student interaction and utilizing the resources by teachers and students (Baldacchino and Farrugia 2002).

The teacher guides the learners on effective utilization of resources by creating an environment conducive to learning.

Marshalls (2010) has a conviction that for effective living in society Mathematical knowledge is required. This knowledge affects how the other subjects perform thus an important section in learning subjects like geography among others.

The author noted that in pursuing his knowledge, Plato had to integrate Mathematics. In his findings, Butler-Por (2013) brings an argument that those seen by some people as weak students happen to be very bright and this makes them lose confidence in themselves. This has a ripple effect in them losing confidence in what they can do to cope up with the mathematical concepts being taught. These students can excel if given assistance and little more attention from the teachers.

It can be seen that the syllabus of Kenyan education has topics to build learners' ability to find solutions to real-life problems, (Ngetich, Wambua, & Kosgei 2014). The researchers also noted that visualization of resources in Mathematical textbooks such as drawings can have a significant impact on students. Provision of enough materials to learners for learning and time for them to understand mathematical concepts and have an interest in them. Mathematics concepts need to be integrated as a whole by organizing the syllabus in sequential series.

Concepts in Mathematics are logically related in a sequence as stated as provided by Education Ministry (2010). The organization and capability are therefore created in the

learners. Teachers are allowed by the curriculum to build new topics that are based on the knowledge obtained from the contents of the previous lessons. When a teacher is present, resources adequately provided and a close interaction of content and instructions for teaching lead to performing optimally in academics (Republic of Kenya, 2005).

Lack of enough teachers translates to poor performance (Ngala, 2017). Teachers need to ensure learners have access to knowledge thus enhancing learning. Across the country dismal performance is caused by inadequate resources as noted by Obwocha (2005).

The low performance noticed during the national examinations schools were reported having inadequate resources of which teachers were included. It therefore means that the government needed to avail funds to schools for them to equip departments of learning and cater for the cases of national cadre schools being trounced by small schools as seen in some cases.

Similarly, Ekal (2016) also set out to determine the role of principals in influencing academic achievement of learners in KCSE. The emphasis of the research was on the principals' monitoring strategies and the findings revealed that often principals lack access to funds to facilitate the purchase of physical and educational resources, for instance, it was revealed that computer laboratories were a major challenge for the schools and principals failed to acquire computers, internet and constant supply of electricity to facilitate teacher's integration of ICT to teaching and learning. Similar findings were reported by Yara and Omondi (2016) who set out to determine the impact of education resources provision in the performance of Mathematics among students from Bondo.

The researchers adopted a descriptive study design where 405 senior students were selected and issued with questionnaires. The findings showed that the availability of classrooms, textbooks, and other materials for learning and teaching like computers had a statistically

significant influence on the student's academic achievements. As such, they argued that the government should ensure that the principals receive adequate funds to help them purchase the necessary resources.

The study contributed to the existing literature showing that availability of educational resources is crucial in the performance of students. However, the study was focused in Bondo Sub-Coutny while the current study was focused in Meru County.

The adoption of Information Technology to demystify learning of Mathematics is not a practice in Kenya due to various factors. The use of IT resources like touchscreen, digital projector, interactive white board and other digital equipment makes it easy to teach and learn Mathematics. ICT enhances interactivity and engagement of students making education to be learner-centered, thereby underscoring the evidence that availability of other resources, methods used in teaching, and attitudes of learners can significantly influence performance in Mathematics.

The issue of attitude should be addressed by the administrators to reverse the trend. In as much as most students and teachers could not be utilizing or even with the knowledge of the unique abilities for using computer technology to teach and learn, having a positive attitude towards use of computer in education shows there is a bright future in teaching Mathematics. This will enhance improved performance in the subject.

Learning is an activity of interaction of various components such as motivation, student interaction, teaching resources, physical facilities and skills to teach what the curriculum states (Lyons, 2012). Enhancing learning among students and effectiveness in the learning process require resources as a basic item. Presence of material for instruction has some internal advantages as they are unique in teaching (Blumberg, 2011).

These materials motivate the learners to learn more each time and give the teacher captivating forums to convey the message. Learner curiosity is increased by being provided with private study and reference opportunities. Chances to overcome the physical difficulties that strain effective topic demonstration are overcome by the teachers thus teaching becomes easier and less demanding.

Availing adequate and relevant instructional resources make teaching effective (Afolabi, Adeyanju, Adedapo & Falade 2006). The authors add that these materials need to be utilized by schools to make learning and teaching more real in the classrooms. With this, the educational outcomes will be enhanced by providing the right quality and quantity as students will not lose interest in the class as what is relevant to them is offered.

Daluba (2012) records that effective delivery of science education to learners depends on availing teaching aids, the instructed text books and other relevant reading materials. In his study in West Africa, Isola (2010) found that the performance of students in the West Africa School Certificate Examination (WASCE) positively correlated the resources used for teaching and learning. Students need to actively contribute as stressed on the approaches of teaching-learning. This is because the curriculum is not overloaded with boring abstract concepts but rather dynamic involvement to minimize disruption.

Utilizing instructional materials and resources facilitates active participation in the sessions. Effective learning is dependent on provision of enough materials for instruction to enhance learners' academic achievement (Falade, 2006). Oyeniran (2003) points out that when students observe and see during the learning sessions, they will be able to absorb new knowledge better.

Oyeniran suggested having a substitution with objects in the real life is useful as an instructional material. Smit (2001) continues to pass the point that curriculum implementation is negatively affected by lack of appropriate resources. Resources such as text books and note books make learning simple and successful. Teachers need to access guides for the syllabus, schoolbooks and any relevant curriculum materials (Lunenburg, 2010).

Williams et al. (2005) conducted a research project on effective schools under the direction of Ed, Stanford University, University of California, Berkeley, and the American Institutes for Research that covered over 5,500 teachers and 257 principals. The research found that in schools where principals provided modern educational resources alongside with additional information to guidance for struggling students was a factor that was also found to correlate with student achievement highly.

A similar large-scale study conducted by Ellis, Gaudet, Shultz, Kaufman, Hoover, Spencer and Su (2007) and took place in the urban areas of Massachusetts found close identical results to those of (Williams *et al*., 2005). The secondary schools in Kenya have insufficient resources (Chiriswa, 2002; The World Bank, 2008). Secondary schools receive financing from the government to acquire resources like text books which is disbursed according to the enrolment in the schools which was an intervention started in 2008 to subsidize secondary education.

The Constituency Development Fund (CDF) which was introduced in 2003 supports other facilities such as laboratories and libraries (Asayo, 2009a). Adequate educational facilities and equipment should be acquired and allocated and be provided with the right quality and quantity to support learning.

Department for International Development (DFID) (2007) points out those availing educational resources such as textbooks the most recommended cost- effective contribution that affects students learning and achievement. In this regard, adequate resource is presumed to be at least one textbook per three students so that every learner has the opportunity to read.

Padmanabhan (2001) points out that the acquisition and allocation of resources can be used to measure the effectiveness of an education system. Equipment and other classroom materials such as course books are essential tools for learning and teaching and when their supply is inadequate, instructors are forced to handle lessons abstractly and as a result students are not able to grasp difficult concepts. There is need for principals to develop good plans to ensure educational resources are availed to support learning efforts. The principals also have a duty to ensure effective acquisition, allocation and distribution of the resources in a way that support the goals and objectives of their schools and improve outcomes.

According to DFID practice paper (2007) research supports that students' performance is dictated by the availability of educational resources and argues that providing adequate materials such as textbooks can significantly contribute to performance improvements. Teaching and learning materials are often extremely underfunded in most schools. Consequently, learners' academic performance is always reflected in the disparities in the materials invested in learning institution where learning outcomes are high are associated with use, allocation and sufficient educational resources while in schools where resources are under ultilized, low learning achievement is evident.

The learning outcomes of students are affected by the insufficient material resources in schools. Good results are seen in schools that have enough educational materials based on Padmanabhan (2001). Academic achievement has a correlation with instructional resources in a school (Adeogun, 2001; Likoko, Mutsotso & Nasongo, 2017).

The scholars emphasize that the process of learning involves the utilizing resources for instructions as they reinforce learning in students.

In areas where text books are scarce, use of creative visual aids in lesson delivery sparks interest in students. The authors further denote that in order for the system of learning to meet the demands of quality, efficiency and productivity, materials such as personnel, text books, physical facilities and libraries need to be provided.

According to (Gogo, 2002), schools with sufficient educational resources tend to perform well compared to those that don't have. Availability of resources in schools that perform highly and the low performing is of significant difference. There are challenges cited by research in Kenya, on the concept of educational materials and how they relate to curriculum implementation. The challenges include the allocation, acquisition and accessibility of these resources that has negative impact on how the teacher performs in the classroom (Orodho, Waweru, Ndichu & Nthinguri, 2017).

A report by UNESCO 2015 gave that the number of students who either do not have a text book or share textbooks with other students in Kenya continues to increase (UNESCO, 2015). Cohen, Raudenbush and Ball (2003) states that for effective utilization of the resources so that their values are realized, the educational resources should be provided on time for leaners and teachers to use them as required. Heilig and Williams (2010) also caution that student achievement can not only be improved solely by the availability of the resources but rather how they are used. The sentiments are shared by Owiny (2006) who states that there are no proper physical structures within NFE learning institutions. This was, therefore, very de-motivating to learning and unattractive to learners hence hindered students' performance.

From the aforementioned, the Principal needs to ensure that there are adequate teaching and learning resources in schools to facilitate learning and hence improve students' academic performance.

2.4 Principals' Encounter Inadequate Funds in Provision of Teaching And Learning Materials To Improve Students' Performance In Mathematics

The task of improving the students' performance in Mathematics is not easy for the principal, it comes with various factors that hinder it that need to be tackled by the principal. As identified by Njuguna in 2004 in her research done in Gatanga, the factors that affects negatively on the KCSE performance by students were listed as: - (i) inadequate educational resources, (ii) inadequate monitoring of school-based curriculum, (iii) poor syllabus coverage, (iv) indiscipline, absenteeism and poor entry behaviors by students and (v) parents less involvement in the affairs of the school caused by poverty.

Similar findings were presented in a study conducted in Embu by Amukowa and Karue (2012 to establish factors contributing to poor performance in day secondary schools. In their findings, factors such as bad company, weak students being admitted in schools, absenteeism due to lack of school fees, and lack of enough instructional resources (Tambunan, 2019). The researchers also argued that leadership style employed by principals can also affect performance of students. The study, was however, conducted in Embu whereas the current study was conducted in Meru.

The educational resources needed by a school to achieve its mission include having qualified staff, physical facilities and furniture, enough support staff and stores and even enough playground (Mungambi, 2015). In her study, Mueni (2019) agreed that in secondary schools there is inadequacy of materials for teaching and learning leading to overexploitation of the

few available resources. However, the study had been conducted in Nakuru county and targeted grade one learners. The findings were therefore, not generalizable to the current context; hence the study sought to fill this gap in literature.

We see the classrooms overcrowded with students because of insufficient classrooms. In the views received by the commission of inquiry into the education system which were taken from members of the public cited various problems that affect educational attainment as physical facilities being inadequate and unsuitable; inadequate instructional resources equipment and also insufficient teachers appropriately trained and the issue of the curriculum being overloaded (Koech Report, 2005).

School heads in Africa are in a dilemma of lack of resources as stated by Nzambi (2012). He stated further that the conditions for the teachers' works were deplorable, they are underpaid and overworked and worse still in some countries they are not paid for months. The subjects taught are not adequately taught due to the few numbers (Otunga et al, 2008). In a study done in 2012 by Amukowa and Karue in Embu among the district day schools found out that there were fewer teachers for sciences thus the art teachers doubling up as science teachers with the knowledge they got from high school. It was also reported by them that some untrained BSc. Holders graduates had been recruited in some schools to curb the science teachers' shortage. The output of teachers is affected by their lack of commitment, lateness, alcoholism that is quite a challenge to the head teachers today (Kusi, 2008).

Teachers who are not committed to their work may make students sit for the national examinations with uncompleted syllabus thus affecting their performance. There are cases of absenteeism especially due to sexual maturity among girls, for instance, girls may miss school four days in every 28 days as a result of menses and lack of proactive equipment such

as sanitary pads as reported in a study on gender equity and equality on needs assessment by girl-child Network in 2010.

Most secondary school girls are in there puberty. Another factor is riots among students that destroys property and makes parents incur additional cost thus poor results seen in examination (Bomett, 2011).

When students strike, education process is disrupted, schools and parents go through financial challenges thus the relationship between parents, teachers and students is strained (Mutua 2017). The syllabus coverage is affected thus the students not able to adequately prepare for the national examinations. The principal will face a challenge in supervising the curriculum and performance in examinations be low unless a review on how to solve the students' problems consultatively and systematically is done.

Violence causes a disruption in the smooth running of schools in Africa thus affecting the effectiveness of heads of schools (Otunga et al., 2008). Bomett (2011) adds that parents who do not respect the education system affect principals' role on improving the performance of learners. The principal may be overloaded with administrative functions and may not supervise well the learning and teaching process. In Kakamega district, a study done by Mulanda (2008) took an analysis on the constrains of head teachers to effectively supervise public secondary schools. The analysis presented that clinical supervision was not done by the principals due to the administrative functions they performed.

The findings were similar too in Kabarnet and Salwa Divisions in Baringo District where the poor monitoring strategies in terms of observation in the classroom, checking students' notes and teaching (Kimosop 2002).

2.5 Summary of Literature Review

It is an acceptable belief that leadership affects the performance of Mathematics as seen in most studies on educational leadership (Wahlstrom & Louis, 2008; Hallinger & Heck, 2012; Spillance, 2004), and still some scholars ask questions concerning the validity of claims (Witziers, Bosker, & Kruger, 2003). Those that do not support this view say that sufficient proof has not been provided to show that leadership really matters in the performance. In some empirical studies conducted in the Netherlands, they find no significant impact brought by leadership on how students perform in Mathematics (Hallinger & Heck, 2012).

In this study, the consensus on the impact influenced by the principal on the outcomes in the school especially on his/her leadership of the school on how the school performed in Mathematics (Hallinger, 12; Spillance, 2004). This contrasting position leaves the questions about the evaluation of the administrative strategies used by the principals' on how the students perform in Mathematics unanswered.

This study focuses on adding on the evaluation of the administrative strategies employed by principals' and their effects on how students perform in KCSE Mathematics in Meru County. A study finding carried out in Muranga County by Mwagiru (2014) on implementation of SMASE showed that head teachers did not provide enough resources for the teachers to learn and teach and to be used when delivering science lessons to effectively implement and strengthen sciences and Mathematics. Marete (2012) in a study to access implementation of SMASE in Meru County of teaching Mathematics and science education observed this approach was encountering several challenges which were hindering its full implementation.

Therefore, most studies have concentrated on the Implementation of SMASE to improve achievement in Mathematics and Science education.

There are limited studies on Evaluation of principles administrative strategies on student performance in Mathematics in KCSE, which creates a research gap and subsequently the background of this current study.

2.6 Theoretical Framework

Based on the pieces of literature reviewed, several key theories, relations and concepts have been proposed to guide the current study. It will help the researcher to design the right research model and help the researcher explain how the gap identified in the literature review. Performance improvement has been illustrated by several learning theories to give a justification by using administrative approaches. The theories include; human relation theory, social constructivism, and radical constructivism and social constructivism theories of learning.

2.6.1 Human Relations Theory

Mayo's Human Relations Theory (HRT) forms the basis of this study (1920). The theory is premised on peoples' productivity in any organization. The theory suggests that every person desires to be part of a team he believes would be critical for his growth and development. This implies that when members of staff are given special attention by their seniors and resources availed to them according to their needs, they take their jobs with more seriousness and show extra commitments, making them to be more productive and deliver quality work.

The arguments below are evident in the study of human relations:

- Individuals are better involved if they are made to feel important and valued
- Individuals changed attitude when involved and appreciated
- Proponents of HRT back motivation theory.

- The study emphasizes the importance human relations in organizations.
- Individual attention and recognition aligns with the human relations theory.

In this study, individual schools were studied as a social institution that is headed by the principal. The principal has the ability to identify and manage each individual and motivate them to change behavior and attitudes, thereby establishing ways of motivating them to be more productive and recognizing their efforts. The theory emphasizes on social and psychological needs of the staff members and the students.

The theory was useful in examining how the principals as school manager should come up with strategies that address and direct the energy of the teachers and students towards final goal by transforming latent energy into productive workforce in Mathematics using the resources and specialist in a viable fashion. Based on this theory, it was examined how the only way a principal can ensure performance adopting a democratic form of administration, by engaging teachers and students to understand their social, physical and psychological needs.

This theory would therefore be used to help to evaluate how principals' managerial and management practices and strategies affects teachers and ultimately students' performance in Mathematics in Meru County. However, the theory gives little emphasis on the tasks that needs to be undertaken in school.

2.6.2 Radical Constructivist Theory

An interaction of human beings and their ideas and experiences create knowledge as stated in the radical constructivism theory of knowledge (epistemology). The theory looks at the learner as a constructor of information and learning being a constructive and active process. It allows for the teacher to be guide for the learner, scaffold and develop the learners zonal

proximal. Skills of problem solving and reflection are learnt by the student and the independent ones get motivated to discover, enlarge, build and generate a framework of knowledge on their own.

A suggestion from researchers' state that the innate capabilities of the learner are built according to this theory, (Fosnot 2001; Brooks & Brooks 2005). Therefore, the learner actively constructs understanding using authenticated sources and interact socially thus he/she be an active not a passive person (Eggen & Kauchak, 2003). A learner is able to filter knowledge and experience from perceptions and personal theories as a central notion of the constructivism theory (Brown 2004).

Learners here have an encouragement to actively and freely seek for solutions as learning is nonlinear as the focus of the theory on cognitive development as part of the ingredients of a problem-solving approach. This in the long run fosters retention, high level of critical thinking and comprehension especially when is topped with deeper construction meaning of knowledge for learners to improve how they perform in Mathematics. Creating an environment to support constructive learning, investigation and problem solving is the desire for researchers on UCC-CCE distance learners.

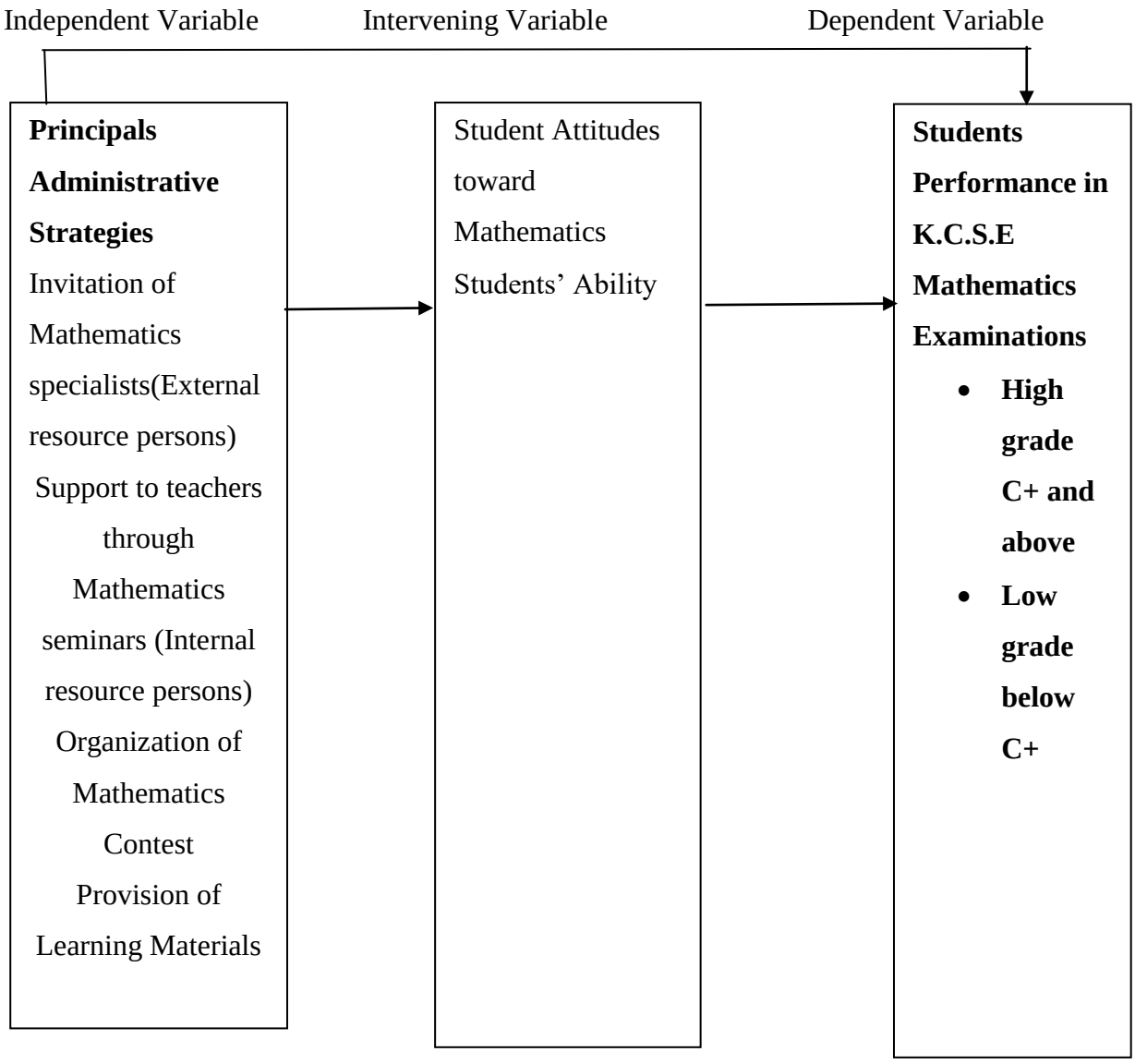
Learners are able to control their learning, (Brooks & Brooks 2005) which forms the heart of constructivist approach to education. The freedom to construct meaning is given to learners i.e. to reflect, interact with ideas, object some and think (cited in Auger & Rich, 2007, pp. 40-43). The deeper meaning construction of knowledge lacks in the UCC-CCE is Ghana for distance learners as they teach and learn Mathematics.

Distance learners in UCC-CCE are not given an opportunity to actively learn Mathematics and construct meaning of it as given in Blooms Taxonomy cognitive domain i.e. application,

analysis, synthesis, evaluation as used in teaching by a majority of Mathematics teachers in Ghana. This could be contributing factor to the low performance of the distance learners in Mathematics thus the study took out to examine

2.7 Conceptual Framework

Figure 1: Conceptual Framework on Strategies Used by Principals and Students' Performance in Mathematics.



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. Workshops and seminars attended by Mathematics teachers would help them to sharpen their skills and competencies and therefore support from the school principals for those teachers who went for in service courses and workshops would ultimately affect academic performance of the subject in examinations. The principals' organization of students' contest would result in increased student learning as well as in other important outcomes and therefore, encouraged principals to form Mathematics contest would affect performance of Mathematics among secondary school students'.

Availability and adequacy of teaching and learning materials would promote the effectiveness of schools as these were basic means that could trigger good academic performance by the student and therefore availing such resources by the school principal could affect performance of Mathematics among secondary school students.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

In this chapter, details on the research design, place where the study was conducted, the population targeted, the procedures for sampling, the pilot testing, instruments used for data collection and analysis of the data, matters reliability and validity the ethical and logistical considerations are covered.

3.2 Research Design

This study used ex-post facto design because the variables under investigation had already occurred (Creswell, 2017); Ex-post facto study or after the facts in which the investigation starts after the facts as occurred.

A technique in which groups with characteristics that already exist are compared on a dependent variable is known as an ex post facto research design. Ex post facto research, often known as "after the fact" study, is considered quasi-experimental since the participants are not randomly allocated; instead, they are grouped based on a certain feature or trait.

Based on the Meru County Schools performance on mathematics as depicted over a period of 5 years the sample data showed that the mean performance ranged at a mean of 4.0 which based on the performance fact is underperformance and hence has raised an alarm for researcher's study. Kumar (2007) asserts that mixed method studies are of great importance especially when dealing with opinion-based data. This is because opinion studies tend to be biased and the use of mixed method can help the researcher establish the consistency to make more credible conclusions for the study. Since the study started by developing research objectives and hypothesized, a positivist paradigm was employed as the guiding philosophy of the study. Positivist paradigm according to Creswell (2017) applies

when a researcher intends to employ established theoretical frameworks to test its consistency with the problem under investigation.

The paradigm heavily relies on literature review to identify variables and then employ established theoretical frameworks to draw hypothetical conceptual framework. In this study, three theories were employed to inform the development of the conceptual framework: Human Relations Theory, Radical Constructivist Theory and Social Constructivist Theory. According to Treagust, Won and Duit (2014), positivist paradigm leads to highly generalizable results since its based on known parameters and is therefore highly recommended for research problems that are likely to be found in other similar circumstances.

3.3 Locale of the Study

Meru County is one of the 47 Counties in Kenya and is in the upper eastern region. From 2012 to 2016, performance of students in Mathematics in KCSE examinations had been low compared to the national performance. In the 2015 KCSE results, Meru County was ranked number 28 nationally out of 47 counties in Mathematics Performances, while the neighboring counties of Embu and Tharaka-Nithi posted better results in Mathematics and were ranked position nine and 18 respectively. Meru County had a mean of 2.8, which is grade D plain, and therefore the researcher sought to evaluate the relationship between principals' strategies of administration and students' performance in Mathematics in KCSE examination in the county. Therefore, because of this poor performance in Meru County, the researcher was justified to carry out a study to see the reason for the poor performance in Mathematics from 2012 to 2016 as displayed in table 1

Table 1Meru County KCSE performance

Year	**Mean grade**
2012	4.332
2017	4.469
2014	4.415
2015	4.637
2016	3.756

Source: KNEC (2016)

3.4 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. The schools are distributed as shown in table 2

Table2: Distribution of target population in Meru County

Sub-county	**Number of schools**
Imenti North	41
Imenti South	32
Imenti Central	35
Buuri	28
Igembe North	22
Igembe Central	40
Igembe South	32
Tigania East	38
Tigania West	31
Total	**299**

3.5 Sample Size and Sampling Procedures

On determining the sample size, Mugenda and Mugenda (2003) states, that depending on time and resources available, a 10% sample can be used for a large population studied, and if more than 1000is studied, while for smaller populations, less than 100, 30% sample can be used. This study therefore used 30% of 299 principals and 836 Mathematics teachers translating to 92 and 251 sample size, respectively. Thisensured that the number of schools per category are a good representative of the whole population and hence increase the precision (Creswell, 2017).

For selecting schools in the different categories, stratified random sampling with proportional allocation was employed as displayed in table 3.3. The method ensured that the characteristics of the three sub-groups as well as sub-counties in Meru County were equally represented.

In each category, the researcher employed simple random sampling to determine the specific school that were visited. Simple random sampling reduces systematic bias, hence making each participant have equal chances of being selected (Creswell, 2017). The same procedure applied to identification of respondents in each of the schools selected. However, principals and Mathematics teachers were purposively sampled since they were the only relevant respondents for this study.

Table 3: Number of Schools Visited per each Category in Meru County

Sub-county	**Proportion**	**Mixed Schools**	**Girls' Schools**	**Boys Schools**	**Total Number**
		64	17	11	92
Imenti North	0.14	9	2	2	13
Imenti South	0.11	7	2	1	10
Imenti Central	0.12	7	2	1	10
Buuri	0.09	6	2	1	9
Igembe North	0.07	5	1	1	7
Igembe Central	0.13	8	2	2	12
Igembe South	0.11	7	2	1	10
Tigania East	0.13	8	2	1	11
Tigania West	0.10	7	2	1	10
Total	**1.00**	**64**	**17**	**11**	**92**

3.6 Research Instruments

The research instruments that aided in conducting this study were:

The Mathematics Teachers' questionnaires and Principals' Interview guides

The researcher developed all the instruments.

3.6.1 Mathematics Teachers' Questionnaires

This study used Mathematics teachers' open questionnaires to collect data from teachers of Mathematics on the administrative strategies of the principals' put in place to improve students' performance in Mathematics in KCSE. According to Mugenda and Mugenda (2005) a questionnaire can enable the researcher to collect data from a wide respondent over a short time. The Questionnaire was subdivided into focused on demographic information, principals' invitation of Mathematics specialists, and principals' support to teachers through Mathematics seminars/workshop and principals' organization of Mathematics contests and provision of learning and teaching materials by the principal(Appendix IV).

3.6.2 Principals' Interview Guides

The principals are in charge of coming up with strategies for improving performance in Mathematics in their schools. In this study they mainly gave information on what strategies they used to ensure that the performance was improved. The researcher and the research assistant was probing the principals to give more insights, opinions, views as well in formation based on their response to the questions.

The interview gave more accurate information which questionnaire could not because interview provides for clarification of the questions that appear confusing for the respondents to provide responses that are relevant (Appendix II).

3.7 Piloting Instruments

To ascertain the validity and reliability of the data collection questionnaires and interviews, pilot survey was conducted. Piloting 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 nine schools was randomly chosen to take part in the pilot study for this study, three schools from each of school category. The nine schools were selected randomly from each of the nine sub-counties in Meru County. This selection ensured there was equal and adequate representation of the study population. All schools that participated in the pilot study were excluded in the main study. This was done to avoid information asymmetry bias. 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.

3.8.1Validity 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 judgment and review was used to enhance content validity of the data collection tools (Kumar, 2009).

There are three types of validity. The first is content validity which refer to the degree to which the items tested fairly represent the entire domain that the test seeks to measure (Salkind, 2010). Content validity is concerned with the content domain and the items the test should sample in a manner that makes the test items representative.

On the other hand, construct validity refers to the evaluation of whether the measurement tool represents the things it is interested in measuring. It is concerned with ensuring that the method of measurement matches the construct it should measure. To ensure construct validity, the researcher ensured that the indicators and measurements were carefully developed based on current and existing knowledge.

The third validity is face validity which considered how suitable the contents of the instruments are on the surface. It is a more informal and subjective assessment. The instruments were prepared with close consultation from the supervisors by the researcher 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, questions of study and objectives 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 Department of Curriculum instruction and Educational Management 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 instruments 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 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.

3.8.2 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 (2017) asserts that split-half technique involves dividing research instruments into two, using 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, 2017). In this study, a coefficient of 0.73 was realized in the questionnaire, which is an implication that the reliability threshold was realized. For the interviews, the researcher looked at the consistency of the responses and judged them based on explicability. After the pilot study, the researcher made several modifications on the research instruments with the view of making them more clear hence increasing their reliability before collecting data for the main study. The researcher modified both the research questionnaires and the interview guides to cure the bias observed in the pilot study. For instance, there were some questions that respondents seemed to confuse to bring a different meaning from the one target by the researcher. Such bias and mistakes were corrected before instruments were subjected to the respondents.

3.9 Data Collection Procedures

The researcher 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 Meru 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 them. 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.

3.10 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). After the data was collected, the researcher examined the collected information for accuracy, completeness and clarity.

The analysis of data was done according to the type of data collected. For the quantitative data, analysis was done both descriptively and inferentially descriptive analysis was done using percentages and frequencies. Inferential analysis was done using chi-squares.

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. It was analyzed using frequency distribution table's percentages. Quantitative data presentation was through tables, percentages and normal distribution tables. For the study to find out the interaction between the invitation of Mathematics specialists by the principals and how the students performed in Mathematics in KCSE examination, Chi-square was used.

The qualitative data gathered from open ended questions was analyzed and the interpretation of information was done. The qualitative data was reported through narratives and statement of the respondents.

To establish the effects of relationship between principals' support to teachers through Mathematics seminars how the students' Performed 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, ANOVA 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. The choice of these types of inferential statistics was informed by their applicability and their potential to best explain the relationship between the independent variables& the dependent variable. According to Glass and Hopkins (2009), chi-squire is employed when dealing with discrete variables that depend on human judgment, to establish the likelihood that they are significantly associated with the problem under study. On the other hand, Hollander, Wolfe and Chicken (2017) explains that ANOVA is applicable with variables under comparison have definite figures that are based on numerical values. The use

of ANOVA in establishing whether the number of mathematics contests organized by principals was systematically influencing KCSE performance of secondary school learners was therefore, within the best statistical choice for the variable. Basically, the use of inferential statistics is crucial for a study like this since it's practically not possible to establish relationships without establishing statistical significance (Fisher, 2006; Finlay and Agresti, 2016). Having adopted descriptive, inferential as well as qualitative analytical methods, the study has explored all important aspects of explaining field data and makes its conclusions highly reliable.

Table4: Summary of the Data Analysis Techniques

Objective	Hypothesis	Data Type	Analysis
To evaluate the effects of the principals' invitation of Mathematics specialists on students' performance in Mathematics in KSCE examination in Meru County.	H0: There is no significant relationship between effects of principals' invitation of Mathematics specialists and students' performance in Mathematics in KSCE examination in Meru County.	Quantitative	Descriptive i. Frequencies i. Percentage Inferential Statistics
To evaluate the effects of principals' support to teachers through Mathematics seminars/workshops on students' performance in Mathematics in KCSE examination Meru County.	H_0: There is no significant relationship between the effects of principals' support to teachers through Mathematics seminars/workshops and students' performance in Mathematics in the KCSE examination Meru County	Quantitative	Descriptive i. Frequencies i. Percentage Inferential Statistics
To evaluate the effects of principals' organization of Mathematics contests on students' performance in Mathematics in KCSE examination Meru County.	H0: There is no significant relationship between the effects of principals' organization of Mathematics contests and students' performance in Mathematics in KCSE examination Meru County.	Quantitative	Descriptive i. Frequencies i. Percentage Inferential Statistics
To evaluate the effects of principals' provision of teaching and learning materials on students' performance in Mathematics in K.C.S.E in Meru County	H0: There is no significant relationship between the effects of principals' provision of teaching and learning materials on students' performance in Mathematics in KCSE in Meru County.	Quantitative	Descriptive i. Frequencies v. Percentage Inferential Statistics

3.11 Ethical Considerations

This was followed by a visit to the schools to explain the purpose of the study and what roles they would play to achieve the purpose, and also to get their informed consent to take part in the study. With the help of research assistants that had already been trained and the researcher, the instruments were administered. This intended that the respondent gave more information to the researcher to achieve the study objectives. At no instance did the respondents get required to give their names as such questions were left from the study framework purpose. The respondents were also not put under any physical nor psychological harm. The respondents were adequately debriefed about the findings of the study.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.0 Introduction

In this chapter, the study presents the analysis of data in line with research objectives which sought to examine the effects of the principals' invitation of Mathematics specialists (External resource persons) on students' performance in Mathematics in KCSE examination, to establish the effects of principals' support to teachers through Mathematics seminars on students' performance in Mathematics in KCSE examination, to determine the effects of principals' organization of Mathematics contests on students' performance in Mathematics in KCSE examination and evaluate the effects of principals' provision of teaching and learning materials on students' performance in Mathematics in K.C.S.E in Meru County.

4.1 Background Demographic Information

Nationally, Meru County was ranked at position 28th out of the 47 counties in Kenya in 2015 in Mathematics performance. Contrary, its neighbours Tharaka Nithi and Embu were ranked eighteenth and nineth respectively. Overall, Meru County had a mean average grade of D Plain. So, due to its poor performance, there was a need to evaluate the effects of principals' strategies of administration and students' performance in Mathematics in KCSE in the county. Therefore, because of this poor performance in Meru County, the researcher was justified to carry out a study to see the reason for the poor performance in Mathematics from 2012 to 2016.

4.2Mathematics Specialists and Students Performance in Mathematics

The first objective was to examine 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 Table 5 was presented which indicate the number of Mathematics specialists (External resource persons) they had invited to their schools, in the last five years (2012 - 2016), to improve student's performance in Mathematics. Their responses are summarized in Table 5

Table 5: External Resource Persons (Mathematics Specialists) and Student Performance in Mathematics

External Resource person	**N=92**	**Those who did**	**Those who did not**
Math Specialist	F	48	44
	%	52.17	47.83
Team Teaching(Internal resource person)	F	12	80
	%	13	87
Peer Teaching(Internal resource person)	F	16	76
	%	17.4	82.6
Others	F	4	88
	%	4.3	95.7

As the Table 5 indicates, 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 a 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.

However, as displayed in the Table 4.2, Majority 48 (52.17%) of principals invited Mathematics specialists while the minority 44 (47.83%) did not invite Mathematics specialists. Other resource persons used by the principals were team teaching 12(13%).

In regards to peer teaching resource person, only 16(17.4%) principals claimed that they invited peer teachers to their schools. Four (4.3%) principals 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 to 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. These 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.

Therefore, the claims by Campbell and Malkus (2010) 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 their Mathematics' teachers whohave 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 4.1, 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).

Table 6: Chi Square Results- Specialists and KCSE Performance

Specialist		KCSE PERFROMANCE				P=value
		N=92	**Poor**	**Average**	**Good**	
Mathematics-Specialist(External resource person)	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(Internal resource person)	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(Internal resource person)	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	

As the Table 6 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 a 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 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.

Lamon (2005) who found that placing Mathematics specialists in the school has a positive impact on the learning goals of the learners also supports these findings. 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 suggest 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 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 52.17% these schools did not invite a Mathematics specialist which explains why their performance was 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.

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.

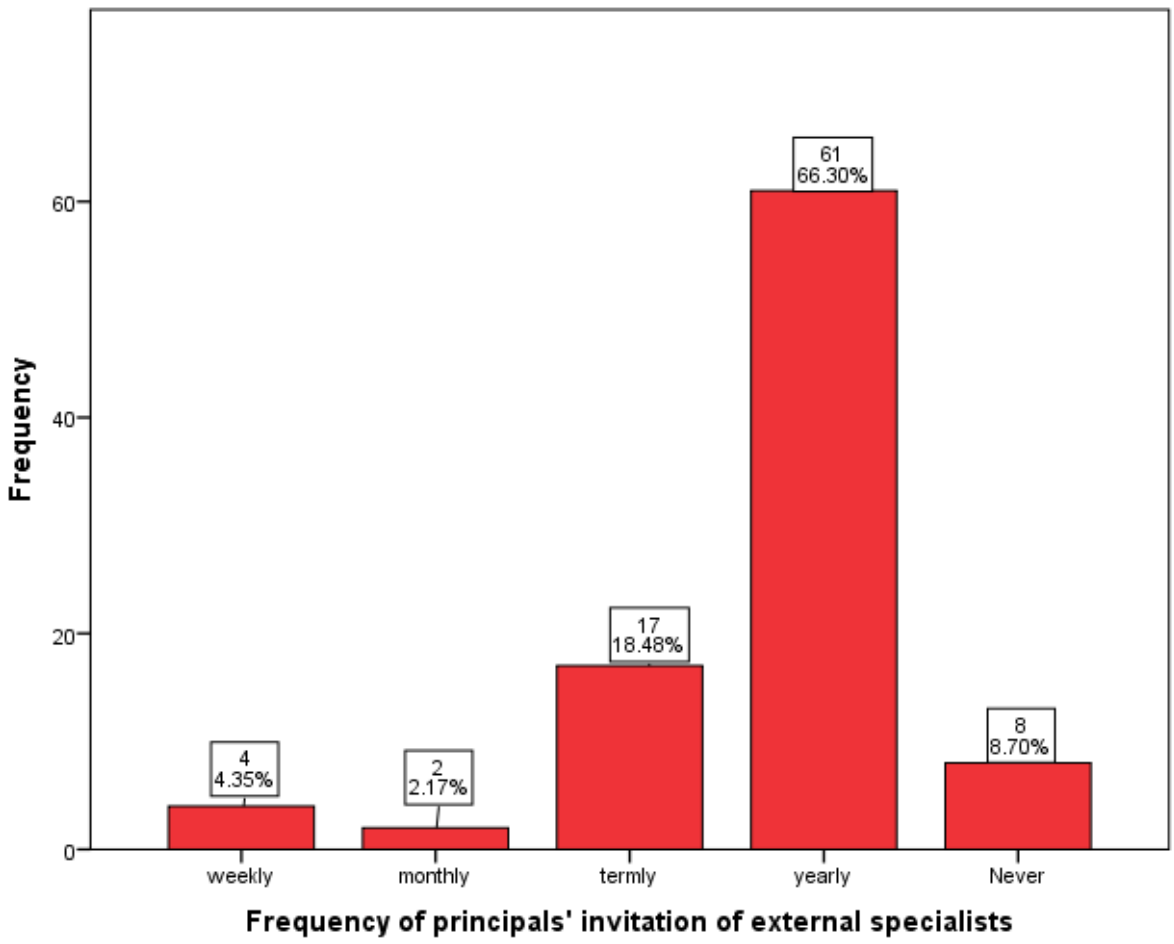
Last, it was seen that most of the schools that did not invite Mathematics specialists but used their internal Mathematics teachers as substitutes for external support staff performed poorly three (3.26%) performed poorly while those that did not invite nor use their Mathematics teachers as specialists 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 likely influenced by 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 students to their Mathematics teachers and their approaches to teaching Mathematics.

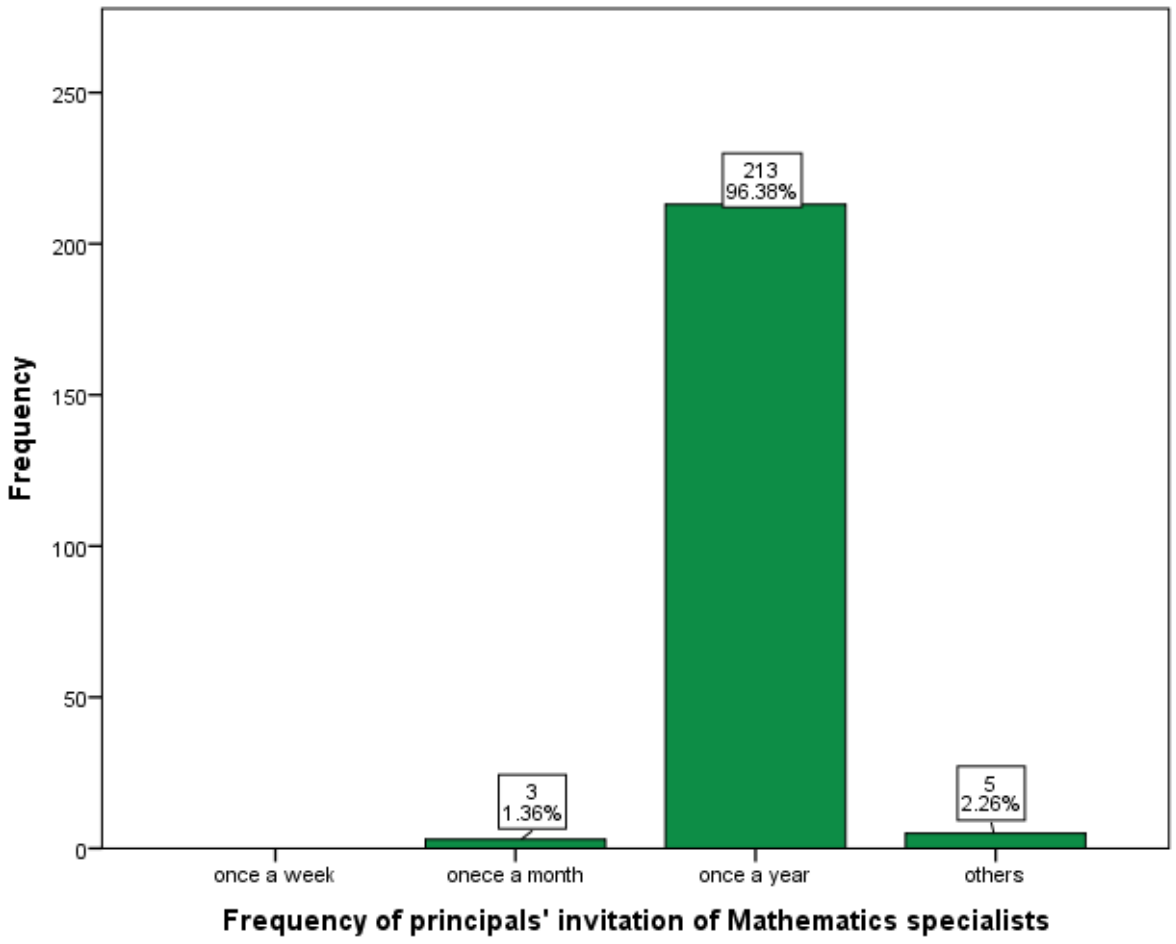
The respondents were then asked to indicate how often they invited the support staff they selected. Their responses are as indicated in Figure 2.

Figure 2: Principals' Views on Frequency Specialist Invitation



As the Figure 2 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 3 showed their responses.

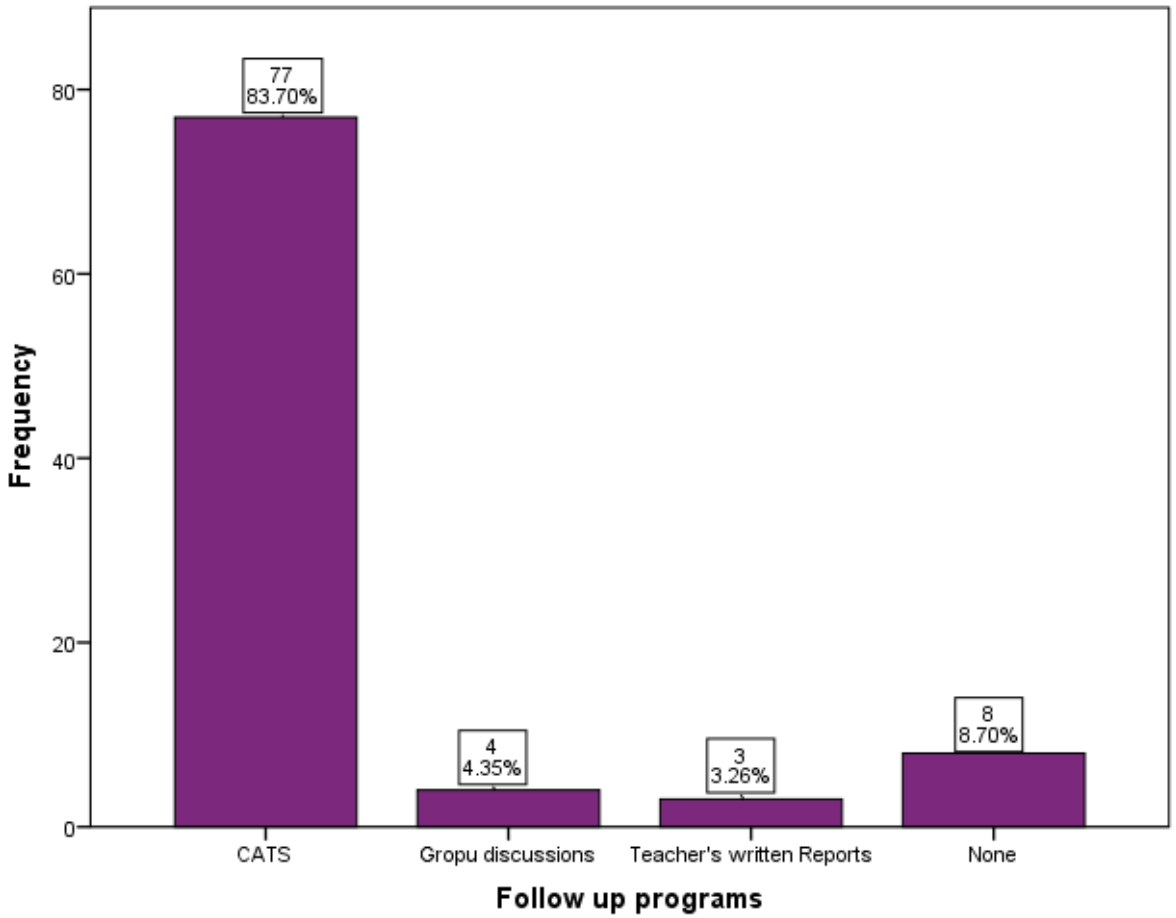
Figure 3: Mathematics Teacher's Views on Frequency of Specialist Invitation



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.

Figure 4: Follow Up Programmes to Ensure Students Retained What They Had Learnt After Specialists Had Left



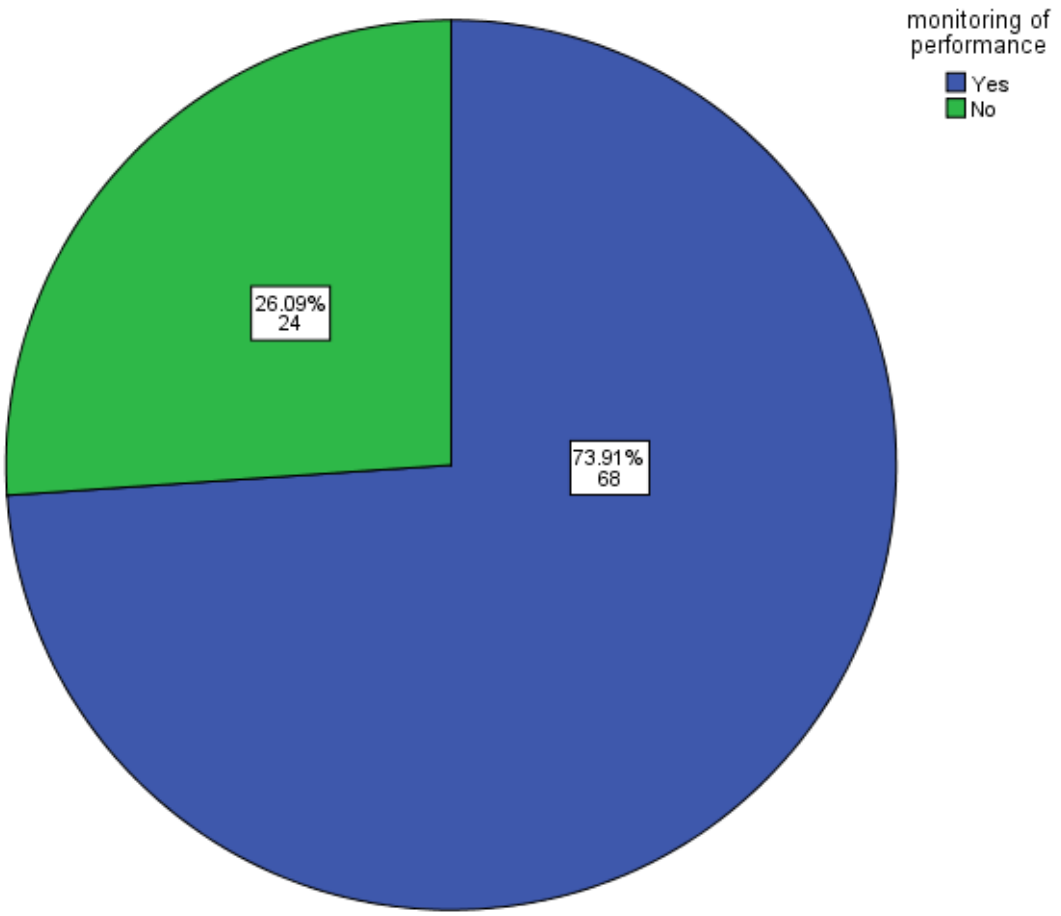
As displayed in the Figure 4, the majority of follow up programmes adopted by the secondary schools were mainly Continuous Assessment Tests (CATS) 77(83.70%) while four (4.35%)

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 5 showed their responses.

Figure 5: Monitoring of Performance after the Invited Specialist Had Left



As displayed in the Figure 5, 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 respondents 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 principal 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.*

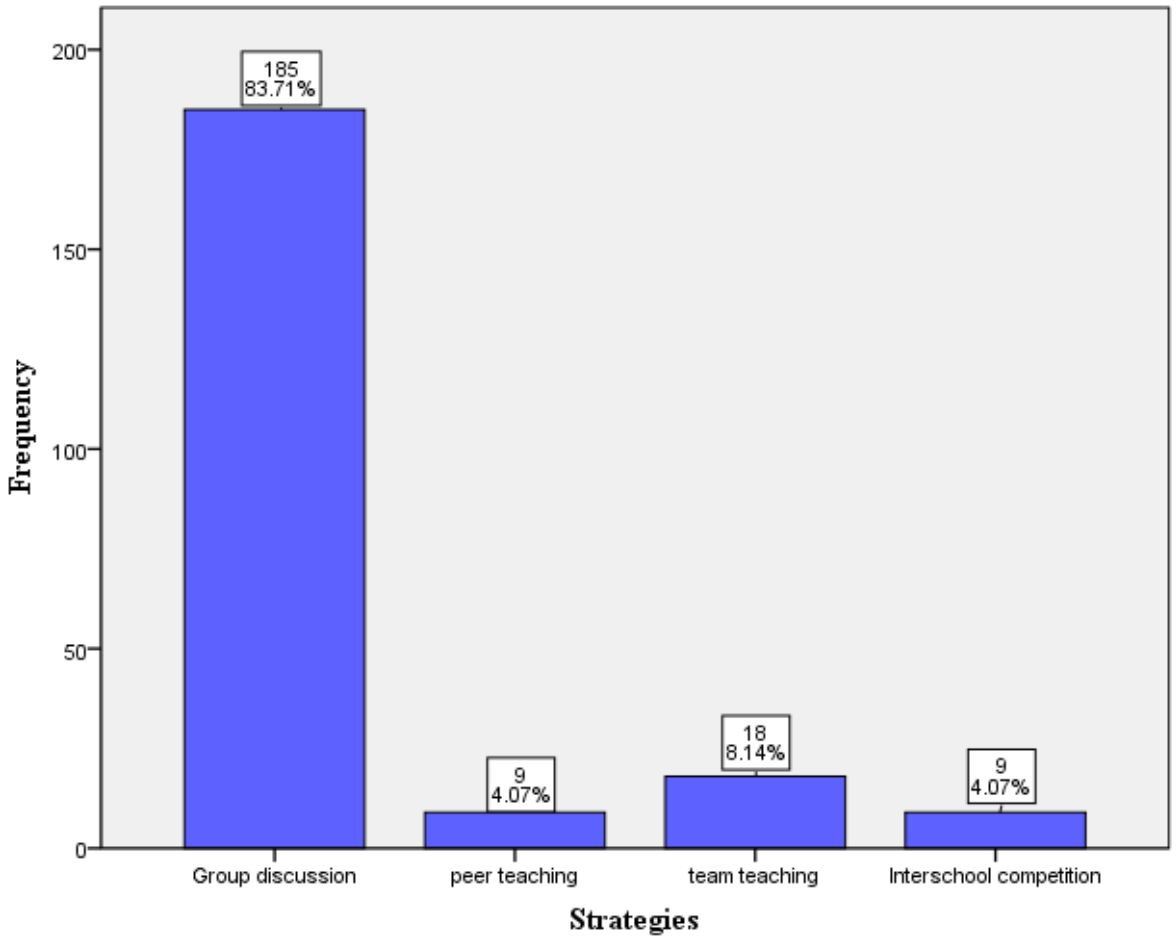
Similarly, another one claimed;

'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 6 showcases the Mathematics teacher's responses on the strategies used to improve student performance in Mathematics.

Figure 6: Mathematics Teachers' Strategies and Mathematics Performance



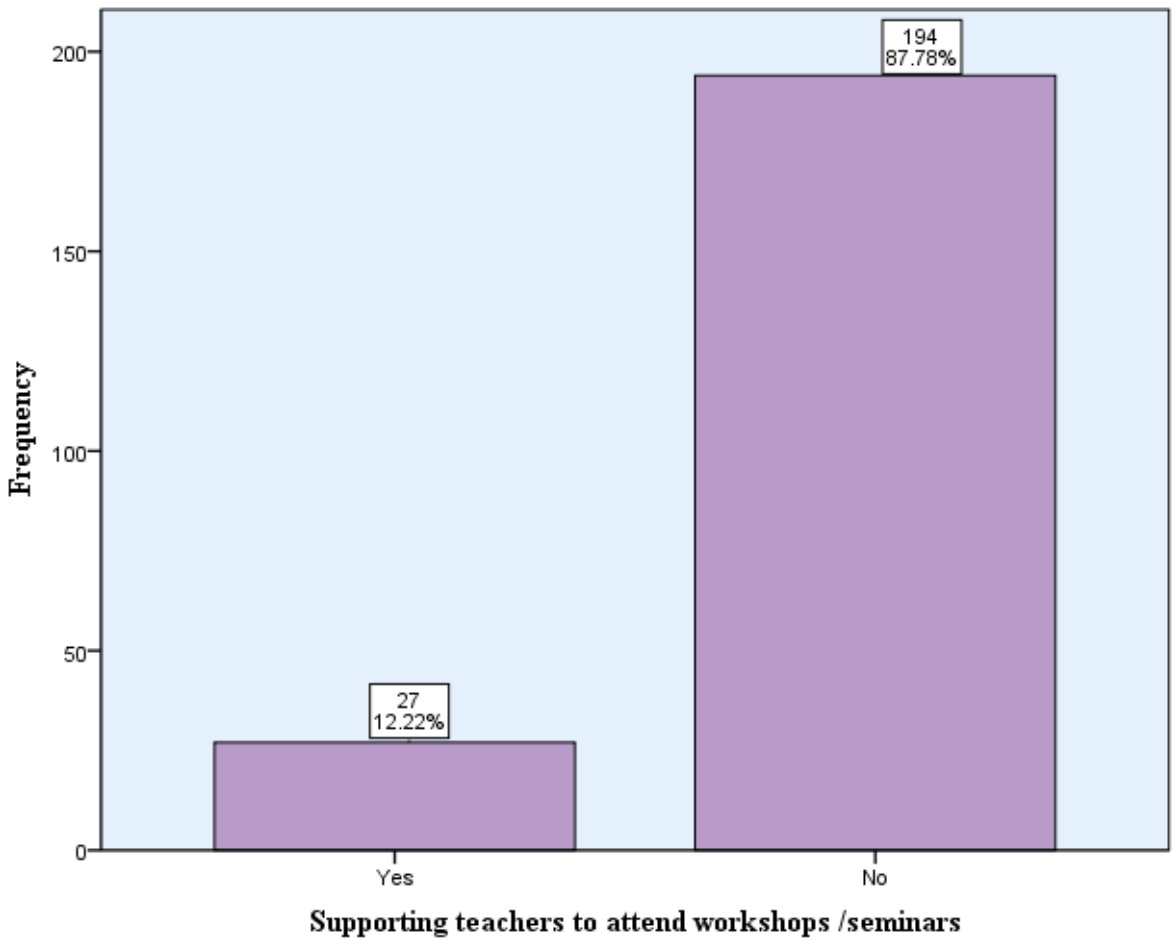
As displayed in Figure 6, the majority of Mathematics teachers 185(83.71%) indicated that they used group discussions, while a minority 18(8.14%) claimed that they used team teaching. Nine (4.07%) asserted that they used peer teaching and nine (4.07%) indicated that they used inter-school competitions. Based on these findings, it was seen that the majority of Mathematics teachers (83.71%) used group discussions to promote student performance in Mathematics.

From these findings, the researcher deduced that the majority of principals did not consider their Mathematics teacher's attendance of seminars as being an important aspect of improving performance of students in Mathematics. This was irrespective of the skills and integration of new instruction skills Mathematics teachers stand to gain from the seminars.

4.3Principal's Support to Mathematics Teachers through Seminars to Improve Performance in Mathematics

The second objective of the study sought to evaluate the effects of principals' support to Mathematics teachers through Mathematics seminars on student' performance in Mathematics in KCSE examination in Meru County. First, the researcher asked the Mathematics teachers to indicate whether their principals supported them by sending them to seminars. Their responses are as displayed in the Figure 7.

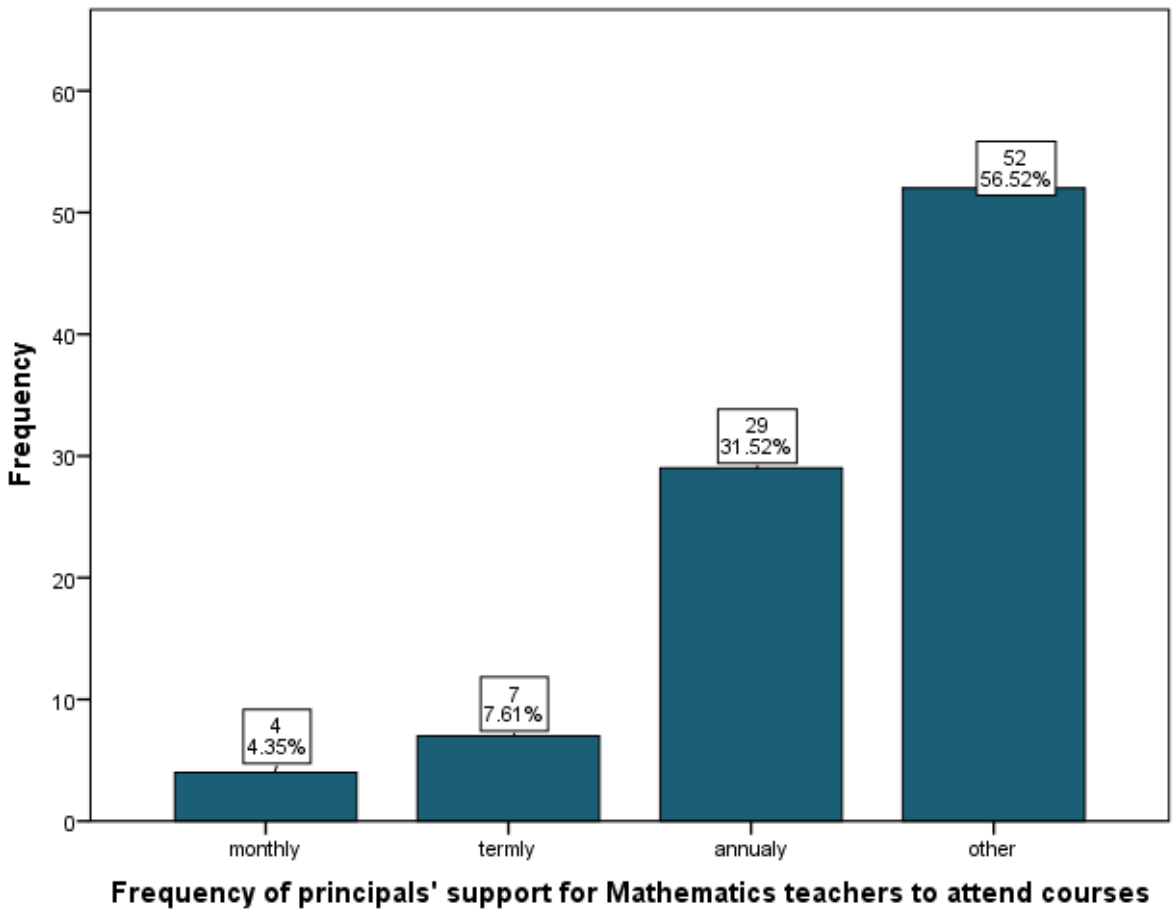
Figure 7: Principals' support to teachers to attend seminars



As indicated in the Figure 7, the majority of the Mathematics teachers 194(87.78%) refuted the claim that their principals supported them to attend seminars with only a minority 27(12.22%) claiming that their principals supported them to attend seminars.

From these findings, the researcher deduced that the majority of principals did not consider their Mathematics teacher's attendance of seminars as being an important aspect of improving performance of students in Mathematics. This was irrespective of the skills and integration of new instruction skills Mathematics teachers stand to gain from the seminars.The principals were then asked to indicate how often they had supported their Mathematics teachers to attend in the last two years. Their results are as provided in the Figure 8.

Figure 8: Course Support by The Principals' To Their Mathematics Teachers



It was seen that most of the principals 52(56.52%) did not organize for their Mathematics teachers to attend professional development courses, while 29(31.52%) supported their Mathematics teachers to attend courses annually, seven (7.61%) supported them once every term and 4(4.35%) supported them once a month.

From these findings, the researcher deduced that in the majority of secondary schools in Meru County, little effort is placed on Mathematics teacher's development through course attendance. These findings go hand-in-hand with the Mathematics teacher's assertions in Figure 4.6 where the majority 194(87.78%) asserted that their principals did not organize for them to attend workshops and seminars.

The lack of continuous professional development through seminars, and course attendance across the majority of schools could be linked to the continued dismal performance in Mathematics in Meru County.

From the interview schedules, the majority of principals felt that the lack of resources was the major reason for their inability to organize courses to support their Mathematics teachers. One of the principals who did not support their Mathematics teachers to attend courses claimed:

"In my school, we lack resources and finances to send our Mathematics teachers out to seminars or even to professional development courses."

Another principal claimed;

'I do understand the importance ofMathematics teacher's professional development through seminars, but strained finances really limit our ability to send ourMathematics teachers to seminars frequently. We do try from time to time, but I feel that we are not really doing enough to ensure that ourMathematics teachers are well-equipped to promote better performance in Mathematics. 'These responses from the principals revealed that financial

obstacles limited schools performance in KCSE in Mathematics. Therefore, the government should look for ways for giving schools adequate finances.

With reference to the lack of professional development, the researcher asked the principals how they motivated their Mathematics teachers to improve performances. One of the principals claimed:

'I provide the Mathematics teachers with materials for CATS such as printers and printing papers.'

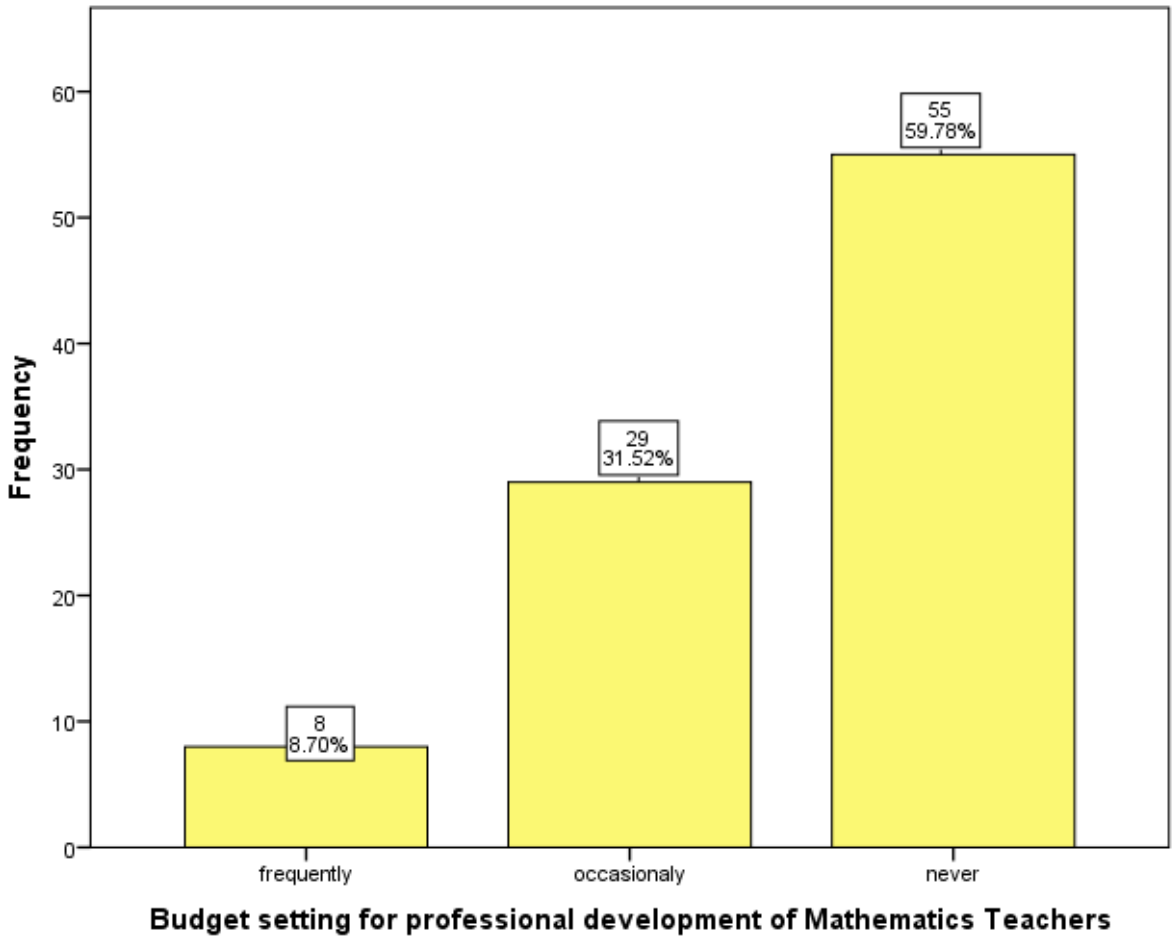
Another principal claimed,

'I allow my Mathematics teachers to attend seminars once a year, and then at the end of the years, I give outstanding Mathematics teachers a small 'bahasha' or small token to appreciate them. I also send them congratulatory messages."

These statements by principals were evidences that some principals supported their Mathematics teachers to improve performance in Mathematics. It was found out that they gave them material resources, supported them to go to seminars and gave them individual recognition, which resulted to improved performance in Mathematics.

The researcher then went forth to ask the principals to indicate how often their schools allocated a budget for teacher's professional development. The principals' responses are as indicated in the Figure 9.

Figure 9: Budget allocations for professional development for Mathematics teachers



It was seen that the majority of principals/schools 55(59.78%) never allocated a budget for Mathematics teacher's professional development, while 29(31.52%) occasionally set a budget aside and a minority eight (8.70%) set a budget forMathematics teacher's professional development frequently.

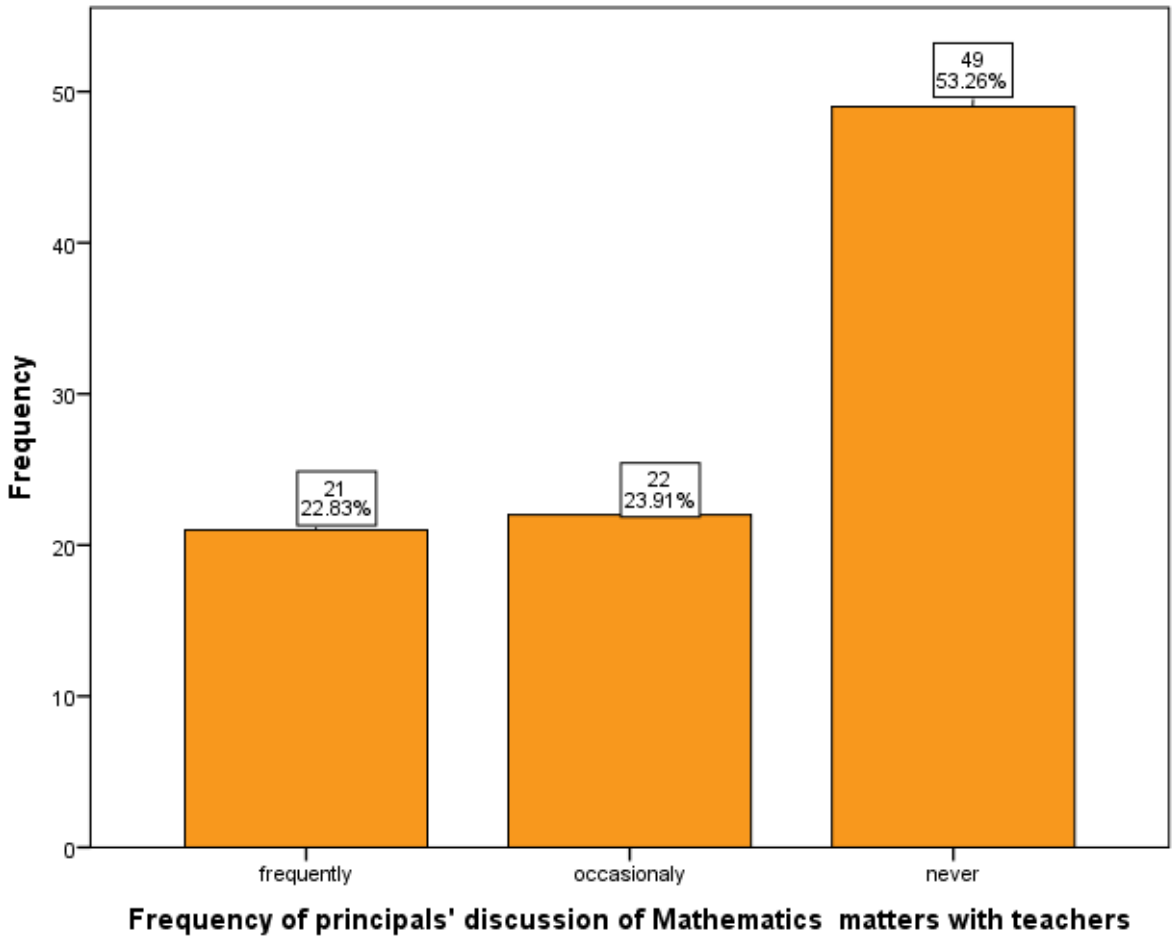
These findings showed that in majority of schools across Meru County, there was no budget set aside to ensure that Mathematics teachers engaged in professional development. This contributed to the declining students' performance in Mathematics as the teachers' knowledge and skills stagnated over the years as they lacked the engagement with peers and experts to initiate and share new ideas and instructional methods to improve students' performance.

These sentiments are expressed by the South Africa Department of Education (2008) which claims that professional development symbolized all the goings-on in teaching and learning with the aim of empowering the Mathematics teachers to accomplish their duties more competently and successfully towards achieving improved learner achievement.

It is concerned with enabling learners receive learning by providing Mathematics teachers with quality teaching skills and subject knowledge in order to enable them impart knowledge to the learners. Additionally, it was specified that teaching involves the experts to be well-informed of new developments, in order to be imaginative and passionate educators so that students could perform well.

The researcher also deemed it important to ask the principals how often they engage Mathematics teachers on discussions pertaining challenges and issues on teaching and learning Mathematics in their respective schools. The responses are as indicated in the Figure 10.

Figure 10: Discussion Frequency to Improve Performance In Mathematics



The Figure 10 showed that most of the schools 49(53.26%) never discussed matters that affected teaching and learning Mathematics with their Mathematics teachers, while 22(23.91%) discussed them occasionally and 21(22.83%) discussed them frequently.

The above findings were supported by the claims by the Department of Education (2008) which stresses that schools need to have staff professional developmental programs in order to achieve endurance in professional development. Professional development should be understood by the principal who is the instructional leader as a tool designed to clarify learners' achievement. Developing the staff is therefore as a way to achieve better, have active and efficient school teaching and learning.

From these findings, the researcher discerned that the majority of schools did not engage their Mathematics teachers to find out what challenges or issues they experience while teaching and learning Mathematics. Therefore, even when teachers were facing challenges, they lacked a platform with which to air their grievances or ask for support; this compromised the delivery of services and how students performed in Mathematics.

The researcher then sought to determine whether the allocation of a budget and discussion of issues and challenges had an association with the student's performance in KCSE. To achieve this, a chi-square test of independence was conducted at 95%confidence interval. The findings are as displayed in Table 7.

Table 7: Chi-Square- Principal's support and KCSE performance in Mathematics

Principal's support	**KCSE PERFROMANCE**					P=value
		N=92	**Poor**	**Average**	**Good**	
Budget allocation	Frequently	F	1	3	4	0.000
		%	1.09	3.26	4.35	
	Occasionally	F	12	16	1	
		%	13.04	17.39	1.09	
	Never	F	54	0	0	
		%	58.7	0	0	
Mathematics discussions	Frequently	F	8	9	5	0.000
		%	8.7	9.78	5.43	
	Occasionally	F	8	14	0	
		%	8.7	15.22	0	
	Never	F	48	0	0	
		%	52.17	0	0	

As the Table 7 shows, most of the schools that frequently allocated budgets for Mathematics teacher's professional development four (4.35%) had good performance while only one (1.09%) of poor performing schools allocated budgets frequently.

Similarly, the table shows that among the schools that occasionally set aside budgets for Mathematics teacher's professional development, the majority 16(17.39%) were from

average performing schools while all 54(58.7%) of the schools that did not allocate budgets for Mathematics teacher's professional development performed poorly.

From these findings, it was seen that there is an association between budget allocation forMathematics teacher's professional development and the school's performance in Mathematics. These findings are echoed by the chi-square results which showed that there is a statistically significant association between budget allocation for professional development and the school performance at p value ($p=0.000<0.05$).

These findings showed that schools that invested in their Mathematics teacher's professional development increased their students' performance while those that neglected to develop theirMathematics teachers professionally continued to perform dismally.

The above findings were supported by the claims by the Department of Education (2008) which stresses that schools need to have staff professional developmental programs in order to achieve endurance in professional development. Professional development should be understood by the principal who is the instructional leader as a tool designed to clarify learners' achievement. Developing the staff is therefore as a way to achieve better, have active and efficient school teaching and learning.

To have effective professional development, therefore, there should be a focus to improve instructional practices, where Mathematics teachers are provided with new knowledge and have methods to evaluate learning with the aim of improving students' learning (*Wei*, Darling-Hammond, Andree, Richardson and Orphanos, 2009). Additionally, Essien, Akpan and Obot (2016) also reported that there was a positive correlation between the principal's support of teacher's attendance of seminars, workshops and in-service training. According to the findings, it is evident that developing teachers professionally was crucial for the

performance of learners.

This would be due to the performance of learners being largely dependent on the quality of the teacher; therefore, when principals send teachers to in-service training, seminars they are improving the quality of the teachers and the student.

In this case, it was deduced that when the teacher's needs are met through their professional development, their competence increases. However, if the teacher's professional needs are not met, then the teacher will be dissatisfied making the teacher unstable and would not be productive. Therefore, in this case, the majority of the schools have been found to fail in allocating budgets to facilitate teacher's professional development.

Therefore, drawing from the assertions of Wei, Darling-Hammond, Andree, Richardson and Orphanos, (2009); Essien, Akpan and Obot (2016) it was evident that the poor performance of the school that did not set aside budgets to send teachers to workshops and seminars stems from the minimal expertise that teachers could get from attending professional development classes.

Additionally, as Essien, Akpan and Obot (2016) affirms, teachers whose professional needs are not met are often psychological unstable and therefore, unproductive. These teachers feel unappreciated and as such, may be dissatisfied and inadequately motivated resulting in poor delivery of subject content. Further, Kyalo, Chepketer, and Kyalo (2016) also reported that despite some schools having well qualified and well-trained teachers there are many instances where teachers require refresher courses to help improve their teaching performances.

As such, it was seen that the performance of students is still poor, more so in public schools. It is evident that the schools are not offering teachers the chance to refresh their skills and knowledge just as has been identified in the current study.

The Table 4.6 then shows that the schools that had good performance five (5.43%) held frequent discussions with their Mathematics teachers to discuss issues and challenges in teaching and learning Mathematics. Similarly, the majority of the schools that occasionally held discussions 14(15.22%) recorded average performances while the majority of the poorly performing schools 48(52.17%) never held discussions with Mathematics teachers to discuss issues affecting teaching and learning of Mathematics in their respective schools.

From these findings, it was evident that holding discussions with Mathematics teachers to highlight and discuss the issues facing Mathematics teachers and students in teaching and learning Mathematics had a significant effect on their performance evidenced by the p value of 0.000<0.05, which was not statistically significant.

From these findings, it was seen that holding frequent discussions gives the mathematicsteachers an opportunity to air the challenges facing them, highlight the issues and find a way to overcome them. Additionally, it affords them the chance to share ideas with peers on effective teaching and instruction strategies. They could also set goals and plans on how to achieve them contrary, the schools that did not engage in occasional or frequent discussions with their Mathematics teachers limit the opportunities for Mathematics teachers to air their grievances, challenges and ideas with the administration and their peers. As a result, the Mathematics teachers were left to deal with issues facing the teaching and learning of Mathematics, which compromises the performances in the subject. This was more so if the issue was beyond the Mathematics teacher's ability to resolve personally.

These findings were supported by the claims made by Gumus and Akcaoglu (2017), who reaffirmed that principals had essential instructional tasks which include leading in support of professional development programs and discussions. These tasks, pointed to the fact that one of the principal's role is to support the Mathematics teachers' growth whether directly or not.

It could also be said that two significant behaviors of effective principals who absolutely affected learners' education talk with Mathematics teachers, model, give feed-back and provide opportunities for professional development.

The principals are supposed to have knowledge about instruction for them to give advice, assess, monitor and direct Mathematics teachers. The principal as the instructional leader was supposed to make sure that Mathematics teachers formulated challenging programs through their attendance of developmental workshops.

Besides, as an instructional leader, the principal must give other Mathematics teachers the chance to be involved in planning for staff development programs because the end results was a feeling of ownership of the programs. Additionally, Kyalo, Chepketer, and Kyalo (2016) claimed that the teacher capacity development had a significant effect on how the students performed.

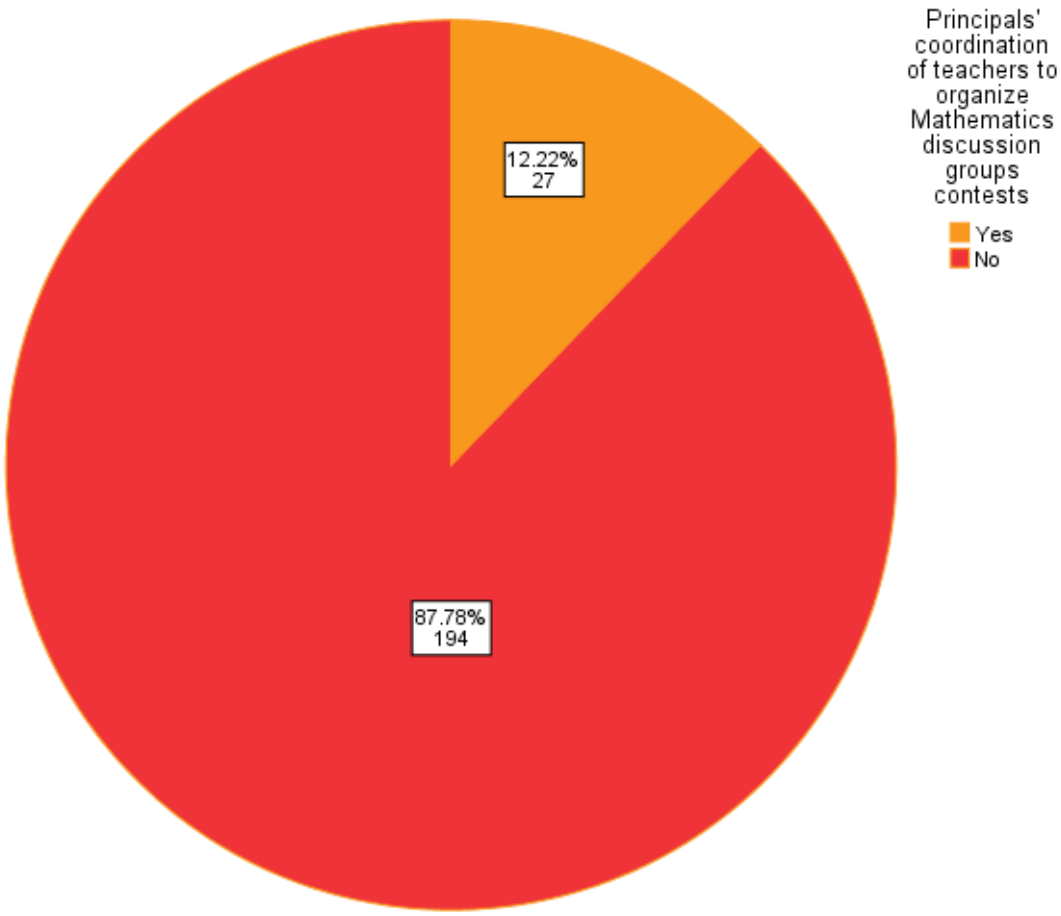
In this case, it was evident that allowing teachers to come together with the administration is a major means of building their capacity. It provides a platform for teachers to interact with their colleagues, share insights, challenges and suggestions on how to address them.

4.4 Organization of Mathematics Contests in order to improve performance in Mathematics

The third study objective set out to evaluate the effects of principals' organization of Mathematics contests on how students performed in Mathematics in KCSE examination in Meru County.

The mathematics teachers were asked to indicate if their principals coordinated efforts to organize Mathematics contests in their respective schools. The pie chart in Figure 11 shows their responses.

Figure 11: Coordination of Mathematics contests



As the Figure 11 displays, the majority of respondents, 194 (87.78%) indicated that their principals did not coordinate efforts to organize Mathematics contests while a minority 27 (12.22%) asserted that their principals coordinated efforts to organize Mathematics contests. These findings suggested that in the majority of schools, principals did not coordinate efforts to organize Mathematics contests. Considering the identified poor performance of the schools in Mathematics, then it was asserted that the lack of coordination of Mathematics contests was a contributing factor. As in the study by Riley & Karnes (2007) suggested, learner's self-directed skills and autonomy were enhanced through competitions. This meant that Mathematics competition purposed to motivate, excite, create interest in the subject and

furnish parents and schools with more information about the abler students. An individual's ability is ignored at a participant level in a competition result but it gives the measure of a student's ability to perform in Mathematics.

Therefore, the minimal levels of external Mathematics contests limited the student's motivation, excitement and interest in Mathematics. The students are comfortable with the status quo in Mathematics performances ranking in their schools which would otherwise be challenged by external competitors.

Contrary, the schools that enter external Mathematics contests were likely to reap the benefits of external competitions. For instance, Bicknell, & Riley, (2012) claimed that participating in outward competitions could result in the awarding of certificates while also being selected to partake in the competitions is a sign of prestige. Therefore, when students are allowed to take part in external competition, then their competitive spirit was aroused and they would invest time and energy perfecting their Mathematics skills and learning to overcome any challenge in regards to finishing the test on time, while working accurately.

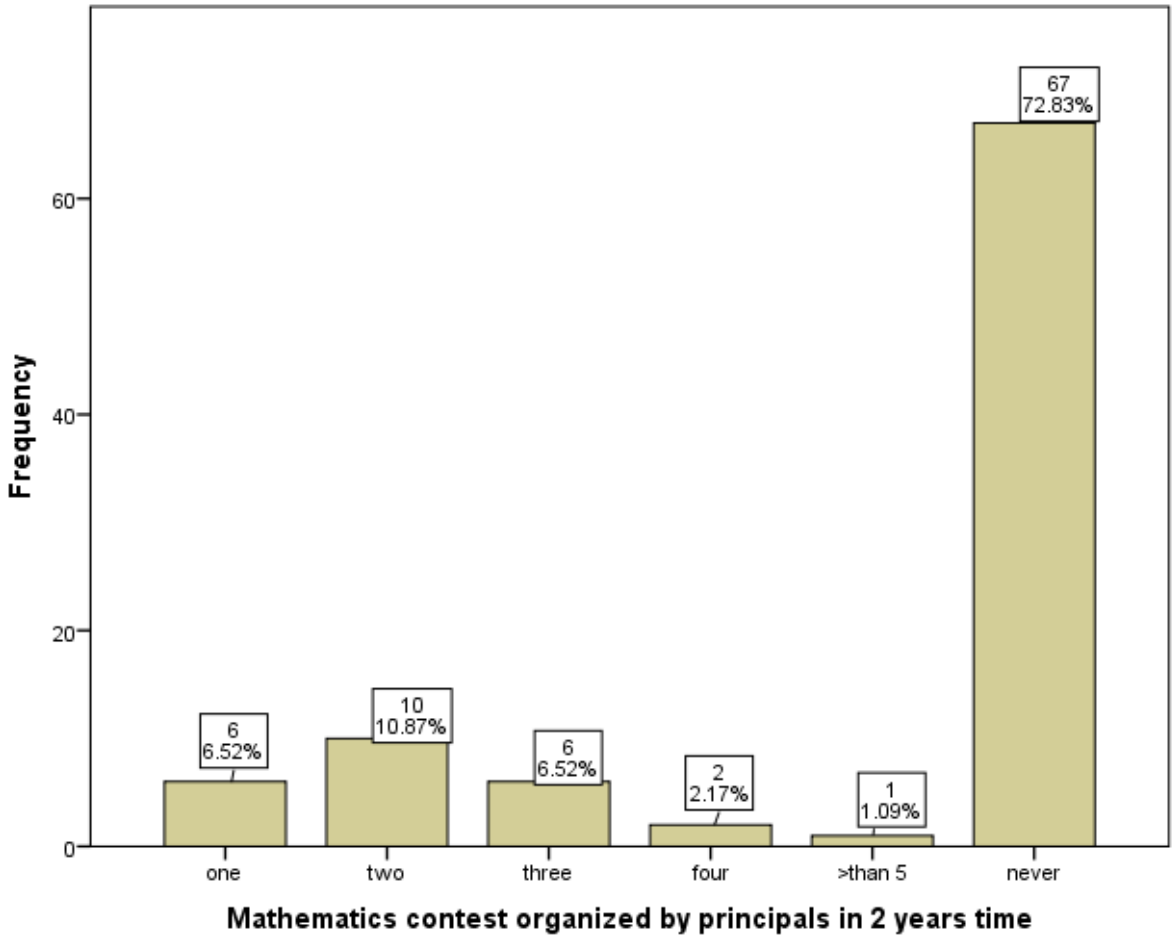
However, care should be taken to ensure that competitiveness did not overemphasize on the need to be a winner in the competitions, but rather, focus should be on developing the talents. This stems from the potential stress that could arise from the competitions as postulated by Davis et al. (2011) who reported that organizing external contests did not promote improved student performance, but leads to stress and feelings of failure.

However, if the teachers and the event organizers encouraged students to build their talents rather than on the competitive aspect of Mathematics contests, then the benefits of entering these contests would be derived by the students.

Similar concerns were also raised by Ruscyk (2012) who cautioned that if the focus of competition is on speed and memory, but not on the ability to think creatively and find a solution to the challenging tasks then the purpose of the mathematics contests is negated.

This shows that caution should be taken to ensure that when Mathematics contests were organized, it was geared towards encouraging creative approaches to Mathematics challenges rather than on boosting student memorization of solutions. The principals were also asked to indicate how often they organized external Mathematics contests in their schools. Their responses are displayed in Figure 12.

Figure 12: External Mathematics contests

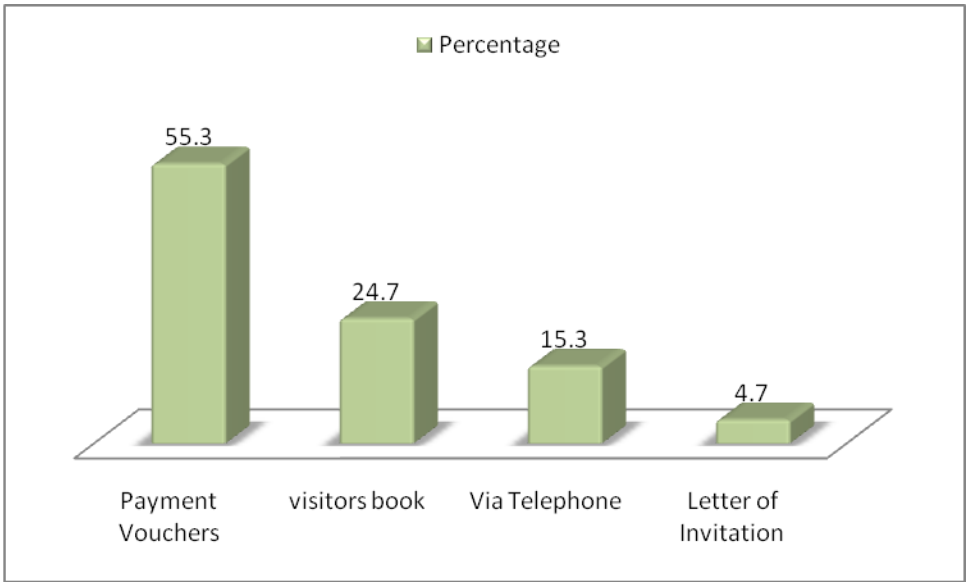


From the Figure 12, it was evident that the majority of the principals 72(78.26%) never organized external Mathematics contests, 16(17.39%) organized them occasionally and only four (4.35%) organized them frequently. From these findings, it was discerned that in the majority of schools in Meru County, principals rarely organized external Mathematics contests for their students.

The study sought from the principals to provide relevant supporting documents of the invitation of the mathematics specialists. The results from the analysis of findings are illustrated in the Figure 13 below:

Document analysis showing mathematics contests held in the schools

Figure 13: Supporting Documents for Mathematics Contests



From the analysis, 51(55.3%) of the respondents indicated that they had payment voucher from the Mathematics contests as evidence. Payment voucher is the money paid to the key officers involved in facilitating the contest on how to improve in Mathematics in KCSE examinations. A 23(24.7%) of the principals indicated that they had the visitors' books indicating there were Mathematics contests organized. Another 14(15.3%) of the principals indicated the organization of the mathematics contests through telephone calls and SMSs. Yet still some 4(4.7%) of the principals indicated the use of letters of invitation as supporting documents for Mathematic contests. The study finding established that the schools which organized contests frequently had better performance than those which did not, while those who organized mathematics contests rarely had lower performance.

Therefore, the study found out that Mathematics contests led to increased students' interest in Mathematics and this resulted to improved Mathematics results to those who organized them frequently.

These findings were reflective of the 194 (87.78%) Mathematics teachers in Figure 4.10 who claimed that their principals did not coordinate efforts to organize Mathematics contests in their schools. From these findings, it was evident that despite the potential of Mathematics contests to stimulate student's interests and motivation in Mathematics, most principals neglected to coordinate external Mathematics contests.

Garett (2008) confers that seminars and workshops are among strategies used in teacher's professional development. There is an emerging understanding about the ways in which professional development impacts student achievement. Although an experimental study examining the features of high-quality professional development showed increased teacher knowledge and desired classroom practice, it did not find that this knowledge translated into improved student outcomes or sustainable changes in practice over time (Garet, 2008; Wilson, 2009). The Mathematics teachers who had gone for induction course or seminars gained better skills in teaching Mathematics and this led to improved results in KCSE performance in Mathematics.

Therefore, the principals limited their students from reaping the benefits of Mathematics contests as Bicknell & Riley (2012), claimed that the contribution of Mathematics programmes was the motivation arising from competitions, which could be outward where certificates and awards are given, students being chosen for other competitions, and the prestige in the recognition.

Additionally, the frequency with which Mathematics contests are organized is crucial in determining how students could utilize the creativity they come up with during the contests

and apply it on their day to day math classes. As Wambui (2002), states, Mathematics was a social complex activity and is difficult to teach and understand.

Therefore, in order for the rational understanding of the Mathematic descriptions, classifications and comprehension of the relationships, students should be involved in the processes to a great extent. Therefore, by organizing Mathematics contexts frequently, schools facilitate social interactions between the students and Mathematics experts and specialists who could help simplify the complex concepts of the subject.

The researcher asked the principals to indicate the reason why they did not organize external Mathematics contests in their schools during the interview. The majority of them cited financial constrains as a major hindrance. For instance, one of the principals claimed:

'*We are often forced to organize internal contests because organizing external Mathematics contests required money set aside for transportation, lunch and a token for the teachers accompanying the students. However, we are under a tight financial budget and we do not have money to spare for external Mathematics contests.'*

Another principal opined:

'In my school, we are yet to acquire a bus, and as such, taking the students for external Mathematics contests required us to facilitate an external means of transport at a fee. However, we are already struggling financially as we are still a new school. Therefore, we forego external Mathematics contests in favour of internal ones due to lack of resources and finances.'

From these qualitative findings, it was evident that the majority of schools faced financial constraints when it comes to organizing any external events that require the

This shows that despite some of the principals being willing to take their students to the external Mathematics contests; their financial capabilities prevented them from doing so. Additionally, with the majority of schools being recently opened with a few students and

limited support from the government, parents and other stakeholders like the NGOs and county government, principals are forced to prioritize things like provision of teaching and learning resources while overlooking external Mathematics contests which did not appear to be a priority when it comes to budgeting.

In this case, the majority of principals, though willing to organize or take their students out for Mathematics contests are forced to organize internal contests in a bid to save funds which were then used for other projects. These points towards the need for other stakeholders including parents and the county governments to facilitate funds for schools, especially the schools that were recently started which lacked the wide range of income sources enjoyed by well-established schools. This way, principals could have more funds which they could then invest in the school's Mathematics contests. To determine the extent to which principals organized Mathematics contests and how it affected the performance of students in KCSE, a chi-square test of independence was done and the Table 8 displays the results.

Table 8: Chi-Square - KCSE Performance and Mathematics Contests

Principal's support		KCSE PERFROMANCE				P=value
		N=92	Poor	Average	Good	
Coordination of Mathematics contests	Frequently	F	8	9	4	0.000
		%	8.7	9.78	4.35	
	Occasionally	F	8	14	1	
		%	8.7	15.22	1.09	
	Never	F	48	0	0	
		%	52.17	0	0	

As the Table 8 indicated, the majority of schools where principals frequently coordinated Mathematics contests were those that performed averagely 9(9.78%) and 4(4.35%) were those whose performances was good. Among the schools where principal's occasionally coordinated external Mathematics contests the majority 14 (15.22%) were those with average performance in Mathematics while all of the schools where principals never organized

Mathematics contests 48(52.17%) performed poorly in Mathematics.

From these findings, it was seen that the principals' coordination of external Mathematics contests in their respective schools had an effect on student's performances in KCSE. These findings are also reflected by the p value ($0.000<0.05$), which is not statistically significant. Therefore, we rejected the null hypothesis which stated that there was no relationship between organization of external Mathematics contests and student performance in Mathematics.

This finding showed that organization of external Mathematics contests had statistically significant effects on student's Mathematics performance in KCSE. These findings are supported by Riley and Karnes (2001) who declared that "the opportunities to tap and showcase kiwi talent far outweigh the negative elements often associated with competitions" (p. 25). Stress and failure feelings arising from excessive competition are stated as the negative outcomes of competition as stated by Rimm et al. (2011) as one Rusczyk in 2012 gave that not all competitions pass the threshold for a good competition.

In his study, he cautioned that if a competition only sharpened memory and speed of students then it would lead them to memorization and thus not insist on their ability to think and find a solution to challenging tasks. Therefore, it was decided that among the schools that partook in external Mathematics contests got the opportunity to stimulate their student's minds and problem-solving skills.

By frequently exposing the students to external competitions allowed multiple method identification process. Moreover, the students were able to have a comparison of themselves with the others and hence work for personal achievement. Generally, Mathematics contests provided gifted students with an environment to excel, compete and even honor their

abilities.

Further, the researcher asked the principals to state how many Mathematics contests they had organized in the last two years and their responses are as presented in Table 9.

Table 9: Number of Mathematics Contests Organized in two Years

Frequency	Frequency	Percent
One	6	6.5
Two	10	10.9
Three	6	6.5
Four	2	2.2
>than 5	1	1.1
Never	67	72.8
Total	**92**	**100.0**

As the table showed, the majority of the principals 67(72.8%) had never organized Mathematics contests for their schools while 10(10.9%) had organized only two contests, six (6.5%) had organized one contest, two (2.2%) had organized four contests and only one (1.1%) had organized more than five Mathematics contests in the last two years. From these findings, it was evident that in most of the schools across Meru County, Mathematics contests were not a priority as only one school organized more than five Mathematics contests in two years.

However, the majority of the schools did not organize any Mathematics contests which prevented students from striving for personal achievement and comparing themselves with others. As a suggestion from Karnes and Riley (2006) competitions enhanced students' self-directed learning skills and sense of autonomy.Therefore, the lack of Mathematics contests in the majority of the schools limited the student's sense of autonomy a self-directedness contributing to the continued dismal performance of students in Mathematics. Therefore, with the findings showing that over 70% of schools not organizing Mathematics contests, the

benefits of Mathematics contests stipulated by Ridge & Renzulli (2001) could not be derived by the schools.

According to the researchers, Mathematics competitions were a source of motivation, excitement and interest in the Mathematics subject. The students were able to meet and interact with peers from other schools, who could challenge them while also motivating them to be the best in Mathematics that they could be.

Therefore, when students interact with other students, they get to determine how their performance measures up to the other students from other schools. This was more so when the students were exposed to Mathematics contests from schools that were high performers in the subject. They get an opportunity to witness first-hand how the students from the other schools performed.

This gave them an opportunity to learn things from other students, gauge how they utilized their time during the contest and maybe even ask their teachers questions that could improve their approach to Mathematics. The researcher then conducted an ANOVA test to determine whether the differencesin organizing Mathematics contests had a significant difference in the mean performance of the individual schools. The findings are displayed in table 4.8 and 4.9.

Table 10: Report of number of contests organized in two years

CSE_PERFORMANCE Number of Contests Organized in a Period of Two Years	Mean	N	Std. Deviation
One	4.3590	6	2.63582
Two	6.8388	10	.53993
Three	6.4783	6	2.62689
Four	8.0830	2	1.10733
>than 5	6.0600	1	.
Never	3.4361	67	1.35223
Total	4.1941	92	2.00936

From Table 10, it could be seen that the majority (67) of principals who never organized Mathematics contests had the lowest KSCE mean performance at 3.43, while those who had

organized Mathematics contests four times had the highest mean at 8.08, while the only school which organized the Mathematics contest more than five times had a mean performance of 6.06. The schools that organized Mathematics contests once had a mean performance of 4.36. It could be observed that the schools which organized Mathematics contests more often, in the period of two years, had better performance in Mathematics in KCSE.

The difference in the performance of schools which had never organized Mathematics contests (mean =3.43) and those that had organized them once (mean =4.36) was small. Schools that had organized the Mathematics contests more than two times evidently had a higher mean performance in Mathematics as compared to those that organized them once, or those that never did.

These study findings are supported by the study of Riley and Karnes (2006) who suggested that learner's self-directed skills and autonomy were enhanced through competitions. This meant that Mathematics competition purposed to motivate, excite, create interest in the subject and furnish parents and schools with more information about the abler students.

However, competition result discriminated ability levels of individuals at the participant's level in as much as it measured the students' mathematical ability. Furthermore, Campbell (2000) asserted that organizing Mathematics competition is critical for the metal well-being of the students. This was more so when the student was talented as external competition offers a platform where the student could build their skills and hone them to best suit their career projector. Additionally, it allows the student to measure their competency with other students with equal prowess.

It is also a good platform where students could challenge themselves while also sharing their expertise, knowledge and skills with peers. Therefore, at the end of the contests, the student would not have only tested their Mathematics skills, but would also leave with new

knowledge and insight on challenges they would not have previously perceived. The contests are also critical in giving the students a chance to self-evaluate and then self-direct based on the identified shortcomings during the contest. This shows that the higher the number of Mathematics contests the higher the performance in Mathematics.

This shows that the more students are exposed to Mathematics contests, the more they self-evaluate and self-direct to improve their performance by overcoming their weaknesses and improving on their strengths. Therefore, if principals were to improve their student's performance in Mathematics, then they need to improve the number of contests they expose their students to which as Watson (2003) concludes, would result in higher student performance.

Table 11: ANOVA Table on Mathematics contests organized by the principals for the last two years and KCSE performance

			Sum of Squares	df	Mean Square	F	Sig.
Number of Contests Organized in a Period of Two Years	Between Groups	(Combined)	173.642	5	34.728	15.413	.000
	Within Groups		193.773	86	2.253		
	Total		367.415	91			

The ANOVA findings showed that there was a significant difference in the performance of the 92 schools under study (p=0.000) at 95% confidence interval. It was established that there was a systematic change KCSE performance based on the number of contests organized by the principals. These findings revealed that organizing Mathematics contests had a significant effect on how the schools in Meru County performed. It showed that the mean differences observed in Table 4.9 where the schools whose principals organized more than two Mathematics contests performed averagely or good as compared to those which organized less than one Mathematics contests in two years, which performed poorly. These findings

suggested that for schools to improve performance in Mathematics, they should find ways to overcome the constraints preventing them from organizing Mathematics contests and increase the frequency of the contests to allow their students reap the benefits of such events.

Bicknell, & Riley, (2012), pointed out that competitions played an external role where certificates, awards, recognition and prestige were the reward. “Gifted children need to learn to deal with competition constructively considering the nature of Western culture as completion is a high level of achievement,” (Udvari 2000) stated in his comprehensive analysis of the literature on competitions (p. 215). Similar sentiments were expressed by Riley, Bevan-Brown, Bicknell, Carroll-Lind, and Kearney (2004) who claimed that organizing Mathematics contests is crucial for gifted and talented students.

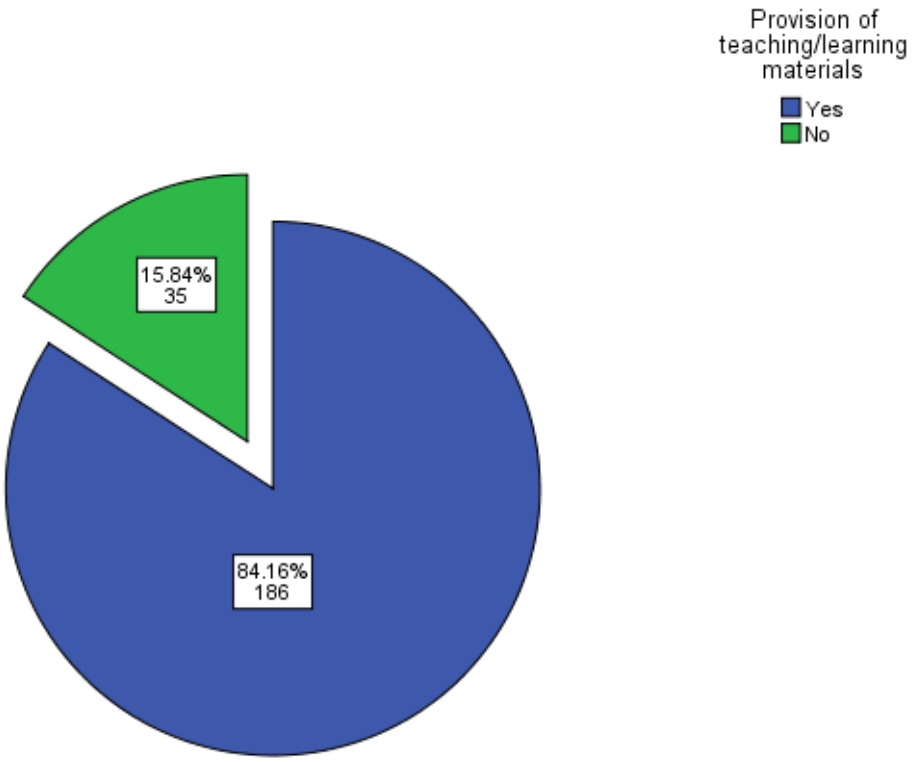
It offers them the opportunity to showcase their skills. Mathematics contests offered the students an avenue to compare themselves to the others and crave for personal recognition when they show their prowess in the subject. This means that the contests were a way for the students to excel, compete and honor their abilities.

Therefore, with the organization of Mathematics contests evidently having a statistically significant effect on the performance of students in Mathematics contests, schools should strive to increase the amount of contests they enter and organize. This implies that principals should come up with means of organizing the contests even if it means coming together with other principals to share the costs of the contests.

4.5 Provision of Teaching and Learning Resources

The fourth and last objective of the current study was to evaluate how principals’ provision of learning and teaching materials affected students’ performance in Mathematics in K.C.S.E in Meru County. The researcher asked the teachers to indicate whether or not in their schools they were provided with learning and teaching resources by the principals and their responses were as documented in the Figure 13.

Figure 14: Provision of teaching and learning materials



The Figure 14 shows that the majority of Mathematics teachers 186(8.4.16%) concurred that their principals provided teaching and learning materials, while only 35(15.84%) stated that their principals did not provide teaching and learning resources.

The findings implied that the majority of principals in Meru County provide their teachers and students with the resources they required to undertake teaching and learning processes. From these findings, it was expected that good performance amongst the students should be recorded as Maicibi (2003) was of the opinion that adequate provision of teaching and learning resources should trigger good performance by the students.

This was because the availability of teaching and learning resources makes the teaching and learning process more effective. Through the school textbooks, classrooms, laboratories,

teaching aids and trained teachers, schools could be able to break down the complex aspects of Mathematics through practical teaching and learning models. These sentiments were also expressed by Yara and Otieno (2010) who affirmed that teaching and learning resource are crucial for the good performance of students in teaching and learning Mathematics.

The principals were also presented with a range of opinions in a Likert-scale, whereby 1-Unsatisfactory, 2-Satisfactory, 3-Good &4 - Very Good. The researcher implored the respondents to indicate their opinion of the statements in the respective boxes (a to b).

Table 12: Teaching and Learning Resources

Availability of teaching / Learning resources and supervision	**N=92**	**1**	**2**	**3**	**4**
a) Teaching resources					
Mathematics syllabus	F	22	34	35	1
	%	23.9	37.0	38.0	1.1
Adequate departmental teaching and revision materials	F	31	31	29	1
	%	33.7	33.7	31.5	1.1
Schemes of work made and checked	F	47	40	5	0
	%	51.1	43.5	5.4	0
Teaching resources adequate, text books and revision materials	F	15	67	10	0
	%	16.3	72.8	10.9	0
b) Learning Resources					
Enough text books	F	40	43	9	0
	%	43.5	46.7	9.8	0
Teaching aids for Mathematics e.g. mathematical tables, set square.	F	23	35	33	1
	%	25	38	35.9	1.1
School financially stable	F	48	32	12	0
	%	52.2	34.8	13	0
Student competitions in Math's internally	F	4	72	15	1
	%	4.3	78.3	16.3	1.1
Students competition in Math's externally	F	55	32	5	0
	%	59.8	34.8	5.4	0
c) Teacher motivation in Mathematics					
Teacher/school collaboration between schools for Mathematics	F	25	62	5	0
	%	27.2	67.4	5.4	0
Established office for HOD	F	66	19	7	0
	%	71.7	20.7	7.6	0
School/principal/HOD strategies for Mathematics	F	22	60	10	0
	%	23.9	65.2	10.9	0
Mathematics construction instruments ruler and protractor	F	4	70	16	2
	%	4.3	76.1	17.4	2.2
Special room with grid board, globe, charts etc.	F	67	20	5	0
	%	72.8	21.7	5.4	0
Good teacher/student relations	F	4	13	47	28
	%	4.3	14.1	51.1	30.4
Mathematics radio sessions	F	88	4	0	0
	%	95.7	4.3	0	0
Computer laboratory	F	77	12	3	0
	%	83.7	13	3.3	0

As the Table 12 displays, the majority of respondents 34(38%) perceived the provision of Mathematics syllabus as good, 34(37%) as satisfactory and 22(23.9%) as unsatisfactory, while only one (1.1%) as very good. These findings suggest that the majority of principals perceive their provision of Mathematics syllabus as being satisfactory.

With regards to adequate departmental teaching and revision materials,31(33.7%) and 29(31.5%) respondents stated they were satisfactory and good respectively. Contrary, 31(33.7%) claimed the departmental teaching and revision materials were unsatisfactory and one (1.1%) asserted that they were very good.

It could be discerned that the majority of principals were satisfied with their provision of departmental teaching and revision materials. A close relationship exists between different concepts in Mathematics in a logical sequence as echoed in 2010 by The Ministry of Higher Education, Science and Technology that boosts the organization and capability in learners.

New topics were built by teachers as allowed by the curriculum and dwell on the knowledge on previous contents of the lesson. Adequate supply of resources, presence of teachers and the close interaction between the content and its teaching instructions lead to optimal performance in academics (Republic of Kenya, 2005).

The majority of the principals were also unsatisfied with how the schemes of work were made and checked while 40(43.5%) were satisfied and five (5.4%) deemed how the schemes of work were made and checked as good.

From these findings, the researcher deduced that majority of the schemes of work were not well-made and checked, and this had a detrimental effect on the performance of students on Mathematics. This was because poorly made schemes of work implies that the teachers were not attentive to detail and planning their instruction and execution of Mathematics strategies.

Consequently, the teachers were bound to overlook the details when it comes to executing the lesson plans and the schemes of work. Therefore, despite the principal's reportedly providing adequate resources as indicated in the Figure 4.12 where 84.16% of the respondents claimed that their principals provided adequate teaching and learning resources, teachers were more likely to overlook utilizing these resources as they were not well-planned for in the schemes of work. Therefore, the benefits of having sufficient resources as indicated by Padmanabhan (2001) were bound to be missed as their teachers overlooked details in their preparations of schemes of work. They were bound to consider how the different resources could be utilized in the different models of teaching.

In regards to the adequacy of teaching resources like textbooks and revision materials, the majority of principals 67(72.8%) asserted that they were satisfactory, 15(16.3%) unsatisfactory and 10(10.9%) deemed them as being good.

These findings suggested that in the majority of schools in Meru County, shortage of textbooks and revision materials was not a major challenge teachers and students had to contend with. Similarly, the provision of teaching aids for Mathematics, like Mathematics tables, set squares among others were reported by most of the principals 35(38%) and 33(35.9%) as being satisfactory and good respectively, while one (1.1%) considered his/her provision of teaching aids as being very good, while 23(25%) claimed that their provision of teaching aids was not satisfactory. From these opinions, it could be seen that in most of the schools 68(73.9%) provision of teaching aids was not an issue for the principals.

Therefore, with teaching aids being satisfactorily provided by the teachers, the continued dismal performance evident in the majority of schools across the county could be attributed to other factors like poor making and checking of marking schemes of work.

Also the dismal performance could be attributed to the unsatisfactory stability of schools financially where majority of the principals 48(52.2%) claimed that their financial stability was unsatisfactory while 32(34.8%) claimed their financial stability was satisfactory and 12(13.0%) asserted that their financial stability was good. Based on these claims, it could be seen that across Meru County, there is a disparity in the financial stability in the schools, with some schools enjoyed financial stability while the majority of the schools struggled financially.

This may explain the differences in the ability to provide teaching aids, textbooks and other Mathematics related materials. It also links with the principals claims in regards to organizing Mathematics contests and sending teachers to workshops and seminars where most claimed that financial constraints limited them. Poor performance in the country is contributed by lack of resources in schools (Obwocha, 2005). Schools that performed poorly as noted by him were due to lack of enough resources for learning and teaching compounded with less Mathematics teachers. However in this case, the majority of schools (84.16%), as indicated in the Figure 4.13, have sufficient teaching and learning resources.

Therefore, the stipulation by Obwocha (2005) was not a major factor affecting performance of students in this county. Rather, as has been evidenced by the findings in the table, the majority of teachers had poorly planned schemes of work. However, in Table 4.11, when each and every resource is broken down to the specific ones like the availability of textbooks, revision books and other essential teaching and learning resources were not well provided for. This implies that the findings in Figure 4.13 refers to the general resources like chalks, dusters, marking pens and such, but not the essential resources like classrooms, charts, laboratories and textbooks necessary for improved student performance.

Therefore, when coupled with the financial challenges that face most of the schools, this may explain why schools continued to perform poorly in Mathematics. The principals' provision of these teaching and learning sources is limited as their financial capabilities are bound to the amount of money they can spare after allocating finances to the different aspects of school operations.

Therefore, teachers and students are left with little resources to facilitate the teaching and learning of Mathematics. Teachers were often forced to use the lecture methods as practice classes require more resources like computers and other ICT-related resources like the internet and constant supply of electricity. In the majority of schools, however, these resources are non-existent meaning that teacher's ability to integrate new models of teaching Mathematics are limited.

In regards to Mathematics competitions internally, the majority of teachers 72(78.3%) deemed them as being satisfactory, 15(16.3%) as being good, one (1.1%) as being very good while four (4.3%) deemed them as being unsatisfactory. Contrary, when it came to Mathematics contests externally, 55(59.8%) of the principals were unsatisfied with their students competition externally, 32(34.8%) were satisfied and five (5.4%) deemed it as good.

From these findings, it could be deduced that Mathematics contests were done internally on a constant basis due to the limited need to incur financial expenses in terms of transportation, teachers token and lunch and snacks for the students. This shows that often the students were involved in contest with students from other streams.

This offers the students an opportunity to be competitive with others from outside their classrooms. It also served as a good mode of revision, especially when the contests are inter-class where students in the upper forms are able to work with students from the lower forms.

It offers them a chance to test whether they still remember the concepts they learnt in their previous classes while also testing to see if their skills are better than those from the other forms.

It also served as a motivator for the lower forms students, especially if they did well against the higher-form students more so those in form three and four who have more experience and knowledge in Mathematics. It would reinforce the skills, knowledge and talent of the students in form one and two if they could hold up their own during the contests against the students in the upper forms.

Additionally, as the internal Mathematics contests were easy and required minimal funds to organize, they could be done on a weekly or a fortnight basis to offer a continuous challenge for the student. It also ensures that the process if continuous as the teachers introduce new concepts, they were able to test them during the contests.

In regards to external Mathematics contests, there are several benefits that could be derived from the same. The students, just like the internal Mathematics contests, got the opportunity to challenge themselves and gauge their prowess against other students. However, in the external contests, students were exposed to students with different skills and knowledge levels. It offered a new opportunity to challenge oneself and strive for better performance.

Therefore, attending these contests was critical for creating a competitive environment where students could learn new skills and appreciate their talent. Contrary, external Mathematics contests were a bit costly where the principal were required to provide money to facilitate them (Likoko, Mutsotso & Nasongo, 2017). Consequently, the potential benefits that students would have derived from external competition like self-stimulation, learner's self-directed skills and autonomy are enhanced through competitions as suggested by Riley & Karnes

(2006).

This meant that Mathematics competition purposed to motivate, excite, create interest in the subject and furnish parents and schools with more information about the abler students. Success in Mathematics competitions, Ridge and Renzulli (2001) warned is indicative of a particular type of mathematical talent and tells us little about the slower more logical formal type of mathematical talent.

The majority of principals 62(67.4%) claimed that collaboration between teachers and the schools for Mathematics was satisfactory while 25(27.2%) claimed the collaboration was unsatisfactory, and five (5.4%) affirmed that collaboration between the teachers and schools was satisfactory.

Based on these claims, it was seen that there is limited discussions, engagement and inclusivity of all the parties with a stake on Mathematics performances in the schools. Earlier in Figure 4.10, most of the schools 49(53.26%) never discussed matters that affect teaching and learning Mathematics with their teachers while 22(23.91%) discussed them occasionally and 21(22.83%) discussed them frequently which shows that collaboration is a challenge in the schools.

It could be discerned that collaboration between the teachers and the school administration is a challenge that Mathematics teachers contend with which negatively impacts their ability to teach Mathematics. According to Boudett & Moody (2005) there were several ways that principals could inspire school-wide discussions involving both the teachers, students and other stakeholders.

One such way was by creating a data team that could develop data that teachers could utilize and by developing structures that could build discussions on student performance. In this

case, having discussion about the student performance could focus on the skill sets possessed by the students and coming up with strategies that could be followed to achieve the goals.

This could be a weekly or monthly to ensure that nothing went unsolved for too long. However, as was seen in the Table 4.12, the majority of principals did not engage teachers in discussions. This shows that there is a major challenge as the teachers are not given a chance to air their grievances, provide solutions and set strategies to help achieve the goals and objectives set by the principals. Similarly, majority66 (71.7%) of the principals claimed that they were unsatisfied with the established office for the HOD, 19(20.7%) were satisfied while only seven (7.6%) deemed their HOD office establishment as being good.

The findings implied that in most of the schools, HOD offices were not well-established which could also explain the limited collaboration between the teachers and the teachers in the majority of schools. The HOD acts as a link between the administration and the teachers, and the lack of a well-established HOD office limits interactions between the Mathematics department and the administration. Fullan and Miles (2014) asserted that performance demands resources for teaching, for substitutes, for new materials, for new space, and above all, for time. Berman and McLaughlin (1976) found that a significant level of human resource support was important, and that student's performance would not have been possible without proper financial support.

Teaching and learning materials are tools that no learning programme could be implemented without them, and thus if no adequate resources for teaching and learning were not provided, then meaningful teaching and learning could not take place.Most of the principals 60(65.2%) were satisfied with the school/principal/HOD strategies for Mathematics while 22(23.9%) termed their strategies as being unsatisfactory and 10(10.9%) claimed that the strategies were good.

It was discerned from these findings that in most schools, the strategies developed in the schools by the HOD and principals were satisfactory. Provision of Mathematics construction instruments like rulers and protractors was satisfactory to majority 70 (76.1%) of the principals, 16(17.4%) good to some principals, two (2.2%) deemed their provision as very good and four (4.3%) thought that their provision was unsatisfactory. Contrary, the majority 67(72.8%) of principals were unsatisfied with their provision of special rooms with grid boards, globes and charts among others, while 20(21.7%) were satisfied with their special rooms and five (5.4%) thought their special rooms were good.

The mixed findings in terms of provision of special rooms and Mathematics instruments show a clear disparity in the school's investment in Mathematics materials and resources. These findings are similar to Jepchumba (2010) who showed that a lot of material resources were lacking and those available were not properly managed.

In regards to the teacher-student's relations, the majority of principals 47 (51.1%) were confident that they were good, 28(30.4%) as very good and 13(14.1%) termed them as

Another scholar Agwagah (2007) states that use of Mathematics laboratory that had adequate teaching and revision materials would solve the problem of ineffective teaching.

The researcher then conducted a chi-square test of independence to determine whether provision of teaching and learning resources affected the performance of secondary schools in Mathematics. The Table 13 displays the results.

Table 13: Principals' Chi-Square-Provision of Teaching Resources

Availability of teaching / Learning resources and supervision		N=92	Poor	Average	Good	P-Value
a) Teaching resources						
Mathematics syllabus	unsatisfactory	F	65	8	1	0.039
		%	70.6	8.7	0.01	
	Satisfactory	F	5	9	4	
		%	5.4	9.8	4.3	
Adequate departmental teaching and revision materials	unsatisfactory	F	67	8	1	0.035
		%	72.8	8.7	1.1	
	Satisfactory	F	3	9	4	
		%	3.2	9.8	4.3	
Schemes of work made and checked	unsatisfactory	F	44	3	0	0.001
		%	47.8	3.3	0	
	Satisfactory	F	26	15	5	
		%	28.3	16.3	5.4	
Teaching resources adequate, text books and revision materials	unsatisfactory	F	50	2	0	0.282
		%	54.4	2.2	0	
	Satisfactory	F	20	15	5	
		%	21.7	16.3	5.4	

The Table 13 displays the chi-square results on teaching resources and it was seen that provision of Mathematics syllabus had a significant effect on the school's performance supported by the cross-tab results showing that the majority of schools with unsatisfactory provision of Mathematics syllabus 65(70.6%) performed poorly while the majority of those that provided Mathematics syllabus had four (4.3%) and nine (9.8%) good and average performance respectively. Similarly, adequate provision of departmental teaching and revision materials was found have a statistically significant effect on the school's performance in Mathematics. This was seen in the cross tab results where the majority of schools 67(72.8%) with unsatisfactory provision of textbooks and revision books performing poorly.

These findings are supported by Fullan and Miles (2014) who asserted that performance needs resources for teaching, substitution, for acquiring new space and materials, for new space, and most importantly for time. Berman and McLaughlin (1976) found that support from human resource and without proper financial support then the performance of students would not be made possible.

Materials needed for teaching and learning materials are essential for any learning programme to be implemented as meaningful learning is made possible with materials being provided. From these findings, it was evident that the provision of teaching and learning resources affected the performance of schools in Mathematics.

This implies that when principals ensure that their teachers and students had sufficient teaching and learning resources, they facilitated effective teaching and learning process. It allows the teachers to adequately share the resources to ensure that the learning process is meaningful. According to Friend and Cook (2010) provision of adequate teaching and learning resources ensures that there is improvement in the programme instruction. Therefore, for teachers to adequately instruct the students, they needed to have adequate textbooks and other resources.

This is more so for the weak students whereby the adequate provision of revision textbooks and classroom arrangement where they were seated with students who performed better could help improve their performance. Therefore, for principals to feel the impact of adequate provision of resources, they should frequently monitor the resources to ensure they are adequate and work with the teachers to ensure that these resources were effectively utilized to benefit all the students.

It was seen that all the schools with good performance and the majority 15(16.3%) of those with average performance had satisfactory schemes of work while the majority of schools with poor performance 44(47.8%) had unsatisfactory schemes of work. These findings were supported by the chi-square findings where a p value of 0.001 implies that satisfactorily made and checked schemes of work have a significant effect on the school's performance.

Table 14: Chi-Square-Provision of Learning Resources

Learning Resources		**N=92**	**Poor**	**Average**	**Good**	**P-Value**
Enough text books	Unsatisfactory	F	60	1	1	0.000
		%	65.2	1.1	1.1	
	Satisfactory	F	10	16	4	
		%	10.9	17.4	4.4	
Teaching aids for Mathematics e.g. Mathematical tables, set square.	Unsatisfactory	F	44	8	2	0.248
		%	47.8	8.7	2.2	
	Satisfactory	F	26	9	3	
		%	28.3	9.8	3.3	
School financially stable	Unsatisfactory	F	65	8	1	0.021
		%	70.7	8.7	1.1	
	Satisfactory	F	5	9	4	
		%	5.4	9.8	4.3	
Student competitions in Math's internally	Unsatisfactory	F	12	1	0	0.317
		%	13.0	1.1	0	
	Satisfactory	F	58	16	5	
		%	63.0	17.4	5.4	
Students competition in Math's externally	Unsatisfactory	F	52	18	2	0.000
		%	56.5	19.6	2.2	
	Satisfactory	F	18	13	3	
		%	19.6	14.1	3.3	

In regards to learning resources, the Table 14 shows that satisfactory provision of textbooks had a significant effect on the school's performance in Mathematics with a p value of 0.000. This was further supported by the findings showing that the majority of schools with unsatisfactory provision of textbooks 60(65.2%) were those that performed poorly.

These findings revealed that provision of adequate textbooks is crucial in ensuring that the teachers and students made the learning process meaningful, which was then reflected in the student's performance. Therefore, seeing that the majority of the schools with unsatisfactory textbooks were those that perform poorly, it was evident that textbooks are important in determining how students performed.

Consequently, principals should ensure that the textbooks in their schools were enough for each student or for a pair of students. This way, the students could follow what the teacher is instructing without having to crowd with their students. Additionally, when the textbooks are adequate, student can use them during their free time to hone their skills. These sentiments are expressed by Atieno (2018) who reported that material resources for teaching and learning had a significant effect on how the students performed.

According to the researcher, material resources facilitated learning of abstract concepts and ideate while discouraging rote-learning. However, when the resources were inadequate, the quality of classroom learning is compromised which in invariably reflected in the low academic achievement of students.

Financial stability was also found to have a significant effect on Mathematics performance at p value 0.021 whereby the majority of poorly performing schools 65(70.7%) were not financially stable while the majority four (4.3%) of the schools with good performance were financially stable. Fullan and Miles (2014) asserted that performance requires resources for teaching, substitution, to acquire new space and materials and most significantly for time.

Berman and McLaughlin (1976) found that a significant level of human resource support was important, and that student's performance would not have been possible without proper financial support. Materials needed for teaching and learning materials were essential for any

learning programme to be implemented as meaningful learning was made possible with materials being provided.

The principals were often faced with this challenge as the funds availed to them were not sufficient for them to invest in teaching and learning resources. As such, the principals were often forced to only purchase exercise books and a few textbooks to be shared with many students.

This implies that revision materials were rarely included in the budgeting of books. Therefore, as Atieno (2018); Mugambi (2015) and Ndege (2017) argued, the most common challenge facing the principal's provision of teaching and learning resources was lack of financial ability to ensure that their teachers and students had adequate textbooks and other teaching and learning resources to ensure that meaningful learning occurs in the classroom.

Consequently, the performance of Mathematics continue to be dismal as evident in the Table 1.1 where it was seen that the average performance of students in KCSE is a D+ for the schools in Meru County. This shows that due to the inability to adequately provide for the student and teacher's teaching and learning resources, principals limited their students' ability to perform well in Mathematics in KCSE.

Internal Mathematics contests were found to bear no significant effect on Mathematics performance, whereas completion in external Mathematics contests was statistically significant at p value 0.000 where the majority of poorly performing schools 52(56.5%) did not participate in external Mathematics contests satisfactorily while the majority of the average and good performing ones 13(14.1%) and three (3.3%) had satisfactory participation in external Mathematics contests.

These findings are in line with Bicknell, & Riley, (2012) who claim that the role of competitions in a Mathematics programmes was motivation from competitions which could also be extrinsic, resulting in certificates and awards, selection for other competitions, and recognized prestige.

As a result, it leads to improved student performance in the subject. Similarly, Kendorov (2017) also found that mathematic competitions with the people and organizations who engage in them form an immense and vibrant network.

He claims that these networks serve many roles and that taking part in these competitions helps identify the students who possess higher abilities in Mathematics. Through them, students were motivated to hone their talents as well as seek professional realization in the science subjects. Additionally, competitions also had a positive impact on the education of the students. The network keeps the elementary Mathematics knowledge alive, preserved and developed through the network of competition and its related activities.

Table 15: Chi-Square-Teacher Motivation

Teacher motivation in Mathematics		N=92	Poor	Average	Good	P-Value
Teacher/school collaboration between schools for Mathematics	Unsatisfactory	F	58	3	0	0.042
		%	63.0	3.3	0	
	Satisfactory	F	12	14	5	
		%	13.0	15.2	5.4	
Established office for HOD	Unsatisfactory	F	51	16	4	0.171
		%	55.4	17.4	4.35	
	Satisfactory	F	19	1	1	
		%	20.7	1.1	1.1	
School/principal/HOD strategies for Mathematics	Unsatisfactory	F	49	7	1	0.021
		%	53.3	7.6	1.1	
	Satisfactory	F	21	10	4	
		%	22.8	10.9	4.4	
Mathematics construction instruments ruler and protractor	Unsatisfactory	F	55	0	0	0.049
		%	59.8	0	0	
	Satisfactory	F	15	17	5	
		%	16.3	18.5	5.4	
Special room with grid board, globe, charts etc.	Unsatisfactory	F	56	11	4	0.398
		%	60.9	11.9	4.4	
	Satisfactory	F	14	6	1	
		%	15.2	6.5	1.09	
Good teacher/student relations	Unsatisfactory	F	41	12	3	0.660
		%	44.6	13.0	3.3	
	Satisfactory	F	29	5	2	
		%	31.5	5.4	2.2	
Mathematics radio sessions	Unsatisfactory	F	66	0	0	0.032
		%	71.7	0	0	
	Satisfactory	F	4	17	5	
		%	4.4	18.5	5.4	
Computer laboratory	Unsatisfactory	F	60	15	4	0.895
		%	65.2	16.3	4.4	
	Satisfactory	F	10	2	1	
		%	10.9	2.2	1.1	

As displayed in Table 15, five (5.4%) schools that had good performance and the majority 14 (15.2%) of those that performed averagely had satisfactory teacher/school collaboration for Mathematics, while the majority of schools that performed poorly 58(63%) had unsatisfactory teacher/school collaboration.

These findings were supported by the chi-square results which showed that teacher/school collaboration had a significant effect on the school's performance in Mathematics. These findings were statistically significant at p value 0.042.

From these findings, it was seen that in the majority of schools, there was insufficient teacher/school collaboration. Often, the teachers were left to their own devices. They were left to deal with challenges in the acquisition of teaching and learning resources and to address the challenges in dealing with students.

Therefore, by avoiding teacher/school collaboration, principals fail in supporting their teachers, yet it was their duty to ensure that the teachers receive all the support they require. These findings were in line with the sentiments by Hou, Cui and Zhang (2019) who argue that collaboration is the foundation of good outcomes in any organization.

These positive outcomes were not excluded from educational outcomes. They posit that for schools to enjoy the positive outcomes of the learning process, collaboration between all the stakeholders in paramount.

These findings implied that in schools, the demand for collaboration between the school and its teachers is paramount. It provides an avenue for the teachers to discuss different issues with their principals, come up with joint goals for the students and align these goals with the student's capabilities and the school's resources.

Collaboration also ensures that the teachers were updated on the school's management in terms of financial constraints, budget allocation and resource management. This way, the teachers could work with the principals to maximize resources in the areas where there was high demand.

However, it was seen that in most schools, there was no collaboration between the teachers and the school, which according to Allen, Grigsby, and Peters, (2015) was critical for the

improved performance of student. The authors alleged that collaboration fosters teamwork in addressing the school's shortcomings.

The teachers would also feel that their input was valued and their ideas appreciated which in turn improved their productivity levels. The same sentiments were also expressed by Hallinger, and Heck, (2010) who claimed that collaborative leadership approaches in schools promoted the performance of students. It ensures that every approach developed by the school administration is acceptable and enforceable by the Mathematics teachers. Mathematics teachers could work closely with the principals to acquire the necessary resources to allow for the adoption of the strategies in the classroom.

The school/principal/HOD strategies for Mathematics were found to have a significant association with the school's performance at p value 0.021. This was also evidenced by the majority of the schools with good performance four (4.4%) and 10(10.9%) of the average performing ones having satisfactory strategies while the majority of the poor performing ones 49(53.3%) having unsatisfactory strategies.

The findings showed that the majority of the schools, had a well-established HOD department, but were found to bear no statistically significant effect on the performance of Mathematics. However, the findings further shows that the principal/school/HOD strategies had a statistically significant effect on the student's performance in Mathematics.

These findings point towards a collaborative approach where the school management and the HODs, who were the link between the management and Mathematics teachers, were aware of the strategies, and the Mathematics teachers were comfortable with and approved the strategies. These findings were in line with those of McNeill, Cavanagh and Silcox (2017) who found that pedagogical leadership was critical in the performance of student.

The findings from their study found that in schools where collaborative strategies were implemented students tend to perform well. This was attributed to the general agreement of

the feasibility to these strategies in line with the school's set achievement target and its resources availability.

Additionally, by aligning the strategies with the HOD's goals, the schools are able to implement these strategies successful. Additionally, all the parties would be in agreement with the administration on the goals set and the strategies to achieve them. This means that there was no disquiet or disagreement by the teachers.

Similar observations could also be made in regards to Mathematics construction instruments where the majority of schools with poor performance 55(59.8%) had unsatisfactory instruments while all the average performing and good performing ones had satisfactory instruments.

The chi-square significant p value (p=0.049) which was found supported these results, showing that schools with satisfactory provision of Mathematics instruments had an increased probability of performing well in Mathematics. Contrary, there was no significant association between special rooms and Mathematics performance at p value 0.398. According to Sammons, Gu, Day, and Ko (2011) provision of instruments in schools was critical for the performance of students. It enables the teachers to demonstrate and have the students practically perform the different aspects of the lessons.

This was a more effective means of instructing the students. They got to transfer the abstract concepts of the subject into a meaningful and understandable way of learning.

Therefore, with some of the schools investing in provision of these instruments, then their performance is bound to be higher than the schools with no additional learning instruments. For instance, schools with special rooms where there were globes, large protractors, rules and other Mathematics implements were more likely to effectively engage the attention of the students (Shatzer, Caldearella, Hallam, & Brown, 2014). Additionally this room refocuses the

attention of the student to details because the equipment therein are appropriate for the subject content.

However, with no special rooms or instruments, students were left to their own strategies. This applied in cases where there were no rooms for Mathematics teachers to demonstrate to the students some of the content they were teaching. This implies that the content will remain abstract to the students which then limit their understanding and ultimately results in poor performance.

A significant association was found between Mathematics performance and Mathematics radio sessions ($p=0.032<0.05$) where the majority of the schools with poor performance in Mathematics had unsatisfactory radio sessions 66(71.7%) and all the schools with good and average performance had satisfactory radio sessions. Contrary, there was no association between Mathematics performance in KCSE and availability of computer rooms. Radio sessions were important in exposing students to a new mode of learning aside from the normal lecture sessions adopted by the teachers.

Though it was an audio form of teaching, the radio lessons provides a new way of learning where the students could learn to listen and put the concepts learnt into practice. Additionally, the presenters in the radio programs were experts and could be deemed as Mathematics specialists; therefore, even in schools where external specialists could not be invited to the schools, principals could take advantage of the radio programmes to serve as a form of Mathematics specialists for their students.

Thorvaldsen, and Vavik (2012) was of the opinion that exposing students to competent teachers who could provide a new way of learning and new models of teaching Mathematics could significantly improve the student's performance. New ideas could be gained from listening to other students being taught through radio sessions.

Moreover, the sessions are normally interactive with students being engaged in the programmes which make it an interesting break from the normal modes of teaching. However, for this to be successful there was a need for the schools to be equipped with a quiet room where the radio sessions could be conducted with minimal disturbances.

However, seeing as most schools lacked resources as indicated in the Table 4.12, 72.8% of schools lacked sufficient resources and radio sessions were found to be minimal at 97.5%. Lamon (2005) asserts that for the schools to engage the students, principals need to find alternative strategies of instructing learners. Radio sessions was an important alternative that could help students learn new concepts. However, the lack of financial resources to purchase these radios means that the potential benefits of the radios to the students' performance was not realized.

This may in turn be seen in the continued dismal performance of learners as displayed in the Table 4.2.Additionally, Garland (2018) reported that Mathematics achievement was associated with the principals' ability to support the student's interactive sessions with resources including the radio sessions where the students could be exposed to new forms of learning.

Generally, it was seen that satisfactory provision of Mathematics instruments, radio sessions, collaboration between HOD/Teachers and principals to come up with strategies had a significant effect on Mathematics performance.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the study's findings, conclusions and then makes recommendations based on the study's conclusions. The conclusions are drawn from the study's findings and summary.

5.2 Summary

The first objective was to evaluate the effects of the principal's invitation of mathematics specialists on students' performance in the KCSE examinations in Meru County. From Table 4.2, it was found that the majority of 72 (78.3%) of principals claimed that they did not invite mathematics specialists to their schools, and only 20 (21.7%) of principals invited mathematics specialists. The majority of schools invited the specialists only once a year. According to the Chi-square test of independence, 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 effect on how students perform. Most of the schools used CATs as follow-up programmes, while group discussions, peer and team teaching, CATS, mathematics contests, and symposiums were cited by the principals as the most commonly used strategies to improve student performance. The chi square tests revealed that team teaching (p=0.031), group discussions (p=0.006), peer teaching (p=0.016), CATS (p=0.033), and mathematics contests (p=0.022) had significant effects on students' performance.

The second objective of the study was to evaluate the effects of principals' support to teachers through mathematics seminars and workshops on how students perform in the KCSE examinations in Meru County. The majority of 194 (87.78) of mathematics teachers refuted that their principals supported them attending workshops and seminars, with the majority

having never attended mathematics contests in the last two years. The minority of 27 (2.22%) of mathematics teachers claimed that their principals supported them in attending the workshop. The principals cited a lack of resources and budgetary allocation for the low number of mathematics teachers attending seminars and workshops. The majority of principals did not discuss mathematics issues with their mathematics teachers. There was a statistically significant association between those that frequently had discussions and their good performance in mathematics, with a p value of 0.000.

The third objective is to evaluate the effects of principals' organization of mathematics contests on students' performance in mathematics in the KCSE examinations in Meru County. The **majority of** 87.78 percent of mathematics teachers revealed that most principals did not organize mathematics contests; while a minority of 27 (12.22%) asserted that their principals coordinated efforts to organize mathematics contests. The ANOVA results showed a significant association between the mean performance in mathematics and the number of mathematics contests organized by the principals, with a p value of 0.0000.05. The frequency with which the principals organized Mathematics contests was also found to have a statistically significant association with the school's mean performance in Mathematics, a p value of $0.000<0.05$.

The last objective aimed to evaluate the effect of principals' provision of teaching and learning materials on students' performance in Mathematics in K.C.S.E in Meru County. It was revealed by mathematics teachers that the majority of 186 (84.16%) of their principals provided them with teaching and learning resources, while only 35 (15.84%) claimed that their principals did not provide them with teaching and learning resources. The findings revealed that in regards to teaching resources, the majority of schools had satisfactory mathematics syllabus provision, adequate departmental teaching and revision materials, and adequate textbooks.

However, the marking and checking schemes of work were not satisfactory to the majority of the respondents. In regards to learning resources, the majority of respondents affirmed that teaching aids were satisfactorily provided, but schools were not financially stable, which was evidenced by the low organization of mathematics contests externally as compared to high organizations internally. Teacher collaboration was reported to be satisfactory, while the HOD office establishment was unsatisfactory similar to the strategies created and implemented by the principals and the HODs. Construction of special rooms and computer rooms were unsatisfactory to the majority of the respondents.

5.3 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 effect 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.

The researchers also concluded that attendance at seminars was minimal or non-existent in the majority of the schools, considering that there was a significant association between teachers' attendance at seminars and student performance in mathematics. It was concluded that the poor attendance at seminars and workshops for professional development has negatively affected the school's performance in mathematics.

Regarding the principals' organization of Mathematics contests, it was concluded that schools in Meru County did not generally organize external Mathematics contests. There was also a significant association between the organization of mathematics contests and poor performance.

Therefore, the study concluded that poor performance in mathematics among schools in Meru County could be associated with the infrequent organization of mathematics contests.

Lastly, the study concluded that the provision of teaching and learning resources was generally unsatisfactory, which had a negative impact on the performance of schools. Therefore, the study concluded that the provision of teaching and learning resources affected school performance in mathematics.

5.4 Recommendations

The study recommends these strategies to lead to improved performance in the Mathematics KCSE in Meru County, in particular, and in Kenya in general.

The study recommends that you

1. Principals should invite more than one specialist frequently to the school to ensure that mathematics teachers and students are exposed to different kinds of skills and strategies for improving mathematics performance in the K.C.S.E examination.

2. The principals need to send their mathematics teachers to more seminars and workshops to promote their professional development.

- The principals should also increase the frequency of organizing external mathematics contests to ensure their students gain the benefits of such contests.

1. The provision of teaching and learning resources should be enhanced to support the teaching and learning of mathematics across secondary schools.

5.5. Suggestions for Further Studies

The suggestions for further studies are necessary because the study concentrated only on the administrative strategies of principals' on how students performed in Mathematics in the Kenya Certificate of Secondary Examination in Meru County. The following studies should be carried out in order to narrow the mathematics performance gaps further and eventually improve mathematics performance in other countries: (1) carry out a study to evaluate teachers' training skills in order to improve mathematics performance in Kenya.

1. The study was basically confined to the secondary schools in Meru County, Kenya. Further and related studies are recommended to be carried out in other regions of Kenya so that the results can be compared.

2. The study was confined to a few of the administrative strategies that could affect secondary school students' performance in mathematics. Further and related studies on other administrative strategies are recommended to be conducted.

The study found that the majority of the teachers were professionally qualified to teach mathematics, yet they did not show the expected professionalism when teaching the subject. Further study on the types of training that they received from the universities in Kenya is recommended.

REFERENCES

Abagi, O., & Odipo, J. (2017). Status of education in Kenya. Indicators for planning and policy management.in Kenyan Secondary Schools.

Abdulkafi, A. (2004). Teachers' attitude towards information, communication technology and innovation.in science.

Irungu, C., Kagema, J., & Gachahi, M. (2019).Influence of Principals' Collaborative Practices on Students' Performance in Secondary Schools in Murang'a and Kirinyaga Counties, Kenya.EDUCATIO: Journal of Education, 4(2), 111-124.

Sebastian, J., Huang, H., & Allensworth, E. (2017).Examining integrated leadership systems in high schools: Connecting principal and teacher leadership to organizational processes and student outcomes. School Effectiveness and School Improvement, 28(3), 463-488.

Liebowitz, D. D., & Porter, L. (2019).The effect of principal behaviors on student, teacher, and school outcomes: A systematic review and meta-analysis of the empirical literature. Review of Educational Research, 89(5), 785-827.

Grissom, J. A., Egalite, A. J., & Lindsay, C. A. (2021). How principals affect students and schools: A systematic synthesis of two decades of research. The Wallace Foundation.

Abuseji, F. A. (2007). Student and teacher related variables as determinants of secondary school students' academic achievement in chemistry. Jdu Vrnaarila Pbelensdidikan, 32(1), 3-18.

Acheson, K. A. & Gall, M. D. (2010).Clinical supervision and teacher development. Hoboken, NJ: Wiley.

Gates, S. M., Baird, M. D., Master, B. K., & Chavez-Herrerias, E. R. (2019).Principal Pipelines: A Feasible, Affordable, and Effective Way for Districts to Improve Schools. Research Report.Santa Monica, CA.

Achievement: A case study of primary schools in Eldoret Municipality. (Unpublished Master Thesis).Moi University, Eldoret.

Adeogun, A.A. (2001). The principal and the financial management of public secondary schools in Osun State.Journal of Educational System and Development.5 (1).1 - 10.

Afolabi, A.O., Adeyanju, O.L., Adedapo, Y. A. and Falade, A.A. (2006).Preparation and use of simple instructional materials.Oyo-SUBEB Training manual for primary school. Teachers in Oyo State.Oyo. Odumatt, 29-36.

Ahmed, A. M. (2018). Principals Perception of Factors Contribution to Students Poor Performance in Chemistry in Public Secondary Schools in Wajir County, Kenya. A (Masters Thesis), Kenyatta University

AIR.(2007). New international benchmarking to measure state and district student math performance against the World. Thomas Jefferson Street, Washington, D.C.: American Institute of Research. Retrieved June 10, 2015 from http://www.air.org/news/press-release/new-international-benchmarking-measure-state-and-district-student-math

Ajayi, G. (2005). Critical perspectives on Nigerias socio-political development in the 20th century. Shomolu, Lagos: Stebak Books.

Aldrich, H. (2009).Organization and Environment. Englewood Cliffs:Prentice-Hall.

Allen, N., Grigsby, B., & Peters, M. L. (2015).Does leadership matter? Examining the relationship among transformational leadership, school climate, and student achievement.International Journal of Educational Leadership Preparation, 10(2), 1–22. Among 10th and 12th grade. New York: Merril Publishers.

Anikweze, C. M. (2009).Simplified approach to educational research. Enugu: SNAAP Press (Nig.) Ltd.

Anioke, C. L. & Chigbuo, A. C. (2016).The extent of teachers' use of library resources as approaches. Nairobi: ACT Press.

Arnot, M., David, M. & Weiner, G. (2016).Educational reforms and gender equality in schools. Research Discussion Series No. 17.Manchester: Equal Opportunities Commission.

Asayo O. (2009a), The immediate assessment of the Introduction of free secondary education in Kenya: Emerging issues Magazine, Centre for International Education University of Sussex.

Aslan, S., Alyuz, N., Tanriover, C., Mete, S. E., Okur, E., D'Mello, S. K., & Arslan Esme, A. (2019, May). Investigating the impact of a real-time, multimodal student engagement analytics technology in authentic classrooms.In Proceedings of the 2019 chi conference on human factors in computing systems (pp. 1-12).

Askew, M. (2017).Effective teachers of numeracy. London: King's College.

Atieno, A. J. (2014). Influence of Teaching and Learning Resources on Students' Performance in Kenya Certificate of Secondary Education in Free Day Secondary Education in Embakasi District, Kenya, Kenyatta University.

Avramidis, E., Bayliss, P. & Burden, R. (2000).A survey of mainstream teachers' attitude towards inclusion of children with special needs in the ordinary school in one educational authority.Educational Psychology, 20(2), 193-213. Retrieved October 15, 2015 from www.tandfonline.com/doi/pdf/10.1080/08856250210129056.

Ayeni, A. J. (2010). Teachers' instructional task performance and principals' supervisory roles as correlates of quality assurance in secondary schools in Ondo State.(Doctoral Dissertation), Obafemi Awolowo University, Ile-Ife Nigeria.

Ayot, H. (2013). Instructional Method.Nairobi: Kenyatta University Afropress.

Baker, B. D., & Cooper, B. S. (2005).Do principals with stronger academic backgrounds hire better teachers? Policy implications for improving high-poverty schools.Educational Administration Quarterly, 41(3), 449–479.

Baldacchino, G. & Farrugia, C. J. (2002).Educational planning and management in small groups

Ballard, C. L., & Johnson, M. F. (2004).Basic math skills and performance in an assessment. Phi Delta Kappan, 80(2), 120-122. Retrieved October 15, 2015 from www.rdc.udel.edu/wp-content/uploads/2015/04/InsideBlackBox.pdf .

Bambrick-Santoyo, (2010).Evaluation of Schools Performance Driven by Data in Jossey.Retrieved From Http://Www.Nlns.Org/Uef.Jsp On 22/03/2105.

Bandura, A. (2017). Self-efficacy: The exercise of control. New York: W. H. Freeman

Barth, R. (2001). Teacher leader. Phi Delta Kappan, 82(6), 443-449. Beach, D. M., & Reinhartz J. (2000). Supervisory leadership: Focus on instruction. Boston: Allyn and Bacon.

Bekee, F. (2013).The effect of behavioral objectives and diagnostic teaching strategies on mathematics.methodology.

Bennars, G.A and Njoroge, (2014); Theory and Practice of Education.Nairobi; E.A.

Bertalanffy V. L. (2011). General System Theory: Foundations, Development, and innovation.

Black, P., & Wiliam, D. (2012).Inside the black box: Raising standards through classroom group interaction.

Blank, R. K., & De Las Alas, N. (2009).The Effects of Teacher Professional Development on Gains in Student Achievement: How Meta-Analysis Provides Scientific Evidence Useful to Education Leaders. Council of Chief State 139 School Officers. One Massachusetts Avenue NW Suite 700, Washington, DC 20001.

Blasé & Blasé (2005).Principals' Instructional Leadership and Teacher Development.Teachers' Perspectives.Educational Administration Quarterly, 3

Blasé & Blasé (2004).The Dark Side of School Leadership: Implications for Administrator Preparation.Leadership and Policy in Schools, 3(4), 245-273.

Blase, J. & Blase, J. (2008).Handbook on Instructional Leadership.How really good principals promote teaching and learning. Thousand Oaks, CA Corwin Press.

Blasé, J. (2000). Effective instructional leadership: Teachers' perspectives on how principals promote teaching and learning in school.Journal of Educational Administration, 38(2) 130-141.

Blumberg, P. (2011).Making evidence-based practice an essential aspect of teaching.The Journal of Faculty Development, 25.3 27-32.

Bogdanov, A. (2002). Essays in Tektology: The General Science of Organization, tran. By George Gorelik. Seaside: Intersystem Publications.

Borasi, R. & Fonzi, J. (2002).Professional development that supports school Mathematics reforms: Foundations series of monographs for professionals in science, Mathematics, and technology education. Arlington, VA: National Science Foundation.

*Borko, H., Wolf, S. A., Simone, G., & Uchiyama, K. P. (2003).**Schools in transition**: Reform efforts and school capacity in Washington state. Educational valuation and Policy Analysis, 25(2), 171-201.*

Botha, R. J. (2004). Excellence in Leadership: Demands on the Professional School Principal.South African Journal of Education, 24(3): 239-243.

Bouchamma, Y. (2005). Evaluating Teaching Personnel. Which model of supervision do Canadian teachers prefer? Journal of Personnel Evaluation in Education 18, no. 4: 289_308.

Boudett, K. P., & Moody, L. (2005).Organizing for Collaborative Work. In K. P. Boudett, E. A. City, & R. J. Murnane (Eds.), Data Wise: A Step-By-Step Guide to Using Assessment

Results to Improve Teaching and Learning (Pp. 11-28). Cambridge, MA: Harvard Education Press.

Boudett, K. P., & Moody, L. (2005).Organizing for Collaborative Work. In K. P. Boudett, E. A. City, & R. J. Murnane (Eds.), Data Wise: A Step-By-Step Guide to Using Assessment Results to Improve Teaching and Learning (Pp. 11-28). Cambridge, MA: Harvard Education Press.

Brandt, C., Mathers, C., Oliva, M., Brown-Sims, M., & Hess, J. (2007).Examining District Guidance to Schools on Teacher Evaluation Policies in the Midwest Region.Issues & Answers.REL 2007-No. 030.Regional Educational Laboratory Midwest. 140.

Bray, M. (2007). The shadow education system: Private tutoring and its implications for planners. Paris: IIEP, UNESCO. Available online at: http://unes doc.unesco.org /images/0011/001184/118486e.pdf.

Bray, M. (2007). The shadow education system: Private tutoring and its implications for planners. Paris: IIEP, UNESCO. Available online at: http://unes doc.unesco.org /images/0011/001184/118486e.pdf.

Brizendine, L. (2006). The female brain. New York, NY: Morgan Road Books. Bush, T. (2007). Educational Leadership and management,Theory, Policy and Practice, 9 (3), 391- 406.

Brooks, M. G., & Brooks, J. G. (2005).The courage to be constructivist. Belmont, CA.

Bruggencate, G., Luyten, H., Scheerens, J., & Sleegers, P. (2012).Modeling the influence of school leaders on student achievement: How can school leaders make a difference? Educational Administration Quarterly, 48, 699–732.

Burns, T.,& Stalker, G.M. (2011).The management of innovation. London: Tavistock.

Burton, A. C. (2000). Crafting multicultural science education with pre-service teachers.

Bush, T. and Middlewood, D. (2017) Leading and Managing People in Education, London: SAGE Publications.

Butler-Por, N. (2013). Underachievers in school: Issues and interventions. Chichester:

Butty, J. L. M. (2001).Teacher instruction, student attitudes, and Students' Performance in Mathematics in Secondary Schools in Kenya.

Cadigan K. (2006), The Effects of Instructing teachers about Good Teaching on the Mathematics Achievement of Fourth-Grade Students. American Educational Research Journal, 16(1), 16.

Calhoun, E. F. (2002). Action research for school improvement. Educational Leadership, 59(6), 18-24.

Campbell, P. F., & Malkus, N. N. (2010).The impact of elementary mathematics specialists.Journal of Mathematics and Science: Collaborative Explorations, 12(1), 1-28.

Campbell-Evans, G., & Maloney, C. (2010).Towards a collaborative teaching model for field experience.AARE Index to AARE conference papers, abstracts and symposia.

Capra, F. (2007).The web of life. New York: Doubleday-Anchor Book.

Carrier, L.L. (2014).Putting the leadership back in instructional leadership: What does an effective model of instructional leadership look like in practice when we place a value on both the work and leadership of principals? Plymouth: Plymouth University. Center for Educational Leadership. (2012). 4 dimensions of instructional leadership: Instructional leadership framework version 1.0. Seattle: University of Washington. Retrieved from http://info.k-12leadership.org/download-the-4- dimensions-of-instructional-leadership.

Center for Performance Assessment Republic of Kenya.(2009). Quality Assurance and Standards Circular No.1.2009- QSA/2/1A/VIL.11/86.

Centre for Educational Research and Innovation (2005) Formative assessment: improving learning in secondary classrooms (Paris, OECD).

Chanyalew, W. (2005).The practice and problems of instructional supervision in four secondary schools of Hadya Zone.(Unpublished Masters of Arts thesis), Addis Ababa University, at Addis Ababa.

Charalambos, C. Philippou, G. & Kyriakides, L. (2002).Towards understanding teachers' teaching methodology.

Checkland, P. (2007). Systems Thinking, Systems Practice. Chichester: John Wiley & Sons Ltd.

Chika, P. O. (2012). The Extent of Students' Responses in the Classroom.International Journal of Academic Research in Business and Social Sciences, 2 (1). 141.

Chiriswa, P. (2002): An investigation into the Probable Factors Responsible for Poor performance in Kenya Certificate of Secondary Education (KCSE) in Vihiga District of Western Province, Kenya. (MED), Kenyatta University Kenya.

Choy, D., Chong, S., Wong, A.F.L., &Wong, I.Y. F. (2011).Beginning Teachers' Perceptions of their Level of Pedagogical Knowledge and Skills: Did they Change since their Graduation from Initial Teacher Preparation?Asian Pacific Educational Review, 12, 79-87.

Chudgar, A., & Luschei, T. F. (2009).National income, income inequality, and the importance of schools:A hierarchical cross-national comparison. American Educational Research Journal, 46(3), 626-658.

Clark, D., Martorell, P. & Rockoff, J. (2009).School principals and school performance (Working Paper No. 38).Retrieved from CALDER Urban Institute website: http://www.urban.org/UploadedPDF/1001427-school-principals. Pdf

Cohen, D. K: Raudenbush, S.W. & Ball, D. B. (2003),Resources Instruction and Research.Educational Evaluation and Policy Analysis.25.119-142.

Cohen, L. (1976). Educational research in classrooms and schools: A manual materials and teaching of mathematics in schools.

Colbert, J., Brown, R., Choi, S. and Thomas, S. (2008). An investigation of the impacts of teacher-driven professional development on pedagogy and student learning.Teacher education quarterly.135-154.

Colleges in the eastern province of Kenya face in preparing trainees to teach Mathematics. (Unpublished Master Thesis). University of Nairobi, Nairobi

Collins, G. (2017). English Dictionary. Glasgo: Harper Collins Publishers.

Costello, J. (2001). Teaching and learning Mathematics. London: Routledge.

Cotton, K. (2003). Principals and Student Achievement: What Research Says? Alexandria, V. A: Association for Supervision and Curriculum Development.

Creswell, J. W., & Creswell, J. D. (2017). Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications.

Creswell, J.W. (2008). Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research. Thousand Oaks, CA: Sage Publications, Inc.

Crosswell, L. & Elliott, B. (2002).Teacher commitment and engagement, the dimensions of

Crowther, F., Kaagan, S. S., Ferguson, M. & Hann, L. (2002).Developing teacher leaders: How teacher leadership enhances school success. Thousand Oaks, California; Corwin Press.

Crum, K. S., & Sherman, W. H. (2008).Facilitating high achievement: High school principals' reflections on their successful leadership practices.Journal of Educational Administration, 46(5), 562-580.

Cunningham, W.G. & Cordeiro, P.A. (2006).Educational leadership: A problembased approach. Boston: Pearson Publishers.

Daluba, N. E. (2012). Evaluation of Resource Availability for Teaching Science in Secondary Schools: Implications for Vision 20:2020.Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS), 3(3): 363- 367.

Danielson, C., & McGreal, T. L. (2000).Teacher evaluation to enhance professional practice.Ascd.

Darling-Hammond, L., Wei, R. C., Andree, A., Richardson, N., & Orphanos, S. (2009). Professional learning in the learning profession. Washington, DC: National Staff Development Council.

Datnow, & Castellano, (2001).The Sustainability of Comprehensive School Reform Models in Changing District and State Contexts.Educational Administration Quarterly, 41(1), 121-153.

Day, C., Gu, Q., & Sammons, P. (2016). The impact of leadership on student outcomes: How successful school leaders use transformational and instructional strategies to make a difference.Educational Administration Quarterly, 52(2), 221–258.

Day, C., Sammons, P., Leithwood, K., Hopkins, D., Harris, A., Gu, Q. and Brown, E. (2010). Ten Strong Claims about Successful School Leadership, the National College for School Leadership, Nottingham.

Deike, M.A.(2009).The principal as an instructional leader within the context of elective data use(Doctoral dissertation): Retrieved from http://gradworks.umi.com/3359189.pdf

Deno, S. L. (2003). Developments in Curriculum-Based Measurement.Journal of Special Education, 37, 184–192.

Department of Education. (2008). Foundations for Learning Campaign 2008-2011, Government Gazette, No. 30880, 14 March 2008. Pretoria: Government Printer.

Desimone, L. (2009). How can we best measure teacher's professional development and its effects on teachers and students?Educational Researcher, 38(3), 181- 199.

Desimone, L. M. (2011). A Primer on Effective Professional Development.Phi delta kappan, 92(6), 68-71.

Desimone, L. M., Porter, A. C., Garet, M. S., Yoon, K. S., & Birman, B. F. (2002).Effects of professional development on teachers' instruction: Results from a three-year longitudinal study.Educational Evaluation & Policy Analysis, 24(2), 81-112.

Desimone, L. M., Smith, T. M., & Ueno, K. (2006).Are teachers who need sustained, content-focused professional development getting it?An administrator's dilemma.Educational administration quarterly, 42(2), 179-215.

Despres, B. (2008) System thinkers in action: A field guide for effective change for leadership in education. Toronto: Rowman & Littlefield Education.

DFID (2007) in, Bontoux V and Buchan A (2007) Secondary Textbook and School Library Provision in Sub-Saharan Africa: A Review based on 19 National Case Studies World Bank, Washington (www.worldbank.org).

DiPaola, M. F., & Hoy, W. K. (2008).Principals Improving Instruction: Supervision, Evaluation, and Professional Development. Boston, MA: Pearson Education, Inc.

Drake, T.L and Roe W. (2003).Principalship (6th ed.). Columbus, OH: Merril, Prentice-Hall.

Ebmeier, H. (2003). How Supervision Influences Teacher Efficacy and Commitment: An Investigation of the Path Model.Journal of Curriculum and Supervision, 18 (2), 110- 141.

Education insight (2005).For quality information, education.communication issues, 8, 21.

Education quality in Kenya.Research in Comparative and International Education, 1(2), 98-102. Retrieved October 14, 2015 from http://dx.doi.org/10.2304/rcie.2017.8.4.510.

Effectiveness.(Research Report 216). Nottingham, England: Department for Education and Employment in kenya.

Efficiency of Nandi District secondary Schools in Kenya. European Scientific Journal, 10 (16), 211-220 Retrieved from eujournal.org/index.php/esj/article/download/3522/3294.

Ekal, L. R. (2016). Influence of Principals' Management of Resources on Students' Performance at Kenya Certificate Secondary Examination in Public Schools in Samburu County, Kenya.(Masters Thesis)

Elliott, B. & Croswell, L. (2008), "Teacher commitment and engagement', the dimensions of ideology and practice associated with teacher commitment and engagement within an Australian perspective. Paper presented to the Australian Educational Research Association Conference, 2002, Brisbane, Available at: http://www.aare.edu.au/02pap/cro02522.htm.

Ellis, J. (2014). Graduate students Teaching Assistants' (GTAs') beliefs, instructional practices, and student success. In Proceedings of the 17th Annual Conference on Research in Undergraduate Mathematics Education (pp. 609-616).

Ellis, S., Gaudet, R., Shultz, G., Kaufman, L., Hoover, M., Spencer, M., & Su, D. (2007).Gaining traction: Urban educators' perspectives on the critical factors influencing student achievement in high and low performing urban public schools.

Elmore, R. F. (2002). Bridging the gap between standards and achievement: The imperative for professional development in education. Washington, DC: Albert ShankerInstitute. emis.math.tifr.res.in/proceedings/PME28/RR/RR141_Uusimaki.pdf.

Emstad, A. B. (2011). The principal's role in the post-evaluation process. -How does the principal engage in the work carried out after the schools' self-evaluation? Educational Assessment, Evaluation and Accountability, 23(4), 271-288.

EPPI–Centre at the Institute of Education, University of London (2002), A Systematic Review of the Impact of Summative Assessment and Tests on Students' Motivation for Learning", June.

Ernest, P. (2001). The impact of beliefs on the teaching of Mathematics'.

Eshiwani, G. (2008). Education in a Semi-Arid Area. A study of determinants of School Achievement in Kajiado District.Bureau for Educational Research, Kenyatta University.

Eshiwani, G. S. (2009). Implementing educational policies in Kenya.Nairobi: Kenyatta.

Eshiwani, G. S. (2013). Education in Kenya since independence.East African Publishers.

Essien, E. E., Akpan, O. E., & Obot, I. M. (2016).The Influence of In-Service Training, Seminars and Workshops Attendance by Social Studies Teachers on Academic Performance of Students in Junior Secondary Schools In cross River State, Nigeria.Journal of Education and Practice, 2(3)31-35

Eteokleous, N. (2008). Evaluating computer technology integration in a centralized school question papers and sample marking schemes. Nairobi: KNEC Research and Data Processing Department.

Evans, L. (2002). What is Teacher Development?Oxford Review of Education, 28 (1), 123-137. 144.

Examination Council report 2008: KCSE 2004, 2005, 2006, 2007. Nairobi: KNEC.

Falade, F. (2006).Engineering and Globalization in Developing Countries: Nigeria A Case Study. 3rd African Regional Conference on Engineering Education.

Fancera, S. F., & Bliss, J. R. (2011).Instructional leadership influence on collective teacher efficacy to improve school achievement.Leadership and Policy in Schools, 10(3), 349–370.

Fennema, E., & Sherman, J. (2018).Sex-Related Differences in Mathematics Achievement. Englewood Cliffs, NJ: Prentice-Hall.

Fernandez, K., Flores, S., Huang, E., Igwe, C., Mcdonald, L., Stroud, R., & Taylor, D. L. (2007).Principal performance in Texas: Tools for measuring effective school leadership. College Station, TX: Texas A&M University.

Fink, E., & Resnick, L. B. (2001).Developing principals as instructional leaders.Phi Delta Kappan, 82(8), 1-10.

Finlay, B., & Agresti, A. (2016). Statistical methods for the social sciences.Dellen.

Fisher, R. A. (2006). Statistical methods and scientific inference.

Fishman, B., Marx, R., Best, S., & Tal, R. (2003). Linking teacher and student learning to improve professional development in systemic reform.Teaching and Teacher Education, 19(6), 643-658.

Fletcher, J. A. (2005). Constructivism and mathematics education in Ghana. Mathematics connection, 5(1), 29-36.

Flynn, G., & Nolan, B. (2008).What do school principals think about current schoolfamily relationships?NASSP Bulletin, 92(3), 173-190.

Fonseca, J., & Conboy, J. E. (2006).Secondary Student Perceptions of Factors Effecting Failure in Science in Portugal. Eurasia Journal of Mathematics, Science & Technology Education, 2(2).

Fosnot, C. T. (2001). Enquiring teachers, enquiring learners: A constructivist approach for teaching. Teachers College Press.

Fried, R. L. (2001). The passionate teacher: A Practical Guide. Boston: Beacon.

Friend, M. & Cook, L. (2010).Interactions: Collaboration skills for school professionals (6thed.). Columbus, OH: Merrill. Pretoria.

Fuchs, L. S., & Fuchs, D. (2002).What is scientifically-based research on progress monitoring?(Technical report). Nashville, TN: Vanderbilt University.

Fullan, M. (2007).The Moral Imperative of School Leadership. Thousand Oaks, CA: Corwin Press.

Furinghetti, F. & Pehkonen, E. (2002), Rethinking characterizations of beliefs. In: G.Leder, E.Pehkonen, and G. Toerner (eds.), Beliefs: A hidden variable in Mathematics education? Kluwer Academic Publishers. Retrieved October 13, 2015 from http://link.springer.com/chapter/10.1007%2F0-306-47958-3_3

Gall, J. P., Gall, M. D., & Borg, W. R. (2005).Applying educational research: A practical guide. Boston, MA: Pearson.

Gamble, Belsky & Robins. (2007). the determinant of parental competence: toward a contextual theory In M. Lewis & L. Rosenblum (Eds.), Beyond the dyad: Social connections. New York: Plenum.

Garet, M. S., Cronen, S., Eaton, M., Kurki, A., Ledwig, M., Jones, W. (2008). The impact of two professional development interventions on early reading instruction and achievement. Washington, DC: Institute of Education Sciences.

Garland, Janice E. (2018). The Relationship between Principal Leadership Behavior and Student Achievement in Low Performing Schools. . Seton Hall University Dissertations and Theses (ETDs). 2511.

Garland,H.(2007). Relation of Effort Performance,Expectance to performance in Goal setting Experiments,Journal of Applied Psychology.

Gay, L. R. (2006). Educational research: Competencies for analysis and application (5thed.).

Gelman, A., & Hill, J. (2006). Data analysis using regression and multilevel/hierarchical models.Cambridge university press.

Gentry, G. C. (2010). A case study: The issues high school principals encounter with instructional supervision. University of Georgia

Ghamrawi, N. (2010). No teacher left behind: Subject leadership that promotes teacher leadership.Educational Management Administration & Leadership, 38, 304-320.

Githua, B. N., & Nyabwa, R. A. (2008).Effects of advance organiser strategy during instruction on secondary school students' mathematics achievement in Kenya's Nakuru district. International Journal of Science and Mathematics Education, 6(3), 439- 457.

Gitonga, J. M. (2009). A study of the problems that teacher trainers in primary teachers

Glanz, J. (2006). What every principal should know about instructional leadership. Thousand Oaks, CA: Corwin Press.

Glass, G., & Hopkins, K. (2009).Statistical methods in education and psychology. Psyccritiques, 41(12).

Glatthorn, A. A. (2017). Differentiated Supervision (2nd Ed.). Alexandria, VA: Association for Supervision and Curriculum Development.

Glickman CD, Gordon SP, Ross-Gordon JM (2009) Supervision and Instructional Leadership: A Developmental Approach, (5th ed). Toronto, ON: Allyn and Bacon.

Glickman, C.D. (2002). Leadership for learning: How to help teachers succeed. Alexandria, VA: Association for Supervision and Curriculum Development.

Goddard, R. (2002). A theoretical and empirical analysis of the measurement of efficacy: The development of a short form. Educational and Psychological Measurement, 62(1), 97-110.

Gogo, J. O. (2002).The impact of cost sharing on access, equity and quality of secondary education in Rachuonyo District Kenya. (Unpublished M. Ed. Thesis).Maseno University.

Goldhaber, D. (2004). Indicators of teacher quality.ERIC Clearinghouse on Urban Education New York NY Good, R. H., Simmons, D. C., & Kameenui, E. J. (2001).The importance and decision-making utility of a continuum of fluency-based indicators of foundational reading skills for third-grade high stakes outcomes. Scientific Studies of Reading, 5, 257–288.

Golinelli, G.M. (2009). L'approcciosistemicovitale: nuoviorizzonti di ricerca per il governodell'impresa. Sinergie.(80), IX-XXII.

Good, T. Grouws, D. & Ebmeier, H. (2003). Active Mathematics teaching. New York: Englewood Cliffs, NJ: Prentice-Hall.

Gordon, S. P. (2017). Has the Field of Supervision Evolved to a Point that it should be Called Something Else? Yes. J. Glanz & R. F. Neville (Eds.), Educational Supervision: Perspectives, Issues and Controversies (Pp. 114-123). Norwood, MA: Christopher-Gordon.

Graczewski, C., Knudson, J., & Holtzman, D. J. (2009).Instructional leadership in practice: What does it look like, and what influence does it have?Journal of Education for Students at Risk (JESPAR), 14(1), 72-96.

Graf, O., & Werlinich, J. (2003).Differentiated supervision & professional development: Using multiple vehicles to drive teaching &learning from good to great. Paper presented at the Principals' Academy of Western Pennsylvania, Pittsburgh, PA. Green, K.C. 2000. School leadership models. Independence, 33(2):321-344.

Griffin, P. (2008). Developmental assessment: Lifting literacy through professional learning

Grissom, J. A., Kalogrides, D., & Loeb, S. (2012). Using Student Test Scores to Measure Principal Performance (Working Paper No. 18568).National Bureau of Economic Research.

Gumus, S. & Akcaoglu, M. (2017).Instructional leadership in Turkish primary schools: An analysis of educators' perceptions and current policy. Educational Management Administration and Leadership, 41(3): 289-302.

Gupton, S. L. (2003). The instructional leadership toolbox. California: Sage Publications.

Guskey, T. (2002).Evaluating Professional Development. Thousand Oaks CA: Corwin Press.

Hallinger, P. (2003).Leading educational change: Reflections on the practice of instructional and transformational leadership.Cambridge Journal of Education, 33(3), 329-351.

Hallinger, P. (2005). Instructional leadership and the school principal: A passing fancy that refuses to fade away. Leadership & Policy in Schools, 4(3), 221- 239.

Hallinger, P. (2007). Instructional Leadership and the School Principal: A Passing Fancy That Refuses to Fade Away.In Leadership and Policy in Schools, 4(3), 221-239.

Hallinger, P., & Heck, R. (2009).Reassessing the Principals Role in School effectiveness.A review of empirical research.Administrative quarterly 32(1), 5-44.

Hallinger, P., & Heck, R. (2011).Conceptual and Methodological Issues in Studying School Leadership Effects as a Reciprocal Process.School Effectiveness and School Improvement, 22(2), 149-143.

Hallinger, P., & Heck, R. H. (2010).Collaborative leadership and school improvement: Understanding the impact on school capacity and student learning. School Leadership and Management, 30(2), 95–110.

Hamilton, L., Halverson, R., Jackson, S., Mandinach, E., Supovitz, J., &Wayman, J. (2009).Making (NCEE 2009-4067). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.

Hardman, F., J. Abd-Kadir, C. Agg, J. Migwi, J. Ndambuku, and F. Smith.(2009). Changing pedagogical practice in Kenyan primary schools: the impact of school-based training. Comparative Education 45, (1), 65–86. 147.

Harris, D. N., & Sass, T. R. (2011). Teacher training, teacher quality and student achievement.Journal of public economics, 95(7), 798-812.

Hattie, J. (2009). Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement. London: Routledge. Hayes, S. (2008). Characteristics of Successful High-Poverty Schools: What the Research tells Us, Vermont: Vermont Department of Education.

Heilig J. V. and Williams A. (2010). Inputs and Student Achievement: An Analysis of Latina/o-Serving Urban Elementary Schools. Association of Mexican American Educators (AMAE) journal.

Helmer, J., Bartlett, C., Wolgemuth, J. R., & Lea, T. (2011).Coaching (and) commitment: linking ongoing professional development, quality teaching and student outcomes. Professional Development in Education, 37(2), 197-211.

Heneman III, H. G., Milanowski, A., Kimball, S. & Odden, A. (2006). Standardsbased teacher evaluation as a foundation for knowledge-and skill-based pay.

Henson, K. T. (2010). Supervision: A collaborative approach to instructional improvement. Waveland Press.

Hinchey, P. H. (2010). Finding freedom in the classroom: A practical introduction to criticaltheory (Vol. 24). Peter Lang.

Hollander, M., Wolfe, D. A., & Chicken, E. (2017). Nonparametric statistical methods (Vol. 751).John Wiley & Sons.

Horng, E., & Loeb, S. (2010). New thinking about instructional leadership.Phi Delta Kappan, 92(3), 66-69.

Hou, Y., Cui, Y. & Zhang, D. (2019)Impact of instructional leadership on high school student academic achievement in China.Asia Pacific Educ. Rev. 20, 543–558. https://doi.org/10.1007/s12564-019-09574-4

Hoy, W. K. & Miskel, C., G. (2008) Educational Administration–Theory, Research and Practice.

Hussein, T. (Ed).(2004). International study of achievement in Mathematics.
A comparison ideology and practice associated with teacher commitment and engagement within an Australian perspective. Retrieved October 15, 2015 from eprints.qut.edu.au/968/1/cro04237.pdf.

Ihunda, C.C. (2004). Element of Management. Owerri: Springfield Publishers Isola, O. M. (2010). Effects of Standardized and Improvised Instructional Materials Students' Academic Achievements in Secondary School Physics'.(Ed Thesis), University of Ibadan, Ibadan.

Indimuli, J., Mushira, N., Kuria, P., Ndung'u, R., & Waichanguru, S. (2009). Teaching secondary schools in Bungoma South District.(Unpublished Master Thesis).Kenyatta University, Nairobi.

Indimuli,J.J.(2017). Teaching primary Mathematics. Nairobi: Gideon S.Were instructional materials in teaching nursery and primary school pupils. Journal of Educational Policy and Entrepreneurial Research, 2 (7), 250-261. Retrieved August 12, 2016 from:www.ztjournals.com/index.php/JEPER/article/viewFile/346/324

Jackson, M. (2017).Systems Thinking: Creative Holism for Managers. Chichester: John Wiley & Sons, Ltd.

Jacobs M, Vakalisa NCG, Gawe N (2011). Teaching-learning Dynamics. South Africa: Pearson Education.

Jacqueline, L., Wanda, B., Joy, B., & Berry, R. (2010).The Nuances and complexities of University of Nairobi, Nairobi.National Council of Teachers of Mathematics.(2000). Principles and standard for school Mathematics. Retrieved October 19, 2015 from http://www.nctm.org/standards/

Jaworski, B. (2014). Investigating Mathematics teaching.A constructivist enquiry.London: Oxford UP.

Jenkins, B. (2009). What It Takes to Be an Instructional Leader. Principal, 88(3) 34- 37.

Johnsen, S. K., Haensly, P. A., Ryser, G. R., & Ford, R. F. (2002). Changing general education classroom practices to adapt for gifted students. Gifted Child Quarterly, 46(1), 45-63.

Johnson, C. C., Kahle, J. B., & Fargo, J. D. (2007).Effective teaching results in increased science achievement for all students.Science Education, 91(3), 371- 383.

Johnson, P. (2000). Skilled supervisor is interpersonal: A response to Duncan Waite.Int. J. Educ. Reform. 9(4):292-297.

Joyce, B., Calhoun, E. & Hopkins, D. (2002).Models of learning – tools for teaching) (2nded.). Buckingham: Open University Press.

K.I.C.D. (2006).Revised 8.4.4 Syllabus for implementation. Nairobi: Jomo Kenyatta Foundation.

Kaggwa, V. (2003).Contribution of teachers' involvement in school administration on students „academic performance in private secondary schools. Kampala: Makerere.

Kakai, M. (2006).Challenges facing students in adopting to Mathematics learning in in Nairobi Province, Kenya. (Unpublished Master Thesis).Kenyatta University, Nairobi.

Kamindo, C.M. (2008). Instructional supervision in an era of change: policy and practice in primary education in Kenya. (Unpublished PhD Thesis) University of Durham UK.

Kamunge ,J.(2005). Educational innovations for the 21st century.Paper presented at a central Province Secondary schools heads seminar on challenges of education in Kenya. Kanezja Publishers.

Kamunge, J. M. (2008). Report of the presidential working party on education and manpower training for next decade and beyond [in Kenya].Kanezja Publishers.

Kaparou, M. and Bush, T. (2015), Instructional leadership in centralized systems: evidence from Greek high-performing secondary schools',School Leadership & Management, 35(3): 321-345.

Kathyryn, M., Barto, & David, M. (2001).Management: Foundation of Behavioral Research.New York: Holt.

Kauchak, D. E., & Eggen, P. D. (2003). Learning to teach: Research based methods.

Kelly, D.,Mullis,I.,& Martin,M (2000). Profiles of student Achievement at the TIMSS International benchmarks.ChestnutHill,MA:TIMSS International Study Centre,Boston College.

Kendall, L. (2008). The conduct of qualitative interview: Research questions, methodological issues, and researching online. In J. Coiro, M. Knobel, C. Lankshear & D. Leu (Eds.), Handbook of research on new literacies (pp.133- 149). New York: Lawrence Erlbaum Associates.

Kenderov, P. (2006). Competitions and mathematics education.Proceedings of the international congress of mathematics, Madrid, Spain, 2006.

Kenya National Examination Council. (2013). The year 2013 examination report. Nairobi: Jomo Kenyatta Foundation.

Kenya National Examination Council. (2006). The year 2005 KCSE examination report, with philosophical beliefs about Mathematics. Paper presented at the International Group. Retrieved October 14, 2015 from eric.ed.gov/?id=ED476093.

Kenya National Examination Council. (2007). The Kenya Certificate of Secondary Education in Kenya: A case of youth polytechnic in Bungoma County. (Unpublished Master thesis).

Kenya National Examination Council.(2008). The Year 2007 KCSE examination candidate in Nairobi Province, Kenya.(Unpublished Master Thesis).Kenyatta University, Nairobi.

Kenya National Examination Council. (2014). Kenya Certificate of Secondary Education 2017 Candidates Performance Report, Nairobi: Government Printers.

Kenya Secondary Schools Heads Association, Manual, (2017). Nairobi Elimu Publishers.

King, M.B. & Newmann, F.M. (2000, April). Will teacher be learning advance school goals?Phi Delta Kappan, 81(8), 576-580.

Kinyanjui, K. (2004). Teacher related factors that influence Students' Performance in Mathematics in Public Secondary Schools in Kikuyu Division. (Unpublished MED Thesis), University of Nairobi.

Kish, J. K. (2005). Quantitative & Qualitative Research Approach. Shangai: Mc Grahill Press.

KNEC Research and Data Processing Department.

Köller, O. (2001). Mathematical world views and achievement in advanced Mathematics in Germany: Findings from TIMSS population 3.Studies in Educational Evaluation, 27(1), 65-78.

Kombo, D., & Tromp, D. (2006).Proposal and Thesis Writing. An Introduction, Nairobi: Pauline's Publications Africa.

Kombo, D. K. (2008).Factors influencing Students Poor Performance in the KCSE Examination among Harambee Secondary Schools in Kathiani Division of Machakos District. (Master of Arts Thesis). Kenyatta University.

Kombo, K., Jepketer, A., & Kyalo, D. N. (2015).Relationship between Teacher Capacity Building Strategy and Students' Performance in Public Secondary Schools in Nandi County, Kenya.International Journal of Humanities and Social Science Invention, 4(1), 37-50

Kothari, C. (2004). Research Methodology. New Delhi:New Age International Publishers Limited.

Kumar, M. (2007).Mixed methodology research design in educational technology. Alberta Journal of Educational Research, 53(1).

Kutsyuruba, B. (2003). Instructional Supervision: Perceptions of Canadian and Ukrainian Beginning High-School Teachers (Master's Thesis). Saskatoon: University of Saskatchewan.

Kwakman, K. (2003). Factors affecting teachers' participation in professional learning activities.Teaching and teacher education, 19(2), 149-170.

Ladd, F. (2008)."Value-Added Modeling of Teacher Credentials: Policy Implications." Paper presented at the second annual CALDER research conference, "The INS and Outs of Value-Added Measures in Education: What Research Says, Washington, D.C.,November 21.

Lahui-Ako, B. (2001).The instructional leadership behavior of Papua New Guinea high school principals,Journal of Educational Administration, 39(3), 233–265.

Lambert, L. (2002).The constructivist leader.Teachers College Press. Larson–Knight, B. (2000). Leadership, culture and organization learning in understanding the schools as intelligent system.

Lashway, L. (2002). Developing instructional leaders. New York: Teachers College Press.

Laszlo, E., (2006). The Systems View of the World: A Holistic Vision for Our Time. New Jersey: Hampton Press.

Lawrence, P., Lorsch, J. (2007). Differentiation and Integration in Complex Organizations.Administrative Science Quarterly. 12, 1-30.

Leithwood, K., & Beatty, B. (2009).Leadership for emotionally hot climate/ International Studies in Educational Administration. 37(1), 91-103.

Leithwood, K., & Jantzi, D. (2008).Effective School Leaders: How to Evaluate for Changing Times. Buckingham, UK: Open University Press.

Leithwood, K., & Mascall, B. (2008).Collective leadership effects on student achievement. Educational Administration Quarterly, 44(4), 529-561.

Leithwood, K., Seashore Louis, K., Anderson, S., & Wahlstrom, K. (2004). Review of research: How leadership influences student learning.

Levine, D.U., & Levine, R. E.(2000). Two Routes to Unusual Effectiveness.)Unpublished Manuscript), University of Nebraska, Omaha.

Lewin, K., & Caillords, F. (2001).Financing Secondary Education in Development: Strategic for Sustainable Growth. Paris. International Institute for Education Planning.UNESCO.

Lezotte, L. (2001). Revolutionary and evolutionary: the effective schools' movement. Okemos, MI: Effective Schools Products, Ltd.

Lezotte, L. W. (2010). What Effective Schools Do: Re-Envisioning the Correlates. Indianapolis, IN: Solution Tree.

Likoko, S. Mutsotso, S. &Nasongo, J. (2017).Adequacy of instructional materials and physical facilities and their effect on quality of teacher preparation in colleges in Bungoma County.International journal of science and research (IJSR)

Loucks-Horsley, S., Love, N., Stiles, K. E., Mundry, S. E., & Hewson, P. (2003).Designing professional development for teachers of science and Mathematics (2nd Ed.). Thousand Oaks, CA: Corwin Press.

Louis, K.S., & Leithwood, K. (2010).Investigating the Links to Improved Student Learning: Final Report of Research Findings. Minneapolis: University of Minnesota.

Louise, S. (2008). Teacher Effectiveness.Studymode.com.

Luhmann, N. (2010). SozialeSisteme.GrundrißeinerallgemeinenTheorie. Frankfurt: SuhrkampVerlag.

Lunenburg, F.C. (2010). The Principal as Instructional Leader.National Forum of Educational.Supervision Journal, 27(4), 1-5.

Lyons, A. (2012). Workers of Tomorrow, Education in Progress, Ministry of Education and Scientific Research.Port Fortis: Fiji.

Lyons, B. J. (2010). Principal instructional leadership behavior, as perceived by teachers and principals, at New York State recognized and non-recognized middle schools.Seto: Hall University.

MacBeath, J. & Swaffield, S. (2008) „Leadership for learning: a matter of principle', paper presented at the 21st International Congress for School Effectiveness and Improvement, The Leadership for Learning (Carpe Vitam) Project: The Legacy, Auckland, New Zealand, 6th-9th January 2008.

Macfarlane, R. and Woods, D. (2011) Glimpses of Greatness, London: London Leadership Strategy supported by the National College for Leadership of Schools and Children's Services.

Mackay Report (2009). Report on the presidential working party on the second public and anxieties about Mathematics.

MacNeill, N., Cavanagh, R., & Silcox, S. (2017). Beyond instructional leadership: Towards pedagogic leadership. In Paper submitted for presentation at the 2017 Annual conference for the Australian Association for Research in Education: Auckland.

Maina, W. (2002).Mathematics teachers background variables related to Kenya Certificate of Secondary Education Students' Performance in Mathematics in Muranga District, Secondary Schools, (Unpublished MED Thesis), University of Nairobi.

Makau, N & T anui, E. (2014).Relationship between Instructional Leaders' Gender and Student's Academic Achievement in Sciences and Mathematics, US

Marete, J. K. (2012). The implementation of strengthening Mathematics and Science education on the teaching and learning of Mathematics in primary schools in Nkuene division, Meru county, Kenya (Doctoral dissertation) University of Nairobi, Kenya.

Marishane, R.N., (2011). School Leadership in a Changing Context: A Case for Open School-based Management, Educational Research Journal, 1,(2), 1-17.

Marks, H. M., & Print, S. M. (2003).Principal Leadership and School Performance: An Integration of Transformational and Instructional Leadership.Educational Administration Quarterly, 39(3), 370-397.

Marsh, J., Payne, J., & Hamilton, L. (2006).Making sense of data-driven decision making in education: Evidence from recent RAND research.

Marshall, S. P. (2010). Schemas in problem solving. New York: Cambridge University Press.

Marzano, R. J., Waters, T., & McNulty, B. A. (2005). School leadership that works: From research to results. ASCD.

Massey, P. A., & Rosenbaum, S. A. (2004).Disability matters: Toward a law school clinical model for serving youth with special education needs.Clinical L. Rev., 11, 271.

Matthews, L. J., & Crow, G. M. (2010).The principal ship: New roles in a professional learning community. Prentice Hall.

Maundu, J. N. (2013). Student achievement in science and mathematics: a case study of extra-provincial, provincial and Haram bee secondary schools in Kenya. Ottawa: National Library of Canada.

Mbiti, D. (2011). Foundations of school administration. Nairobi: Oxford University Press.

McBer, H. (2000). Research into teacher effectiveness: A model of teacher

McCutchen, D., Abbott, R. D., Green, L. B., Beretvas, S. N., Cox, S., Potter, N. S. Gray, A. (2002). Beginning literacy: Links among teacher knowledge, teacher practice, and student learning.Journal of Learning Disabilities, 35(1), 69-86.

Meadows, D.H. (2008).Thinking in Systems: A Primer City: Chelsea Green Publishing, December.

Miheso M. M. (2002). Factors affecting Students' Performance in Mathematics among secondary students in Kenya.

Million M. (2010).An assessment on the status of school-based instructional supervision in Secondary schools of West Arsi Zone.(Unpublished Masters of Arts thesis), Addis Ababa University at Addis Ababa.

Ministry of Education, (2013).Report of a Conference on Educational Administration. Nairobi: Jomo Kenyatta Foundation.

Ministry of Education; Unpublished Republic of Kenya, (2012) Master plan on education and training 2017- 2010, Nairobi: Government printer.

MoEST. (2008). Ministry of Education, Science and Technology: Kenya National Examination Council.

Mohanty, J. (2005). Educational Administration, Supervision and School Management. New York: Deep & Deep Publications.

Momanyi, M. (2003).The role played by principals as instructional leaders in relation to students' academic achievement: A survey of Kisii Central District, Kenya (Unpublished MED) Nairobi. Catholic University of Eastern Africa.

Mondoh, O. H. (2005). Methods of teaching Mathematics (A Handbook for Teachers and and college trainees.

Moswela, B. (2010). Instructional Supervision in Botswana Secondary Schools an Investigation. Educational Management Administration & Leadership, 38(1), 71-87.

Mueni, N. P. (2019). Influence of use of instructional materials on acquisition of mathematical competencies among grade one learners in Nakuru County, Kenya.

Mugambi, M. D. (2015). The Role of Principals in Promoting Students Academic Performance in Secondary Schools in Tigania West Sub-County, Meru County,(Masters thesis), Kenyatta University

Mugenda, A.G., & Mugenda, O. M. (2003).Research Methods: Quantitative & Qualitative Approach. Nairobi: Act Press.

Mugenda, O. M. & Mugenda, A. G. (2005).Research Methods: Quantitative and Qualitative Approaches. Nairobi: Acts Press.

Mulkeen, A., Chapman, D. W., DeJaeghere, J., & Leu, E. (2007). Recruiting. Retaining, and Retraining Secondary School Teachers and Principals in SubSaharan Africa. Washington, DC: World Bank.

Mullis, I. V., & Martin, M. O. (2008).Overview of TIMSS2007. Chestnut Hill, MA: TIMSS & PIRLS.

Murphy, R. (2017). Testing Teachers: What Works Best for Teacher Evaluation and Appraisal. Sutton Trust.

Musungu, J. & Nasongo, J. (2008).The Distribution of Educational Resources, University of Nairobi; Institute of Development studies, 2

Mutune, S. (2005).Head Teachers Performance of their Roles as instructional Leaders in Nakuru Catholic Private Schools, Nakuru Catholic Diocese.(Unpublished Masters Thesis). Nairobi: Catholic University of Eastern Africa.

Mutunga, H. and BreaKell, N. (2014).MathematicsEducation.Nairobi: Educational Research and Publication.

Mwagiru, A. N. (2014). School factors influencing implementation of strengthening mathematics and science education in science teaching in public primary schools in Kandara Division, Muranga County (Doctoral dissertation), University of Nairobi.

Mwiria, K. (1985). Major Issues in Educational Research: The Kenya Experience (Konferenzpapier).

Nalianya, R. S. (2011). Factors influencing career choices by students in tertiary institutions in Kenya.

Ndege, R. W. (2017). Influence of principals' administrative practices on student's performance at KCSE in Buteere Sub-County, Kenya. (Masters Thesis), Kenyatta University

Ndirangu, M., Kathuri, N. J., & Mungai, C. (2003).Improvisationas a strategy for providing methodology of teaching mathematics

Newbill, P. L. (2005). Instructional strategies to improve women's attitudes towards science innovation Ngala, B. J. F. (2017). Management of teachers by head teachers and its influence on pupils' understanding of mathematics.

Ngetich, S.K. Wambui, B.K & Kosgei, Z.K. (2014).Determining optimal size and cost of education.

Ngirachu, J. (2010, April 23). Children troop to school, but still illiterate. Daily Nation, p. 1.

Nicholls, G. (2000). Learning to Teach, Bell and Bain LTD Glasgow, 356-360

Niyazi, C. (2009). The leadership behaviors of educators in primary schools in Turkey. Turkey: Erciyes University.

Nolan Jr, J., & Hoover, L. A. (2011).Teacher supervision and evaluation.John Wiley and Sons.

Nzuve, P. (2005). Elements of Organizational Behavior. Nairobi: Nairobi University Press.

Obanya, P. A. (2009). Current Trends in Examining.Theory and Practice of Education.Lagos: Basic Books Publishers.

Obwocha, B. (2005, October 6). The sick man of the national schools. The Standard, p.11.

Odhiambo, G. (2017). Academic Brain Drain: Impact and implications for public higher education in kenya.

Oduol, T. (2006).Towards the making of education policy in Kenya: Conclusions and implications. International Education Journal, 7(4), 466-479. Available online athttp://iej.com.au of twelve countries, Vol II. Stockholm: Almquist & Wiksell. Retrived October 14, 2015 from:http://eric.ed.gov/?id=ED015130.

Office for Standards in Education (Ofsted) (2009) Twelve Outstanding Secondary Schools: Excelling Against the Odds, London: The Office for Standards in Education, Children's Services and Skills.

Ofsted (2009) Harnessing technology – transforming learning and children's services (1296-2005DOC-EN), DfES 2005.Available online at:www.dcsf.gov.uk/ publications/e-strategy.

Ogula, C. (2012). Ahandbook on Educational Research.Nairobi:New Hermit publishers.

Okendo, E. (2006). Managerial Training Needs for Heads of Departments in Nyamira District.(Unpublished Masters Thesis), Catholic University of Eastern Africa.

Okoth, U.A. (2008). Instructional Leadership role of principals in Implementation of secondary school environmental education in Siaya District, Kenya (Doctorate Dissertation), Catholic University of Eastern Africa (CUEA)

Okumbe, J. A. (2003). Human Resource Management, Educational Perspective. Nairobi: Educational Development Research Bureau.

Okumbe, J.A.(2012). Educational Management Theory and practice. Nairobi: Nairobi University Press.

Olel, M. (2000). Optional utilization of Education Resources in Secondary schools.A case study of Kisumu District (Doctoral dissertation).Maseno University.

Olembo, J. O., Wanga, P. E., & Karangu, N. M. (2014).Management in Education, Educational Research and publications. Nairobi: East African Educational Publishers.

Olembo, J., Wanga, P. E., & Karagu, N. M. (2014). Management in education.Educational Research and Publications.

Olembo, J.O. (2001). Educational Administration and Supervision in Kenyan school.A Course of Lessons for B.ED, Nairobi: Kenyatta University.

Oliva PF, Pawlas G (2004). Supervision for today's schools. Hoboken, NJ: Wiley & Sons Inc.

Ongiri. I. & Abdi, A. (2004). Hard Work Is the Secret of Success, Nairobi: Kenya.

O'Sullivan, M.C. 2006. Lesson observation and quality in primary education as contextual teaching and learning processes.International Journal of Educational Development 26, 246–60.

Opolot-Okurut, C. (2008). Factors that hinder opportunities to learn Mathematics in primary in Nairobi Province, Kenya.(Unpublished Master Thesis).Kenyatta University, Nairobi.

Orodho J. A. (2009). Elements of Education and Social Science Research Methods. Maseno: Kanezja Publishers.

Orodho, J. A. (2009). Factors determining achievement in science subjects at secondary school level in Kenya. (Unpublished PhD Thesis.) Nairobi: Kenyatta University.

Orodho, J. A. (2005). Elements of education and social sciences research methods. Nairobi: University of Nairobi, Nairobi. National Council of Teachers of Mathematics.(2000). Principles and standard for school Mathematics. Retrieved October 19, 2015 from:http://www.nctm.org/standards/

Orodho, J. A., Waweru, P.N., Ndichu, M. & Nthinguri, R. (2017).Basic education in Kenya: Focus on strategies applied to cope with school-based challenges inhibiting effective implementation of curriculum.International Journal of Education and Research.

Orodho, J.(2003). Essentials of educational and social sciences Research method. Nairobi: Masola Publishers.

Osman A, Mukuna T. E (2017). Improving Instructional leadership in schools through building Principals „Capacity.Journal of Education Practice. 4(2):41-47.

Owens, R. (2009). Organization Theories. NewYork: John Wiley & Sons Inc.

Owiny, C. D. (2006). Providing non-formal education to the semi-nomadic Bahima and Karimojong Pastoralists in Uganda (Doctoral dissertation) University of South Africa.

Owiti, A. (2006). Students perceptions of Mathematics Teaching in Secondary Schools in Siaya District,Kenya(Doctorate Proposal),Moi University.

Oyeniran J.O. (2003). Teaching Methods.An Introduction to Principles and Methods of Teaching. In O. Olayiwola Ed. Revised ed. Lagos: SIBIS Ventures.

Padmanabhan, Y. (2001). Internal Efficiency in Primary Education available at: http//www. Sterioso41188eci.htm.

Pajak, E. F. (2000). Approaches to Clinical Supervision: Alternatives To Improving Instruction (2nd Ed.). Norwood, MA: Christopher-Gordon.

Pajares, M. H. (2014). Teachers' beliefs and educational research: Cleaning up a messy construct.Review of Educational Research, 5(5), 59-62. Retrieved October 15, 2015 from: eric.ed.gov/?id=ej453784

Pansiri, N. O. (2008). School retention in basic education: a rural ethnic minority case study in Botswana (Doctoral dissertation), University of Bristol.

Pawlas, G. E., & Oliva, P. F. (2007).Supervision for today's schools.Wiley Global Education.

Payne, D., & Wolfson, T. (2000).Teacher professional development – The principal's critical role.National Association of Secondary School Principals (NASSP) Bulletin, 84(618), 13-21.

Penuel, W., Fishman, B., Yamaguchi, R., & Gallagher, L. (2007, December).What makes professional development effective? Strategies that foster curriculum implementation. American Educational Research Journal, 44(4), 921-958.

Phillips, J.A. (2012). Manager-Administrator or Instructional Leader: Shift Role of the Principal's Pinto, P. (2018).The Leadership of Principals and Their Influence on Student Learning in Public and Private Schools in Tripura, India. Educational Studies Dissertations. 134. https://digitalcommons.lesley.edu/education_dissertations/134

Planning and Evaluation Service (2000).Does professional development change teaching practice? Results from a three-year study [electronic version]. U.S. Department of Education (Document#2000-04).

Pollard, A. (2002).Reflective teaching: Effective and evidence-informed professional practice. New York: British Library.

Puyate, S. T. (2008). Constraints to the effective implementation of vocational education programme in private secondary schools in Port Harcourt Local Government Area. International Journal of Work-Integrated Learning, 9(2), 59.

Quinn, D. M. (2002).The impact of principal leadership behaviors on instructional practice and student engagement.Journal of Educational Administration, 40(5), 447-467.

Range, B. G., Young, S., & Hvidston, D. (2017).Teacher perceptions about observation conferences: what do teachers think about their formative supervision in one US school district? School Leadership & Management, 33(1), 61-77.

Raw, V. K. (2003).Quality Teaching. New Delhi:APH Publishing Corporation.

Reeves, D. (2003).High performance in high poverty schools: 90/90/90 and beyond. Denver, CO: regulations and syllabuses 2007-2008. Nairobi: KNEC.

Renzulli, J. S. (2004). Schools for talent development: A practical plan for total school achievement.Mansfield Center, CT: Creative Learning Press.

Republic of Kenya, (2002).Waruhiu Commission Report. Nairobi: Government printer.

Republic of Kenya, (2009).The presidential party on establishment of a second university

Republic of Kenya, (2008).The presidential working party on education and manpower

Republic of Kenya, (2005).The report of the commission of enquiry into the education

Rheinberg, F. & S. Krug (2005), Motivations for derungim Schulalltag (2.Auflg.), Germany:Hogrefe, Göttingen,

Riley, T. L., & Karnes, F. (2007). Competitions for gifted and talented students: Issues of excellence and equity. In J. Van Tassel-Baska (Ed.), Serving gifted learners beyond the traditional classroom (pp. 145-168). Waco, TX: Prufrock Press.

Robinson, V. (2007).School leadership and student outcomes: Identifying what works and why (ACEL Monograph Series No. 41). Victoria, Australia: University of Melbourne, Centre for Organizational Learning and Leadership.

Robinson, V. M. J., Lloyd, C. A., & Rowe, K. J. (2008).The Impact of Leadership on School Outcomes: An Analysis of the Differential Effects of Leadership Types. Educational Administration Quarterly, 44(5), 635-674.

Rous, B. (2004). Perspectives of teachers about instructional supervision and behaviors that influence preschool instruction.Journal of Early Intervention, 26(4), 266-283.

Ryan, K. & Cooper, J. (2008).Those who can, teach. Cengage Learning. Salazar, William H. (2014).The Relationship among Principal Instructional Leadership, Collective Teacher Efficacy, Student Academic Achievement, and Socioeconomic Status in Appalachia Eastern Kentucky High Schools.

Ryan, R. M., Kuhl, J., & Deci, E. L. (2017).Nature and autonomy: Organizational view of University of Nairobi, Nairobi. National Council of Teachers of Mathematics.Principles and standard for school Mathematics. Retrieved October 19, 2015 from:http://www.nctm.org/standards/

Safer, N., & Fleischman, S. (2005). How student progress monitoring improves instruction. Educational Leadership, 62(5), 81-83.

Salau, M. (2000).Options in sustaining Mathematics as a language science and technology in in Nairobi Province, Kenya.(Unpublished Master Thesis).Kenyatta University, Nairobi.

Salkind, N. J. (2010). Encyclopedia of research design (Vols. 1-0). Thousand Oaks, CA: SAGE Publications, Inc. doi: 10.4135/9781412961288

Sammons, P., Gu, Q., Day, C., & Ko, J. (2011). Exploring the impact of school leadership on pupil outcomes: Results from a study of academically improved and effective schools in England. International Journal of Educational Management, 25(1), 83–101.

Sansotti, F. J. N., & A., Goss, S. (2012). High school principals' perceptions of the importance and availability of response to interventions practice within high school settings. Psychology Review.30(2),286-295.

Sanzo, K. L., Sherman, W. H., & Clayton, J. (2011).Leadership practices of successful middle school principals. Journal of Educational Administration, 49(1), 31-45.

Sass, R. (2007).The Determinants of Student Achievement: Different Estimates for Different Measures. Paper presented at the first annual CALDER research conference, Washington, D.C., October 4.

Saxe, G., Gearhart, M., & Nasir, N. S. (2001).Enhancing students understanding of Mathematics: A study of three contrasting approaches to professional support.Journal of Mathematics Teacher Education, 4, 55-79.

Schenkel, B. (2009). The impact of an attitude toward Mathematics on Mathematics teaching in secondary schools in Kenya.

Schiefele, U. & Csikszentmihalyi, M. (2010), Motivation and ability as factors in in Kenya: A case of youth polytechnic in Bungoma County. (Unpublished Master thesis).

Schmidt, W., Houang, R., & Cogan, L. (2002).A Coherent curriculum. American

Schmoker, M. (2001).The results field book. Alexandria, VA: Association for Supervision and Curriculum Development.

Seashore-Louis, K., Wahlstrom, K. L., Leithwood, K. and Anderson, S. E. (2010).Investigating the Links to Improved Student Learning Final report of Research Findings. New York: The Wallace Foundation.

Sergiovanni, T. J. (2009). The Principal Ship: A Reflective Practice Perspective (6th ed.). USA: Pearson Education Inc.

Sergiovanni, T. J., & Starratt, R. J. (2002).Supervision: A Redefinition, Boston, MA: Mcgraw-Hill.23.

Seyfarth, J.T. (2001). Personnel management for effective schools. London: Allyn and Bacon.

Shatzer, R. H., Caldarella, P., Hallam, P. R., & Brown, B. L. (2014).Comparing the effects of instructional and transformational leadership on student achievement: Implications for practice. Educational Management Administration & Leadership, 42(4), 445–459

Sidhu, K. S. (2003). The Teaching of Mathematics. New Delhi: Sterling Publishers Pvtl Ltd.

Sidhu, K.G. & Fook Y. C. (2010).Formative Supervision of Teaching and Learning: Issues and Concerns for the School Heads.European Journal of Scientific Research, 39(4): 589-605.

Simon, M. K. (2006). Dissertation & scholarly research: A practical guide to start and complete your dissertation, thesis, or formal research project. Dubuque, IA: Kendall/Hunt.

SMASSE Project.(2008). Statistical analysis on SMASSE project impact assessment survey.

Smit, B. (2001). How Primary Teachers Experience Education Policy Change in South Africa. Perspective in Education, 19(3): 67-83.

Social and neurobiological aspects of self-regulation in behavior and development.Development and Psychopathology, 9(2), 701–728.

Sparks, D. (2005).Staff Development and School Improvement: An Interview with Ernest Boyer.Journal of Staff Development, 5(2), 32-39.

Spillane, J. P., Halverson, R. & Diamond, J. (2004).Towards a theory of leadership practice: A distributed perspective.Journal of Curriculum Studies, 36, 3-34 156.

States. Geneva: International Labour Organization. Retrieved October 23, 2015 from: iles.eric.ed.gov/fulltext/EJ1000212.pdf

Stecker, P. M., Fuchs, L. S., & Fuchs, D. (2005). Using curriculum-based measurement to improve student achievement: Review of research.Psychology in the Schools, 42(8), 795-819.

Stein, M. K., Grover, B. W. & Henninssen N. (2009).Building student capacity for Mathematics experience and achievement.Journal for Research in Mathematics Education, 226(2), 163-181. Retrieved October 12, 2015 from: jwilson.coe.uga.edu/EMAT7050/Students/Dwyer/749208.pdf

Stemler, S. E. (2004). A comparison of consensus, consistency, and measurement approaches to estimating integrate reliability. Practical Assessment, Research & Evaluation, 9(4), Available online: http://pareonline.net/getvn.asp?v=9&n=4.

Stronge, J. H., Ward, T. J., & Grant, L. W. (2011).What makes good teachers good? A cross case analysis of the connection between teacher effectiveness and student achievement. Journal of Teacher Education, 62(4), 339-355.

Stronge, J.H. (2002). Qualities of effective teachers. Alexandria, VA: Association for Supervision and Curriculum Development Students). Njoro: Egerton University Press.

Students' achievement in integrated science.(Unpublished Doctorate dissertation), University of Ibadan, Ibadan.

Sullivan, S., & Glanz, J. (2005).Supervision that improves teaching: Strategies and techniques (2nd Ed.). Thousand Oaks: Crown Press.

Supovitz, J. A., & Turner, H. M. (2000).The effects of professional development on science teaching practices and classroom culture. Journal of Research in Science Teaching, 37(9), 963-980.

System in Kenya (The Koch Commission, 2009). Nairobi: Government Printers.

Teaching Mathematics for cultural relevance and social justice. Journal of Teacher Education, 5(2), 98-101. Retrieved June 13, 2015 from:http://jte.sagepub.com/content/61/3/261.refs

Teams.Assessment in education principles policy and practice.Retrieved June 14, 2015 from:www.aiz.vic.edu.au/.../Article-PGriffin-et-al-Lifting-literacy-through-Professional-Learnig teams.com.

Teijlingen, T. & Hundley, S. (2001). Quantitative Research Methods. New York: Sage.

The Education Trust (2005). Gaining traction, gaining ground: How some high schools accelerate learning for struggling students? Retrieved from: http://www.edtrust.org/sites/edtrust.org/les/publications/_les/GainingTraction Gaining

The 21st century.Paper presented at the Annual Conference of Mathematics Association of Nigeria (MAN).

Thorvaldsen, S., & Vavik, L.(2012). Foundations for success in mathematical competitions: A study of best praxis in lower secondary schools in Norway. The Mathematics Enthusiast: 9(3).

Timperley, H., Wilson, A., Barrar, H., & Fung, I. (2007).Teacher professional learning and development: Best evidence synthesis iteration. Wellington: Ministry of Education.www.minedu.govt.nz/goto/bestevidencesynthesis

Tokyo: JICA. Spatial Visualization and Affective Factors. American Educational Research Journal, 14(1), 51. Doi: 10.2307/1162519.

Too, C., Kimutai, C. K., & Kosgei, Z. (2012).The impact of head teachers' supervision of teachers on students' academic performance.Journal of Emerging Trends in Educational Research and Policy Studies, 3(3), 299-306.

Treagust, D. F., Won, M., & Duit, R. (2014).Paradigms in science education research. In Handbook of Research on Science Education, II, 17-31. Routledge.

Ubben, G.C., L.W. Hughes, & C.J. Norris. 2004. The principal: Creative leadership for excellence in schools. 5th ed. Boston, MA: Allyn and Bacon.

UNESCO, (2015). Education for All: Global Monitoring Report (2000-2015). Achievements and Challenges 157 UNESCO. 2010. EFA global monitoring report 2010. Education for all: Reaching the marginalized. Paris: UNESCO.

Uusimaki, L. & Nason, R. (2004).Causes underlying pre-service teachers' negative beliefs in teaching mathematics in secondary schools.

Van Deventer, I. (2003). Education management in schools. In: Van Deventer, I. & Kruger, A.G. (Eds). An educator's guide to school management skills. Pretoria:

Van Schaik. Villegas-Reamers, E. (2003). Teacher professional development: an international review of the literature. Paris: International Institute for Educational Planning.

Virginia Department of Education.(2007). Licensure Regulations for School Personnel. Retrieved May 8, 2015, from 2017.

Von Bertalanffy, L. (2008). General System theory: Foundations, Development, Applications. New York: George Braziller.

Wahlstrom, K. L& Louis K. S. (2008).How Teachers Experience Principal Leadership: The Roles of Professional Community, Trust, Efficacy, and Shared Responsibility. Educational Administration Quarterly, 44(4), 458-495.

Wallace Foundation. (2011). Research findings to support effective educational polices: A guide for policymakers (2nd ed). New York.

Wango, G. (2009). School Administration and Management-Quality Assurance and standards in schools. Nairobi: Jomo Kenyatta Foundation. Englewood Cliffs, NJ: Prentice-Hall.

Wanzare Z (2012). Instructional supervision in public secondary schools in Kenya. Educ. Manage. Adm. Leadership. 40(2):188-216.

Wanzare, Z. & da Costa, J. L. (2000).Supervision and staff development: Overview of the literature. NASSP Bulletin, 84 (618), 47-54.

Wayman, J. C., Cho, V., Jimerson, J. B., & Spikes, D. D. (2012). District-Wide Effects on Data Use in the Classroom.Education Policy Analysis Archives, 20(25), n25.

Wayne, A. J., Yoon, K. S., Zhu, P., Cronen, S., & Garet, M. S. (2008).Experimenting with teacher professional development: Motives and methods.Educational Researcher, 37(8), 469–479.

Wei, R. C., Darling-Hammond, L., Andree, A., Richardson, N., & Orphanos, S. (2009). Professional learning in the learning profession: A status report on teacher development in the United States and abroad. Dallas, TX: National Staff Development Council.

Wiles J, Bondi J (2004). Supervision: A Guide to Practice (6thed.). Upper Saddle River, NJ: Pearson

Wilkins, J. L. (2008). The relationship among elementary teachers' content knowledge, attitudes, beliefs, and practices. Journal of Mathematics Teacher Education, 11(2), 139-164.

Williams, T., Kirst, M., Haertel, E., (2005).Similar students, different results: Why do some schools do better? A large survey of California elementary schools serving low-income students. Mountain View, CA: Ed Source.

Wilson, S. (Ed). (2009). Teacher quality (Education Policy White Paper). Washington, DC: National Academy of Education.Retrieved from http://www.naeducation.org/Teacher_Quality_White_Paper.pdf

World Bank. (2008). National Assessment of Education Achievement Vol.1: Assessing indicators of achievement. Washington D.C.

Wise,C. & Bush,T.(2005). From Teacher to Manager: The role of the Academic Manager in Secondary School. Educational Researcher 41(2), 183-195.

Woodford, K., Jackson, G., Gillard, P., Harley, A., Cranz, D. & Glennon, D (Eds.). (2003) Cambridge Advanced Learners' Dictionary. Cambridge: Cambridge University Press.

Yoon, K. S., Duncan, T., Lee, S. W.-Y., Scar loss, B., & Shapley, K. (2007).Reviewing the evidence on how teacher professional development affects student achievement (Issues & Answers Report, REL 2007–No. 033). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southwest

Tambunan, H. (2019). The Effectiveness of the Problem Solving Strategy and the Scientific Approach to Students' Mathematical Capabilities in High Order Thinking Skills.International Electronic Journal of Mathematics Education, 14(2), 293-302.

Wanjiru, R. D., Kitainge, K., & Samikwo, D. (2021).Effects of Students' Language Interpretation on Performance in Mathematics in Selected Secondary Schools in Nakuru North Sub-County Kenya.African Journal of Education, Science and Technology, 6(3).

Zepeda, S. J. (2007). The principal as instructional leader: A handbook for supervisors. Larchmont, NY: Eye on Education.

Zepeda, S. J. (2012). Professional development: What works?Larchmont, NY: Eye on education.

Zepeda, S. J., & Kruskamp, B. (2007).High School Department Chairs-Perspectives on instructional supervision. The High School Journal, 90(4), 44-54.

APPENDICES

Appendix I : Authority Letter

Dear Respondent

I am a postgraduate student at Maasai Mara University currently undertaking research on the topic:

TO GIVE INFORMATION ON STUDENTS' KCSE PERFOMANCE IN MATHEMATICS IN MERU COUNTY

You have been identified as one of the respondents for this study and therefore i kindly requested to provide the much-needed information to enable the researcher write the report. Please feel *free and honest* to provide the required information to the best of your knowledge and will not only be *kept confidential and anonymous* but also will be *strictly used for the purpose* of the study.

Yours Faithfully,

Honjen Thiharu Maingi Kirikua

Appendix II: Principals' Interview Guide

Please be free and honest to provide the information required which will not only be kept confidential and anonymous but also will be used strictly for the purpose of the study.

PART 1: PRINCIPALS' INVITATION OF MATHEMATICS SPECIALISTS

1. Which of the following external support staff do you use in your school to improve Students' Performance in Mathematics?

[] Mathematics specialist

[ ] Team teaching

[ ] Peer teachers

[ ] Any others, please explain

2. How often do you invite the external support staff you have selected above?

[ ] per week

[ ] Per month

[ ] Once per term

[ ] Once per year

3. What follow-up programs do you carryout to ensure the students retain what they had gained from external support staff in order to improve performance in Mathematics?

.....

.....

4. Assess the above strategy for the last 5 years. on its impact on Students' Performance in Mathematics?

……

……

…….

5. What other strategies do you use to improve Students' Performance in Mathematics in your school?

.....

.....

.....

.....

Briefly explain your strategies.....

.....

.....

.....

6. What is your assessment of the above strategies in Students' Performance in Mathematics?

…….

.....

.....

.....

7. Do you monitor the performance after the invited specialist has left?Pleaseevaluate?

.....

.....

.....

PRINCIPALS' SUPPORT TO TEACHERS THROUGH MATHEMATICS SEMINARS/ WORKSHOP

1. What ways do you support your teachers in order to improve performance in the Mathematics? Explain how you support them

……

……

2. In the last two years, how many courses have you supported your Mathematics teachers to attend?

Once a Month [ ] Once a Term [ ] Once a Year [ ] Other [ ]

Please explain……

.....

.....

.....

3. How do you motivate your Mathematics teachers to attend courses?

Please explain how……..

.....

.....

.....

4. How often does your school set a budget for professional development for Mathematics Teachers?

Frequently [ ] Occasionally [ ] Never [ ]

Please explain why……...

.....

.....

.....

5. How often do you discuss matters that affect teaching and learning Mathematics with your teachers?

Frequently [ ] Occasionally [ ] Never [ ]

Please explain why……

6. What other ways do you motivate your Mathematics teacher in order to improve performance

……

……

……

PRINCIPALS' ORGANIZATION OF MATHEMATICS CONTESTS

1. Kindly assist me with documents showing the various Mathematics contest that were held in your school?.....

.....

.....

.....

2. How often do you organize external Mathematics contest in your school?

Frequently [ ] Occasionally [ ] Never [ ]

Please explain why.

.....

.....

.....

3. In the last two years, how many Mathematics contest have you organized for your schools to participate?

One [ ] Two [ ] Three [ ] Four [ ] 5 and above [ ]

Please explain why.

.....

.....

.....

4. What ways do you motivate your Mathematics teachers in order to improve performance?.....

.....

.....

.....

5. In your own views please evaluate the contribution of participating in Mathematics contests?

.....

.....

.....

6. Principals provision Learning and Teaching Materials and Students Performance in Mathematics

Use the Likert scale for nos. (a-c) whereby 1- Unsatisfactory, 2 - Satisfactory, 3 - Good &4 - Very Good Available/Not Available

. Availability of teaching / Learning resources and supervision	1	2	3	4
a) Teaching resources				
i). Mathematics syllabus				
ii). Adequate departmental teaching and revision materials				
iii). Schemes of work made and checked				
iv). Teaching resources adequate, text books and revision				
b) Learning Resources				
i). Enough text books				
ii). Teaching aids for Mathematics e.g. mathematical tables,				
iii). School financially stable				
iv). Student competitions in Math's internally				
v). Students competition in Math’s externally				

c) Teacher motivation in Mathematics					
i).	Teacher/school collaboration between schools for				
ii).	Established office for HOD				
iii).	School/principal/HOD strategies for Mathematics				
iv).	Mathematicsconstruction instruments ruler and protractor				
v).	Special room with grid board, globe, charts etc.				
vi).	Good teacher/student relations				
vii).	Mathematics radio sessions				
viii).	Computer laboratory				

Appendix III: Document Analysis Meru County Mathematics KCSE analysis for Five years

Year	Mean score	Mean grade	Number of C+ and above
2012			
2017			
2014			
2015			
2016			

Suggest any other strategy that can be used to improve performance in Mathematics

.....

.....

.....

Thanks

Appendix IV: Mathematics Teachers Questionnaire

1. Below are some of the principals' practices aimed at improving performances in Mathematics? Please tick (√) any one of them that you as the principal performs.

	Practice		Yes	No	Explain why
1	Invitation of Mathematics specialist				
2	Provision of teaching/learning materials				
3	Supporting teachers to attend workshops /seminars				
4	Coordinating teachers to organize Mathematics discussion groups contests				
5	Evaluate the extent to which Mathematics contests help the students to improve performance in Mathematics				

2. What are the strategies do you use to improve performance in Mathematics in your school?

(i) ……

……

(ii) ……

……

(iii) ……

…….

3. Suggest any other strategy that can be used to improve performance in Mathematics

.....

.....

.....

4. In your view list the best teaching strategies you use to teach Mathematics to improve performance.

(i) ……..……

…….....

(ii) …….……

…….

(iii) ……..……

……..……

Please explain why

.....

.....

.....

5. Principals' invitation of Mathematics specialists is one of the strategy principals use to improve Mathematics in schools. Please evaluate the effectiveness of use of the strategy to improve performance in this school

.....

.....

.....

6. How often do you invite Mathematics specialists in this school?

[ ] Once a week

[ ] Once a month

[ ] Once a year

[ ] Any other period. Specify

7. After the Mathematics specialist have left do you and your Mathematics teacher carryout follow-up Mathematics exercises to assess whether the students gained skills in order to improve performance in Mathematics. Please explain

…….....

.....

.....

Thanks

Appendix V: Informed Consent form for Research Participants

I……agree to participate in Honjen's research study.

The purpose and nature of the study has been explained to me in writing.

I am participating voluntarily.

I give permission for my interview with...…….……to be tape-recorded if need be

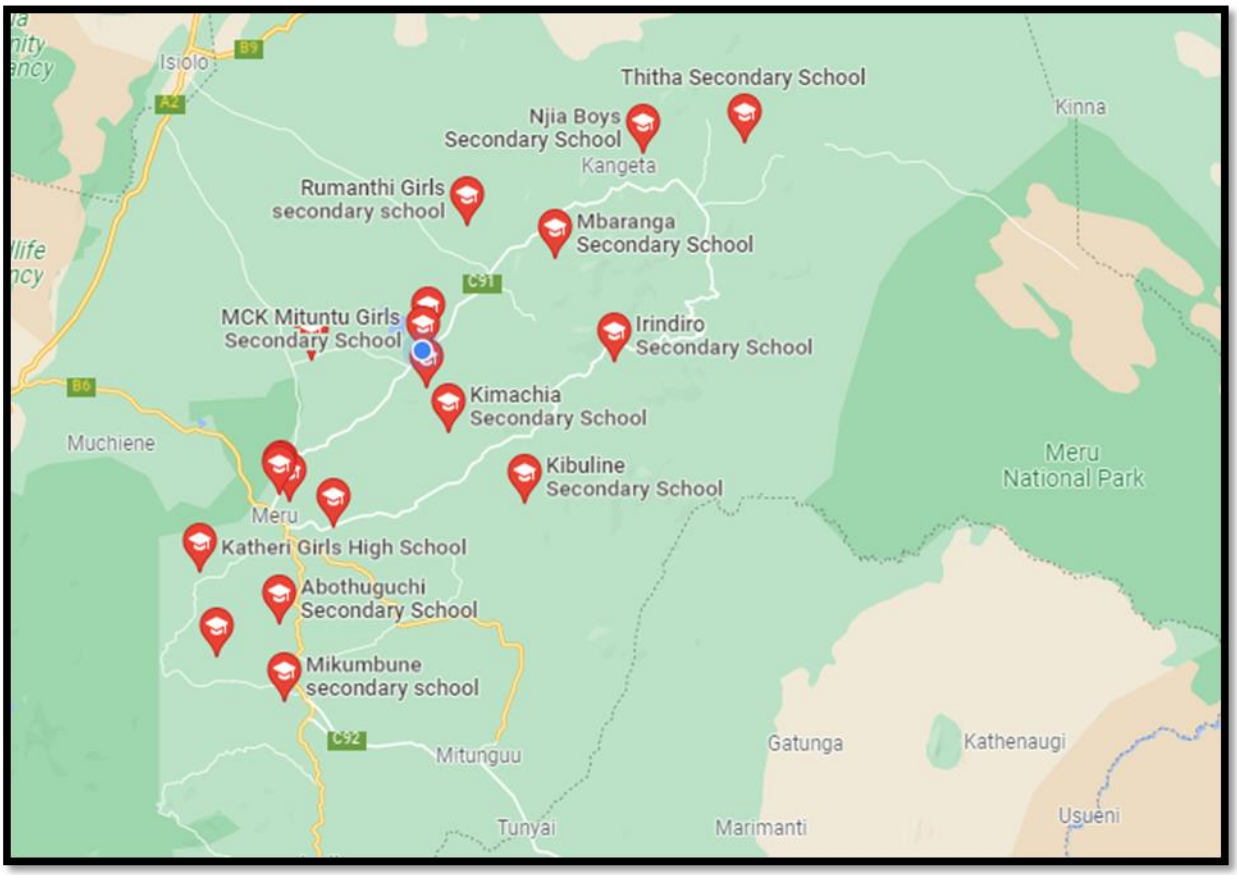
I understand that I can withdraw from the study, without repercussions, at any time, whether before it starts or while I am participating.

I understand that I can withdraw permission to use the data within two weeks of the interview, in which case the material will be deleted.

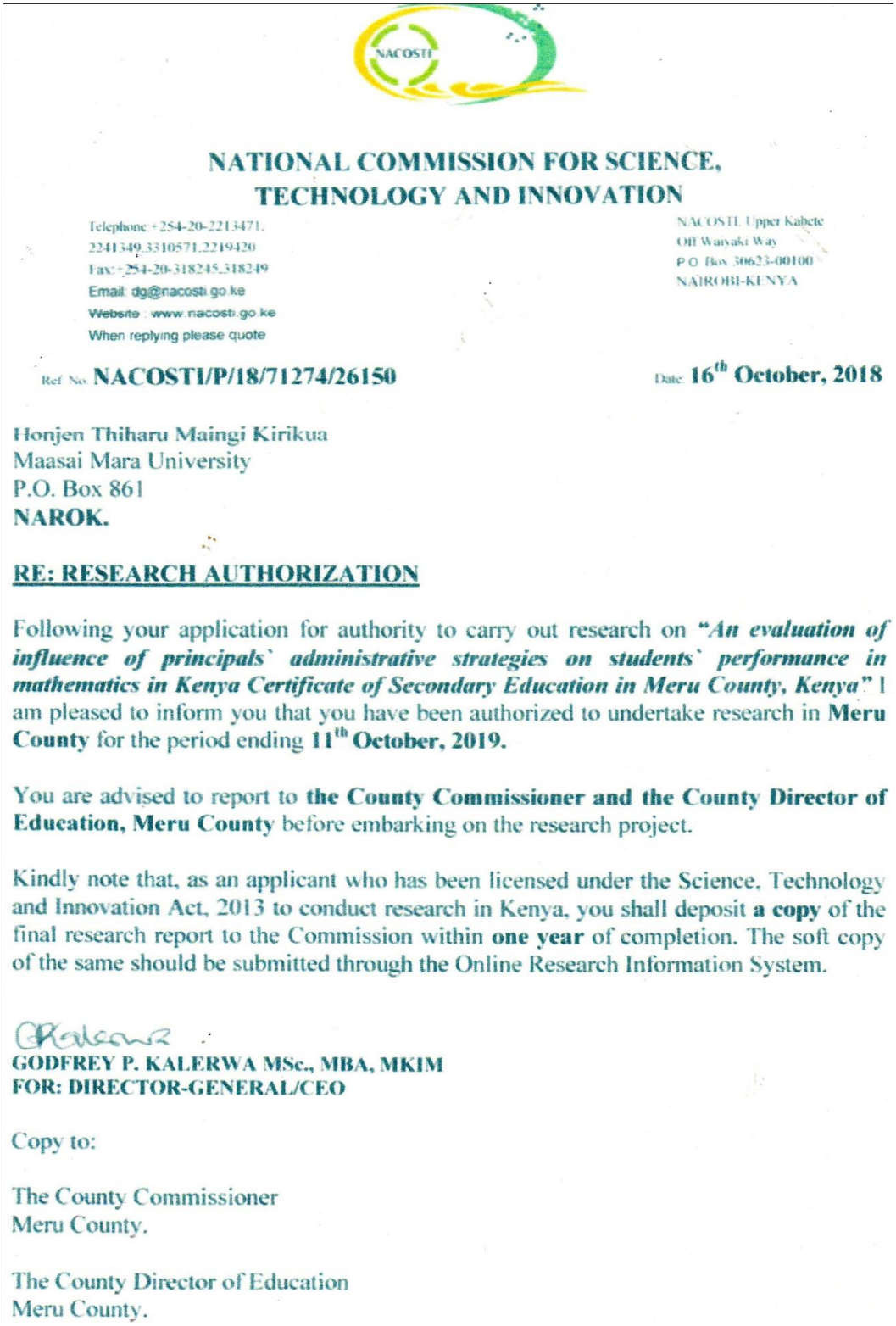
I understand that anonymity will be ensured in the write-up by disguising my identity.

Signed.……. Date…….

Appendix VII: Meru County secondary schools Map



Appendix VI: Research authorization



NACOSTI

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

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NAIROBI-KENYA

Ref. No. **NACOSTI/P/18/71274/26150**

Date: **16th October, 2018**

Honjen Thiharu Maingi Kirikua
Maasai Mara University
P.O. Box 861
NAROK.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"An evaluation of influence of principals` administrative strategies on students` performance in mathematics in Kenya Certificate of Secondary Education in Meru County, Kenya"*** I am pleased to inform you that you have been authorized to undertake research in **Meru County** for the period ending **11th October, 2019.**

You are advised to report to **the County Commissioner and the County Director of Education, Meru County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Meru County.

The County Director of Education
Meru County.