PATTERNS OF RESOURCE ALLOCATION AND THEIR IMPACT ON STUDENTS' PERFORMANCE IN MATHEMATICS AND SCIENCES IN KCSE IN IGOJI DIVISION, KENYA

BY

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DECLARATION

This research report is my original work and has not been presented for a degree in any other university

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This research report has been submitted for examination with my approval as university supervisor.

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DEDICATION

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ABSTRACT

The study set out to establish the patterns of resources allocation and their impact on students' performance in mathematics and sciences in KCSE in Igoji division, Kenya. The study covered the period from 2002-2005, and targeted all the seven head teachers and the 50 mathematics and science teachers in the division. All the seven head teachers were purposively included in the sample while the science and mathematics teachers were selected through stratified random sampling. Two mathematics teachers, one biology teacher, one teacher of physics and one teacher of chemistry were selected from each school by use of the table of random numbers. In total, 35 science and mathematics teachers were included in the sample.

The study utilized an ex-post facto research design. This was because the study sought to establish the relationships between examination scores as an indicator of the students' performance and other variables, which could not be manipulated at the time.

The study sought to achieve the following five objectives:

1) To determine the extent to which the level of availability of physical facilities affects pupils' performance in mathematics and sciences in KCSE in Igoji division.
2) To determine the extent to which the socio-economic status of the students affect their performance in mathematics and sciences in Igoji division.

3) To establish the teacher to pupil ratio, and its effect on the students' performance in mathematics and sciences in Igoji division.
4) To examine the relationship between mathematics and sciences teachers' characteristics (experience, academic and professional qualifications) and students' performance in mathematics and sciences in Igoji division.
5) To determine the extent of availability of teaching and learning resources and their effect on students' performance in mathematics and sciences in Igoji division.

To achieve the said objectives, the study had five main research questions. In order to gather data, the study utilized a head teacher's questionnaire, mathematics and science teacher's questionnaire and an observation schedule. A pre-test was first done in the neighbouring Abogeta division. These instruments were self administered on all the respondents. In total, 40 out of the 42 questionnaires were returned well completed, this translated to a 95% return rate.

Data gathered was then analyzed by use of statistical techniques such as: frequencies, percentages and the Pearson's product moment correlation coefficient-r. The results were presented in form of bar graphs, pie charts, tables and statements.

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D.C	District Commissioner
D.E.O	District Education Officer
K.C.P.E	Kenya Certificate of Primary Education
K.C.S.E	Kenya Certificate of Secondary Education
K.N.E.C	Kenya National Examinations Council

CHAPTER ONE

INTRODUCTION

1.0 Background to the study

Many education researchers have been intrigued by the question of resource allocation in all levels of schooling; primary, secondary and college levels within the African continent and beyond. One such educational researcher was Bowles (1965), who developed a planning model to be used for efficient allocation of resources in education in northern Nigeria. He defined the output of the educational system as the number of students graduated by that system. His model was aimed at improving resource allocation by making the process more efficient through the determination of the total amount of resource use and the distribution of the total resources among the various educational institutions. He saw the benefits of education as constituting of any consequences of the education systems' output, which results in total social utility.

On the other side of the Atlantic, Anne-Marie (2004) investigated the relationship between institutional expenditure related to support students' services, institutional support and institutional grants, retention and graduation rates. She found that expenditures dedicated to instruction, academic support, and institutional grants positively contributed to retention and graduation rates.

Another study in America by Eaton (2004) researched on the relationship between resource allocations among various Missouri middle schools and found that there existed differences in resource allocation levels of the sampled schools.

The National Development Plan for the period 2002- 2008 recognizes that efficient and effective management of education is a prerequisite for the attainment of development of the country (Republic of Kenya, 2002:18). It is also noted in the plan that the number of primary schools has increased from 6,508 to 18,617 while secondary schools have increased from 151 to 3,207 in the last 37 years. The plan also states that the government will give priority attention to improving access, quality relevance and management of secondary education through expanding and rehabilitating existing secondary schools. During the plan period, the government plans to enhance the teaching of English, Science and Mathematics. The plan goes on to state that quality assurance is to be achieved through advise on the provision of proper and adequate physical facilities in educational institutions amongst other pledges. "With regard to quality and relevance, concern continues to be raised on the failure to satisfactorily inculcate a modern scientific culture..."(Republic of Kenya, 2002:55).

Earlier on, the 1979 – 1983 National Development Plan identified education as a basic need. It was pledged that during the plan period, the quality and relevance of educational opportunities was to be substantially improved and plan projection enrollments to be achieved in secondary schools. The ratio of arts to science classes was to be 1:2 by 1983. On top of that, the average class size was to be 28 pupils for sciences and for arts 32 pupils. Up to now, these targets haven't been achieved in our schools.

1.1 Statement of the problem

Igoji division is situated in Meru central district on the eastern slopes of Mount Kenya. There are 8 other divisions within Meru central district. In Igoji division, there are 11 registered secondary schools (DEO's office, Meru Central District). From the population of 468 students who sat for KCSE in 2002, only 120 students or 19% scored a grade C+ (plus) and above. This is taken to be the minimum grade for university admission. The following year, the number increased slightly to 158 students or 31% of all the candidates in the division. In 2004, the number rose to 184 or 36%. However, in the year 2005, only 33% of the KCSE candidates scored a mean grade C+ and above.

The following tabulated data shows the number of students who attained a university minimum entrance grade (C+ and above) in Igoji division within the period 2002-2005. This number of students is also compared to the performance of the students within the district for the period under consideration.

Table 1: Analysis of KCSE performance in Igoji division 2002-2005

SCHOOL	YEAR							
	2002		2003		2004		2005	
	N	%	N	%	N	%	N	%
St. Mary's	98	74%	101	71%	117	84%	128	87%
Igoji boys	4	6%	4	7%	9	18%	6	8%
Miruriri	5	10%	4	7%	7	10%	2	3%
Kiangua	4	7%	6	11%	6	12%	12	24%
Kinoro Girls	2	7%	5	10%	14	30%	1	2%
Gikurune Boys	27	30%	23	42%	19	33%	40	39%
Gakuuni Girls	0	0%	4	24%	2	22%	4	20%
St.Agnes Gaukune	0	0%	0	0%	1	7%	4	20%
Miitine Millenium	New		1	5%	2	10%	2	5%
Gikurune Girls	New		10	21%	7	13%	8	12%
Igoji division	140	31%	158	31%	184	36%	207	33%
Meru c. district	850	19%	1027	22%	1135	24%	1387	26%

N= Number of candidates scoring an overall mean grade C+ and above.

%= Percentage of KCSE candidates scoring grade C+ and above.

Source: DEO's office, *Meru central district*

From table 1, only St. Mary's girls' secondary school managed to have more than 50% of the KCSE candidates attaining a mean grade C+ and above. The other schools, except Gikurune boys had less than 20% of their KCSE candidates scoring C+ and above. Schools like Gakuuni and St. Agnes Gaukune didn't have a single candidate scoring a mean grade C+ in 2002 and 2003. the division has been having very few of its candidates attaining a minimum university entry mark. Over the entire duration under study (2002-2005), it was only in 2004 when 36% of the candidates managed a mean grade C+ and above. The most notable thing

is that more than 50% of those students were from one school: St. Mary's girls' boarding secondary school.

Not only have these schools been doing poorly generally, but more so in mathematics and sciences. The mean scores of math and sciences have been less than 50% of the school mean scores (M/S) for the five years (2002-2005) as seen in table 2.

Table 2: Mathematics mean scores in comparison with the school mean scores for Igoji division schools from 2002-2005

SCHOOL	Year of examination				
	Category	2002	2003	2004	2005
St. Mary's girls	MATH M/S	5.4511	5.0280	5.3800	5.1840
	SCH M/S	7.5400	7.4965	8.2681	8.4290
Igoji boys	MATH M/S	1.5775	1.7544	2.0000	1.8056
	SCH M/S	3.9300	4.1228	4.6080	4.1810
Miruriri	MATH M/S	1.6350	1.5157	1.6900	1.6090
	SCH M/S	4.1350	3.6330	402250	4.1090
Kiangua	MATH M/S	1.7820	2.0364	2.1200	2.3000
	SCH M/S	3.9250	4.2000	4.3880	5.4800
Kinoro girls	MATH M/S	1.8462	1.9400	1.8400	1.3191
	SCH M/S	4.5860	4.0385	4.7610	3.9150
Gikurune boys	MATH M/S	2.99770	3.4000	4.0700	3.01090
	SCH M/S	5.3440	5.8909	5.5960	6.1080
Gakuuni girls	MATH M/S	1.3750	1.9410	1.7700	1.8420
	SCH M/S	3.8130	4.9412	4.4444	5.0500
St. Agnes Gaukune	MATH M/S	NEW	1.0500	1.6400	2.0000
	SCH M/S	NEW	3.4290	4.0000	4.8333
Miitine millennium	MATH M/S	NEW	1.9000	1.6500	1.3680
	SCH M/S	NEW	5.0851	4.5580	4.677
Gikurune girls	MATH M/S	NEW	2.000	1.8800	1.6620
	SCH M/S	NEW	4.553	4.558	4.6769
Igoji division	MATH M/S	2.3777	2.2566	2.1040	2.2100
	SCH M/S	4.6359	4.5987	4.8348	5.0620

MATH M/S = Mathematics mean scores. SCH M/S = School mean scores

Source: DEO's office, *Meru central district*

Looking at table 2, one can see that except for St. Mary's Girls secondary school, all the other schools had a mathematics mean score which was even was as low as a quarter of the school mean score.

In sciences, performance was slightly better. However, the average mean scores of all the three sciences in all the schools within the division was consistently lower than the overall school mean scores. Table 3 shows the average science mean scores compared to the overall school mean score for Igoji division school from 2002-2005.

Table 3: Average sciences mean scores compared to the overall school mean scores for Igoji division schools from 2002-2005

SCHOOL	Year of examination				
	Category	**2002**	**2003**	**2004**	**2005**
St. Mary's girls	SCH M/S	7.5400	7.4965	8.2681	8.4290
	SCIE M/S	6.6740	6.6647	7.8000	7.8197
Igoji boys	SCH M/S	3.9300	4.1228	4.6080	4.1810
	SCIE M/S	2.5336	3.1411	4.0533	3.2131
Mirurири	SCH M/S	4.1350	3.6330	4.2250	4.1090
	SCIE M/S	2.9150	2.4166	2.9300	2.7877
Kiangua	SCH M/S	3.9250	4.2000	4.3880	5.4800
	SCIE M/S	2.6064	2.9869	3.6467	4.8267
Kinoro girls	SCH M/S	4.5860	4.0385	4.7610	3.9150
	SCIE M/S	3.5690	2.9350	4.2450	2.6490
Gikurune boys	SCH M/S	5.3440	5.8990	5.5960	6.1080
	SCIE M/S	5.7692	4.6100	5.1467	5.3110
Gakuuni girls	SCH M/S	3.8130	4.9412	4.4444	5.0500
	SCIE M/S	2.3584	3.7055	3.9950	4.05195
Miitine millennium	SCH M/S	NEW	5.0851	4.5580	4.6777
	SCIE M/S	NEW	2.5750	3.2000	2.9870
Gikurune Girls	SCH M/S	NEW	4.5530	4.5580	4.6769
	SCIE M/S	NEW	3.1517	3.3933	3.0087
Igoji division	SCH M/S	4.6359	4.5987	4.8348	5.0620
	SCIE M/S	3.7418	3.3123	4.1999	4.2775

SCH M/S = School mean score SCIE M/S = Science mean score

Source: DEO's office, *Meru central district.*

A quick look at table 3 reveals that the overall mean scores of the school were higher than those of the sciences. Gikurune boy's secondary school was the only school that managed to have the sciences means score being equal to or greater than the overall mean score of the school. This means that the low scores that students scored in the sciences accounted for the low overall mean score.

On comparing table 2 and 3, one can see that both mathematics and sciences mean scores had the same trend; they were lower than the overall school mean score raising the question of why the poor performance. Scholars have suggested that performance in mathematics and science depends on the availability of resources (both human and physical). The question that kept begging to be answered was: Could it be that the pattern of resource allocation in Igoji is not adequate or sufficient to support the teaching of mathematics and sciences?

This study has tried to shed light on the role that patterns of resource allocation play in the performance of form four candidates at KCSE examination in mathematics and sciences. The resources that were considered were human, physical and fiscal. On human resources, the study aimed at determining the impact of the teacher qualifications both professionally and academically on student's performance. The other aspect that was looked at was the relationship the availability of the physical resources within the school and the students' performance. The study also sought to establish the relationships that existed between students' performance in

mathematics and the sciences at the KCSE examination and the socio-economic background of the student as well as the teacher to student ratios.

1.2 Purpose of the study

The main purpose of this study was to investigate the nature of resource allocation patterns that exist within Igoji division public secondary schools. This involved an examination of the relationships between the qualifications of the mathematics and science teachers (academic and professional), availability of physical facilities, availability of teaching and learning resources, socio-economic status of the students, the teacher to student ratio and students' performance at KCSE examination.

1.3 Objectives of the study

The objectives of this study were: -

1) To determine the extent to which the level of availability of physical facilities affects pupils' performance in mathematics and sciences in KCSE in Igoji division.
2) To determine the extent to which the socio-economic status of the students affect their performance in mathematics and sciences in Igoji division.
3) To establish the teacher to pupil ratio, and its effect on the students' performance in mathematics and sciences in Igoji division.
4) To examine the relationship between mathematics and sciences teachers' characteristics (experience, academic and professional qualifications) and students' performance in mathematics and sciences in Igoji division.

5) To determine the extent of availability of teaching and learning resources and their effect on students' performance in mathematics and sciences in Igoji division.

1.4 Research questions

The study sought to answer the following research questions:

1) What is the relationship between the level of availability of physical facilities within the school and the students' performance in mathematics and sciences in KCSE in Igoji division?
2) What is the relationship between the socio-economic status of the student and the students' performance in KCSE in Igoji division?
3) What is the relationship between the mathematics and sciences teachers' to student ratio and students' performance in mathematics and sciences in KCSE in Igoji division?
4) What is the relationship between the mathematics and sciences teachers' characteristics (teaching experience, academic and professional qualifications) and students' performance in mathematics and sciences in KCSE in Igoji division?
5) What is the relationship between the availability of the teaching and learning resources and students' performance in mathematics and sciences in KCSE in Igoji division?

1.5 Significance of the study

First and foremost, the study shall add to our knowledge of the patterns of allocation of resources and how these patterns affect students' performance in mathematics and sciences. Also, the findings of this study shall help to guide educational planners and administrators on the most appropriate pattern of allocation of resources so as to help in improving students' academic achievement in these subjects in Igoji division of Meru central district.

1.6 Limitations of the study

Performance in mathematics and sciences is affected by very many factors and therefore it was not possible to encapsulate all those factors in one study; hence this study focused on a few out of the many possible factors. These factors were studied within one division only. This means that the findings from this study may not hold for other schools in other parts of this country.

The research utilized the ex-post facto research design. This is because the researcher was not in a position to control certain variables because their manifestations had already occurred or because they were inherently not manipulable (Kerlinger, 1973). In addition, some of the teachers who were teaching KCSE candidates in the previous year and whose results the study uses had transferred to other stations or left teaching altogether. Therefore, the background information of these teachers was not exactly the same as that of their predecessors.

1.7 Delimitations of the study

The study was conducted within Igoji division of Meru central district. Only public secondary schools were included in the sample because private schools may have unique characteristics that are different from public secondary schools. Only those schools, which had been in existence for five years or more, were included in the sample. This is because new schools may have teething problems, which in turn may have an effect on the findings. Meru central district has got nine administrative divisions, which are more or less homogeneous in academic performance and other conditions. Therefore, these findings that were obtained from Igoji division can predict with accuracy the situation in the other eight divisions.

1.8 Basic assumptions of the study

In pursuing this study, the following assumptions were made: -

- That the KCSE examination was an acceptable measure of performance.
- That head teachers and teachers would be cooperative and give uninfluenced responses to the items posed by the researcher.
- That performance in mathematics depended on an adequate and appropriate resource allocation pattern.

1.9 Definitions of significant terms

Physical facilities: - Refers to the buildings within the school like the science laboratories, classrooms, libraries, dining halls and kitchens, play grounds, dormitories and structures like students' desks and chairs.

Teacher characteristics: -Refers to the various aspects of the teacher such as academic qualifications of teachers, their professional qualifications and experience, their age and gender.

Teaching and learning resources: -refers to those items, which have been designed, modified and prepared to assist in the teaching and learning process. These include textbooks, reference materials, laboratory apparatus, charts models, laboratory equipment personal reference books and teachers' books/guides.

Teacher to student ratio: - refers to the number of students per teacher within the school.

Socio-economic status: - refers to those factors that are related to the social and economic status of a family such as the ability of the household to support the education of their children by: paying fees, providing basic necessities, buying reference books and supporting school projects.

Public secondary schools: - refers to four-year post-primary schools, which are established, maintained or assisted out of public funds.

KCSE: - refers to the Kenya Certificate of Secondary Education examination which is an examination set for students at the end of the four year secondary course by the Kenya national examination council.

Performance: - refers to the student's academic level of achievement in the KCSE examinations. It is graded on twelve-point scale from the lowest E to the highest A.

Resource allocation: - refers to the process of availing inputs both animate and inanimate to the teaching and learning process.

Science subjects: - refers to subjects taught in secondary schools, comprising of physics, biology and chemistry.

1.10 Organization of the study

The study is organized into five chapters.

Chapter one consists of the background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, limitations and delimitations of the study, basic assumptions and the definition of significant terms as used in the study.

Chapter two comprises of the literature review. It is divided into the following sections; physical facilities, socio-economic status, teacher to student ratio, teaching and learning resources, teacher characteristics, summary of the literature review and conceptual or theoretical framework.

Chapter three consists of the research methodology which is divided into the following areas; research design, target population, sampling techniques and sample size, research instruments, instrument validity, instrument reliability, data collection procedures and data analysis techniques.

Chapter four comprises of the data reporting, analysis and interpretation.

Chapter five consists of the summary of the study, conclusions of the study, recommendations and suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

The purpose of this section was to review relevant literature on factors that affect performance of students. The review focused on five main areas; availability of the physical facilities, socio-economic factors, teacher to student ratio, teaching and learning resources, and teacher characteristics and how each of them affected learning and achievement, a summary of the literature reviewed and conceptual framework.

2.1 Availability of the physical resources

Many research studies have been carried out in Kenya and abroad to determine the effect that availability of physical resources have on academic performance. Postlethwaile (1980, quoted in Eshiwani, 1983) observes that the differences in schools facilities seem to account for differences in academic achievement. Facilities such as libraries, laboratories, textbooks, dormitories, visual aids, electricity, water and fields are related to the students' achievement.

According to Huha (2003) in a study carried out in Karai location of Kiambu district, most of the schools had a shortage of facilities such as desks, which led to two pupils sharing a desk. The situation of libraries was not any better with only 43% of the sampled schools having one. The situation was compounded

further by shortage of staff houses, where only 38% of the teachers were housed within the schools.

Earlier on, in the Republic of Kenya (1999:72) it had been asserted that the quality and adequacy of resources such as physical facilities have a direct bearing on quality of education as they determine how effectively a curriculum is implemented.

Later on, the Republic of Kenya (2002:29) emphasized the same point by stating "... the ministry guidelines on the pupil to classroom and pupil to desk ratio should be met again if learning is to be effective".

In a study carried out in Mbogoni division of Nakuru district through administering questionnaires to 155 pupils, 28 teachers and 17 head teachers, Nyanchama (2002) found that 54% of the schools lacked enough desks leading to sharing of desks while 88% of the schools lacked libraries and this could have contributed to poor results in the examinations. Mukundi (1999) concurs with Nyanchama. She notes that lack of facilities is a contributory factor towards poor performance in KCPE.

Ayoo (2002) used the survey method to investigate factors that affect students' performance in KCSE in Maseno division. She used stratified random sampling to ensure equal representation of boys and girls' secondary schools and found that the availability of learning resources such as laboratories affected students' performance. Those schools that had adequate physical facilities had better

academic achievement than those with inadequate facilities. Eshiwani (1983) is of the same view as Ayoo. His study was done in the western province of Kenya. The study established that among other factors, classroom size, libraries and laboratories affected student performance.

In a study by Muluki (2003) within Nakuru municipality private secondary schools where questionnaires were administered to 10 head teachers, 20 teachers and 200 students, she found that the shortage of libraries and science laboratories contributed significantly to poor performance in KCSE. The study found that 50% of the schools lacked a library facility, while 70% of the schools didn't have a science laboratory. Yator (2003) arrived at similar findings in a study of Kabartonjo division. 83.3% of the sampled schools lacked adequate laboratories and workshops. Data gathering instruments were the questionnaires and were analyzed by the use of frequencies and percentage tables.

Chepkurui (2004) investigated the impact of educational resources on pupils' cognitive achievement in primary schools in Bureti district. The study established that 61.1%of the schools lacked adequate classrooms, hence congested. 22% of the schools had pupil latrine ratio of 60:1 and 47% lacked adequate playgrounds. None of the schools had a library facility. A positive correlation of rho = 0.14 was found to exist between the availability of physical facilities and pupils' performance.

Down south, in Botswana, Mwamwonda and Mwamwonda (1987, quoted in Ayoo, 2002) conducted a study of the effects of the schools' facilities on the performance of the standard seven pupils. This study established that the availability of facilities and the performance of the pupils in examinations were strongly correlated.

Owitti (2003), used a teachers' questionnaire and an observation schedule in which he sought to investigate the availability of science apparatus and the rate of utility of laboratory equipment within the schools. The study found that most of the schools lacked physics laboratories and that provincial schools had better equipped laboratories than the district schools; hence explaining why results for the sciences were different between the two categories of schools.

2.2 Socio-economic factors

Ndiritu (1999) in a study, involving 370 teachers from Central Province and 306 from Nairobi, found that the students from poor socio-economic background performed poorly in comparison with those from well-to-do families. Ten years earlier, Magori (1990) quoting Coleman had reported that socio-economic factors were strongly related to academic achievement, and when these factors were statistically controlled, school characteristics accounted for only a small fraction of the differences in achievement. According to him, lower income restricts the ability of parents and guardians to provide funds for tuition, books, uniform, and other charges for special examinations.

In a study done in Kisumu and its environs, Acholla (1982) found that performance of pupils attending medium cost and low cost schools differed with those attending medium cost schools outdoing their counterparts from low cost schools in the areas they were tested on. Later on, Kitivo (1989) in a study that used questionnaires and a thematic test in which students wrote stories found that a father's occupation was significantly related to the achievement motivation of the girls. Yator (2003) in a similar study carried out in Baringo district found that parents within the sample did not discharge their roles well; paying of school fees and buying of learning materials for their children, which in turn affected the performance of their children negatively.

A lot of controversy still exists concerning the relationship that exists between the social class and performance. Therefore there was need to do more research in this area.

2.3 Teacher to student ratio

The number of students that a teacher is assigned to teach determines to a great extent the teaching method he/she adopts and the effectiveness of the teacher in addressing individual needs of the learners. Quite a number of studies have been done on this area and their findings are quite varied.

In one of the studies, Maengwe (1985) investigating factors that influence KCSE performance in rural areas of Kisii district found that overcrowding in class hampered learning. Pupils crowded in class found it hard to write, while teachers

could not move with ease inside the class to assist students as they sat working on their desks. This in turn affected the students' performance in KCSE. In a similar study not far away from Kisii, Ayoo (2002) arrived at similar findings in her study of Maseno division. The study established that there was a strong relationship between the teacher to student ratio and mathematics achievement.

However, not all studies have established a significant relationship between teachers to student ratio. In a descriptive study of Kiambu district, Huha (2003) established that most schools had a teacher to pupil ratio of 1:40. The study didn't find any significant effect of teacher to pupil ratio on performance.

However, in a study by Chepkurui (2004), a significant relationship was found to exist between the teachers to pupil ratio. Those schools with a 42:1 and below pupil to teacher ratio had better mean standard scores of 228.6 compared to that of schools with 43:1 and above which were 221.6. Further on, the study established that those teachers with workload of 41 to 45 lessons achieved a better mean score than those who had 35 to 40 and their counterparts with 46 to 50 lessons per week. According to the findings of this study, it appears that the school administration has to maintain an optimum number of teachers in a school so as not to have too few or pay for idle workforce.

A study of problems faced by primary school teachers by Magoci (1992), in Ndia division established that most teachers had more than 35 lessons per week. This left them with little time to prepare for lessons and mark students' assignments.

However, the study did not go further to determine whether the high teaching load affected the students' performance in any way.

2.4 Teaching and learning resources

What a hammer and nails are to the carpenter, teaching and learning resources are to the teacher; a necessity. In fact, without these resources, the teacher is incapacitated. In the Republic of Kenya (1999:72), it is emphasized that the quality and adequacy of resources such as equipment, teaching and learning materials have a direct bearing on quality as they determine how effectively a curriculum is implemented. Similar sentiments are voiced in the Republic of Kenya (2000:30) where it is explained that the ratio of textbooks to pupils should be maintained at 1:3 or less where possible. Maritim (2002) in a study of factors contributing to low performance in mathematics among form four students in Bureti district found that 49% of the students shared a textbook amongst 3 to 6 students. Furthermore, most schools in the district lacked essential learning resources such as geometrical sets and logarithm tables.

Nyanchama (2002) investigated factors that influence KCPE performance in Mbogoni division, Nakuru district. He found that 86% of the students felt that textbooks were inadequate. Only 14% of the schools investigated had adequate textbooks. The head teachers unanimously agreed in their responses that the dismal performance in their schools was as a result of shortage of books and learning facilities among other factors.

Eshiwani (1983) carried out a study of western province. His sample was made up of secondary school teachers who taught form four and six, BOG chairmen, and the KNEC. His findings revealed that poor performance was significantly caused by such factors as textbooks availability and laboratory facilities among others. Later on Ayoo (2002), in a survey of Maseno using a sample drawn from secondary schools in the division found that availability of textbooks and laboratory facilities among other things contributed to performance in KCSE.

Koskei (2004) carried out a study of public primary schools in Nairobi province on Constraints affecting implementation of free primary education in public primary schools in Nairobi Province. One of the findings was that due to the implementation of free primary education, most schools lacked enough textbooks and desks, which affected performance negatively. Muluki (2003) in a study of factors effecting performance in KCSE in Nakuru municipality found that the ratio of textbook to student was 1:5. She also found that the laboratory chemicals and apparatus are mostly provided during the examination time that is third term of the year. Njuguna (2004) studied factors influencing performance in KCSE in Gatanga division, Thika district through use of questionnaires. She found that among other factors, schools lacked adequate library books and class textbooks.

Yator (2003) investigated factors influencing performance in KCSE Baringo district. Amongst her major findings, she established that 83.3% of the schools lacked laboratory equipment, textbooks, charts, maps and atlases. This in turn led to poor KCSE results. Her sample constituted of a total of 253 participants, which included 6 head teachers, 6 form four class teachers, 240 form four students and the DEO. A year later, in the neighboring district, Chepkurui (2004) in her study done in Bureti district, Rift Valley province found that 61.1% of the schools didn't have enough

desks for pupils to use. Those schools, which had a lower textbook to pupil ratio, had better results in KCPE. This was shown by a positive correlation of rho = 0.13.

Magoci (1992) carried a study within Ndia division and found that all the schools sampled had an acute shortage of textbooks. Most of the schools had one mathematics textbook per 3 pupils. On top of that, the study revealed that schools generally had insufficient teaching aids like chalkboard instruments, dusters, colored chalks, and mathematics instruments. However, the study didn't establish a relationship between learning facilities and students' performance.

A study quite similar to these mentioned above was carried out in America by Lorraine (2004). The study dealt on Perceptions of quality instruction where the researcher did a comparison of part-time and full-time faculty in Alaska State colleges. The study found that there was a strong relationship between resource allocation within the colleges and the quality of instruction. Another study in America by Eaton (2004) investigated the relationship between school level per pupil expenditure (PPE) and mathematics achievement in Missouri schools and found a strong positive correlation existed between the variables.

There have been studies done in Asia also exploring the relationship between teaching and learning resources and achievement. One such study was done by Heyneman (1984, quoted in Ayoo, 2002) where he evaluated a textbook program in the Philippines. The textbook program had been introduced in the country so as to raise the national level of academic achievement among the students in the subjects: Philippino, science and mathematics in two grades. On introduction of the programme, the textbook to student ratio was reduced from 1:10 to 1:2. This was

followed by a marked improvement in performance. The study arrived at the conclusion that textbook availability had an impact on the pupils' performance.

2.5 Teacher characteristics

Muluki (2003) in her study carried out in Nakuru municipality found that the demographic data of teachers and head teachers contributed to poor performance of individual private secondary schools. These schools employ mostly young teachers who keep on looking for greener pastures thus interrupting the learning process. The teachers and other subordinate staff are harassed and this lowers the working morale hence leading to poor performance.

Njuguna (2004) used the questionnaire method to collect data in Gatanga division, Thika. The first one was for the 10 head teachers, the second one to 65 form four subject teachers and the third type to 10 form four class teachers. She established that most teachers rarely attended in-service training as reported by 75% of the head teachers.

Chepkurui (2004) found that schools with more experienced teachers (those with experience of 16yrs and over) had better mean score with a positive rho=0.12.

Magoci (2992) in a study of Ndia division of Embu district found that 50.74%of the sampled mathematics teachers sampled had credit in mathematics at O-level, while 14.99% had failed in mathematics.

Lorraine (2004) examined the perceptions of part-time and full-time faculty regarding instruction quality in Alaska state colleges. One of the variables she investigated was professional development of the faculty members. She found no strong relationship between the effectiveness of the teacher and his/her professional development.

2.6 Summary of the literature review

The review of literature reveals that, no research study has been carried out to identify the relationship between patterns of resource allocation and performance in mathematics and sciences within Igoji division.

A number of studies have been done but haven't sought to determine the relationship between educational inputs and performance. For instance, Kirujah (2002) carried out a study in Laikipia district, a neighboring district to Meru central district but didn't examine the relationship between the physical resources available and performance.

Schools within Igoji division have been dogged by the problem of poor performance in mathematics and researcher felt that this area has been overlooked for so long.

2.7 Theoretical framework

This study was based on the theory of production function. The production function operates by assuming that the school transforms a variety of inputs such as human, physical and fiscal resources into outputs, such as standardized test

scores and examination results. The education production function shall be described by the following equation:

$$f(H_t, F_t, S_t) = p_t$$

Where H_t is a vector of inputs constituting of the human resources that are availed to the learner at a given time t. F_t is also a vector of educational inputs such as physical facilities at the disposal of the learner provided by the school as well as the learning resources supplied to the student for effective teaching and learning. S_t refers to a vector of inputs that are supplied to the learner from their homes through their parents/guardians in form of provision of additional resource materials and upkeep in school. The output P_t is a positive scalar which represents the performance of the student at a given time t due to the interactions of the various inputs.

It was the assumption of this study that when these three categories of inputs: human resources, physical and material resources and family background of the student interact in certain proportions, they would lead to optimum performance of the student in mathematics and sciences in KCSE.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This section deals with the methodology that was used in conducting this research study. It consists of the following sections; research design, target population, sample and sampling procedures, research instruments, instrument reliability, data collection procedures and data analysis.

3.1 Research design

This study adopted a descriptive survey that utilized an ex-post facto research design. According to Cohen and Manion (1980), an ex-post facto research design is a method of eliciting possible antecedents of events, which have happened and cannot, because of this fact, be engineered or manipulated by the investigator.

Kerlinger (1973) defines ex-post facto research design as systematic empirical enquiry in which the scientist does not have direct control of independent variables because their manifestations have already occurred or because they are inherently not manipulable. The independent variables in ex-post facto research design cannot be manipulated because they are genetically fixed, circumstances do not allow manipulation or the cause is culturally ingrained, (Charles, 1988). The researcher therefore observed the variables under their natural conditions in which they were operating as independent and dependent variables.

On the basis of this theory, the investigator observed variables such as availability of physical resources, socio-economic background of students, teacher to student ratio, availability of teaching and learning resources and teacher characteristics, knowing fully well that such factors could not be manipulated at the time. The researcher relied on past records of events (KCSE results) and processes as they occurred. From the interaction of the independent and the dependent variables, inferences were made regarding the relationships that existed.

3.2 Target population

According to Borg and Gall (1989), target population or the universe of a study is defined as all members of a real or hypothetical set of people, events or objects to which an investigator wishes to generalize the results of the research study. Igoji division has 7 public secondary schools. There are 128 teachers within the division and 7 headteachers (DEO's office Meru Central District). Out of these, 50 teachers teach mathematics and sciences. These constituted the target population for this study. In 2002, there were 8 schools within the division that did KCSE exam and were ranked.

3.3 Samples and sampling method

All the seven public secondary schools in the division were considered for the study as they were too few to warrant any sampling. All the seven head teachers of these schools were automatically included in the sample by virtue of the office they hold in these schools.

The mathematics and sciences subject teachers for the study were selected through stratified random sampling. This is in accordance with the suggestions of Ferguson (1966) who maintains that if a population constitutes of sub-populations, stratified random sampling should be used to ensure that no sub-population is omitted from the sample. The population of the mathematics and science teachers was stratified into mathematics teachers and science teachers. Then the researcher selected two mathematics teachers randomly from each school and three science teachers in a similar manner: one teacher for physics, one for biology and one for chemistry. Having a list of teachers from each school and then using a table of random numbers to select them for inclusion into the sample made this possible. In total, 21 science teachers and 14 mathematics teachers were included in the sample.

3.4 Research instruments

In order to gather data for use in this study, three instruments were used: questionnaires, an observation schedule and document study. There were two types of questionnaires; the head teachers' questionnaire and the mathematics and science teachers' questionnaire. The head teachers' questionnaire was divided into four sections, which included both open-ended and closed-ended items. Part A contained items on the background information it had 4 items. Part B sought information on human resources with five items, Part C had items on teaching and learning resources and had 2 items while Part D contained questions on student social economic background and had 3 items.

The teachers' questionnaire was divided into 3 parts: Part A had items on background information and has 8 items; Part B had items on workload and had 6 items while Part C comprised of items on students' characteristics and had 4 items.

The observation schedule was meant to help the researcher collect data, which could be left out by other instruments. Mainly it contained a checklist of vital physical resources: both teaching and learning resources. Content study was done by use of school registers; KCSE results and log books to cross check information on the students' socio-economic status and performance.

3.4.1 Validity of instruments

Validity of research instruments is "that quality of a data gathering instrument or procedure that enables it to measure what it is supposed to measure" (Best:1998). Validity is also the extent to which an instrument measures what one thinks is measurable (Ary: 1979). Mugenda and Mugenda describe it as the degree to which results obtained from the analysis of data actually represent the phenomenon under study. There are three types of validity: criterion-related validity, content validity and construct validity. The main concern of this study was content validity and construct validity. Content validity refers to the extent to which the instrument represents the content of interest. Content validity was ensured by including all the intended areas of the study; physical facilities, socio-economic status of the learners, teacher characteristics, learning materials and

teacher to student ratio. The supervisor, who is an expert in educational planning, assisted to further improve their validity, by examining the research items.

Piloting the instruments tested their validity. The instruments were piloted in two randomly selected schools in the neighbouring division of Abogeta. This constituted two head teachers and eight teachers: Two mathematics and six science teachers. The schools that were in the pilot were not included in the study. The purpose of the pilot was to further refine the instruments by improving on their construct validity whereby items, which were found to be unclear, were rewritten in a clearer manner.

3.4.2 Reliability of the instruments

Reliability is defined as "the degree of consistency that the instrument or the procedure demonstrates, whatever it is measuring, it does so consistently" (Best: 1998).

It is absolutely necessary to measure what one is measuring with consistency. The reliability of the instruments in the study was established after administering the instruments through the use of the split half method. According to Ruscoe (1969), this method is useful in establishing internal consistency of items.

The questionnaires were administered to teachers selected for the pilot. Then the items were divided into two comparable halves. Scores were obtained for each individual on the comparable halves and a coefficient of correlation calculated for

the two schools. The split-halves were transformed into an appropriate reliability estimate for the entire test, and the Spearman-Brown prophecy formula applied.

$$r_{xx} = \frac{2r_{1/2.1/2}}{1 + r_{1/2.1/2}}$$

Where r_{xx} is the estimated reliability of the entire test and $r_{1/2.1/2}$ is the Pearson r correlation between the two halves.

3.5 Data collection procedures

The researcher first of all sought a research permit from the office of the President through the Ministry of education science and technology before proceeding to the field to collect data. On getting the research permit, the researcher proceeded to the district commissioner's office to hand in a copy of the permit and immediately after that gave the DEO a copy of the same. The DC and the DEO both gave the researcher the nod to go ahead. The researcher then sought appointment with the head teachers of the school before proceeding to the school.

On arrival in each school, the researcher first of all sought audience with the head teacher of the school to whom the researcher gave the copy of the research permit. After that the researcher created rapport with the science and math teachers that form the sample before proceeding to administer the research instruments. The researcher then asked for a guide from the office of the head teacher to guide him as he proceeded to do an observation of the school physical facilities. After a reasonable duration of time the researcher requested the respondents to hand in their questionnaires. However, some were not able to

finish responding to them on time and were allowed to keep them for the day. The researcher went back the next day to collect them. The researcher ensured that the instruments had been fully completed before leaving the station.

3.6 Data analysis techniques

The researcher first of all began by organizing the collected data appropriately. All questionnaires were grouped together; the same applied to the observation schedules. Then the instruments were checked for accuracy and usefulness. Then the data was extracted from these instruments and classified into various categories, classes and heads.

Data was then transferred from data gathering tools to tabular form for systematic examination. Data was then analyzed using several statistical techniques: in frequencies, percentages and tables.

In each of the five research questions, cross-tabulation was used for initial analysis to show the relationship between the variables. Further statistical analysis using Pearson's product moment correlation coefficient-r, was performed in order to show the degree of relationships between the dependent and independent variables.

CHAPTER FOUR

DATA REPORTING, ANALYSIS AND INTERPRETATION

4.0 Introduction

The data reporting, analysis and interpretations in this chapter was aimed at addressing the purpose of the study, which was to investigate the nature of resource allocation patterns that exists within Igoji division public secondary schools and their impact on students' performance. The first part begins with the questionnaire return rate, followed by a report of the data collected then an analysis of these data by use of the Pearson's product moment correlation coefficient and finally a brief summary of the chapter.

4.1 Questionnaire return rate

The data for the study was collected through self-administered questionnaires, one to the head teachers and another to the science and mathematics teachers. Additional data was obtained through the observation schedule.

The head teachers' questionnaire was administered to all the head teachers of the seven public secondary schools in Igoji. The mathematics and science teachers' questionnaire was administered to 35 teachers, where 33 of them were duly filled. This translated to a 94% return rate. The data analysis therefore involved a total of 40 respondents.

4.2 Data reporting

The first part of this section describes the demographic and background information of the respondents, the second part presents the mathematics and sciences KCSE results obtained by the seven public secondary schools in Igoji division while the rest presents data on the availability of physical and human resources as well as the socio-economic status of the students. The results of this study are thus reported under the following 7 headings. These are:

1. Demographic and background information of the respondents.
2. KCSE performance in mathematics and sciences by school in Igoji division.
3. Availability of physical facilities in the schools.
4. Socio-economic status of the students in public secondary schools in Igoji division.
5. Availability of mathematics and sciences teachers in public secondary schools in Igoji.
6. Characteristics of mathematics and science teachers in Igoji division public secondary schools.
7. Availability of teaching and learning facilities in public secondary schools within Igoji division.

4.2.1 Demographic information of the respondents.

The composition of the sample of the head teachers and mathematics and sciences teacher by gender is represented in figure 1.

Figure 1: Gender of the respondents

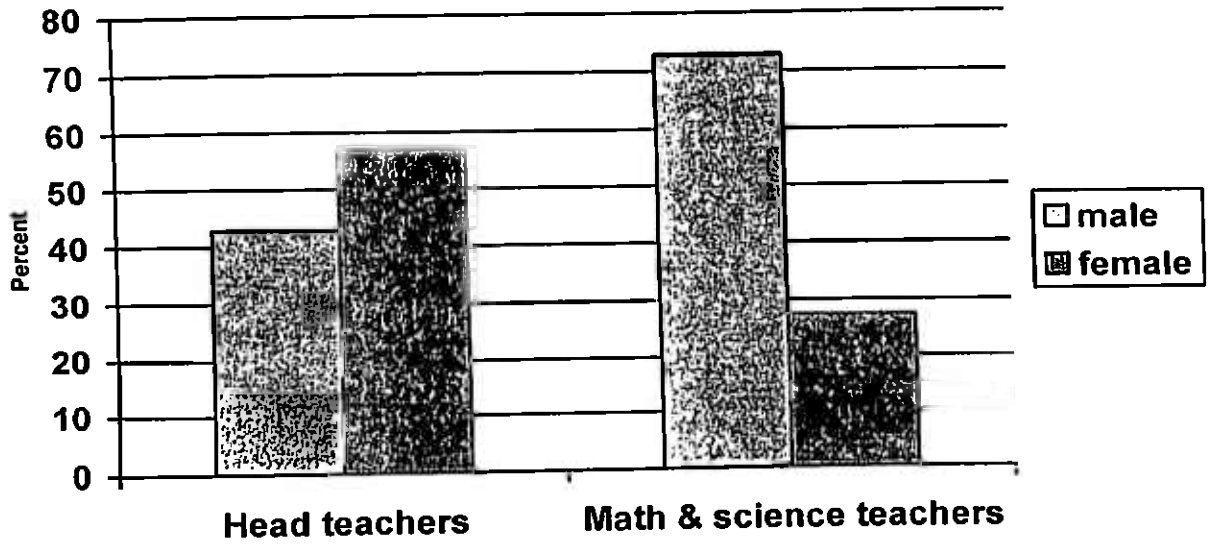

Fig 1 shows near equal representation female 4(57.1%) and male 3(42.9%) head teachers in charge of public secondary schools in the division. However, female teachers were underrepresented in the sample of mathematics and science teachers in the sampled schools where they formed 27.3% of the sample as males comprised of 72.7% of the sample.

The professional qualification of the sample was also considered. The respondents were grouped into males and females. Head teachers were compared with the mathematics and science teachers and the results obtained are illustrated in figure 2.

Figure 2: Highest professional qualification of the head teachers compared to those of mathematics and science teachers

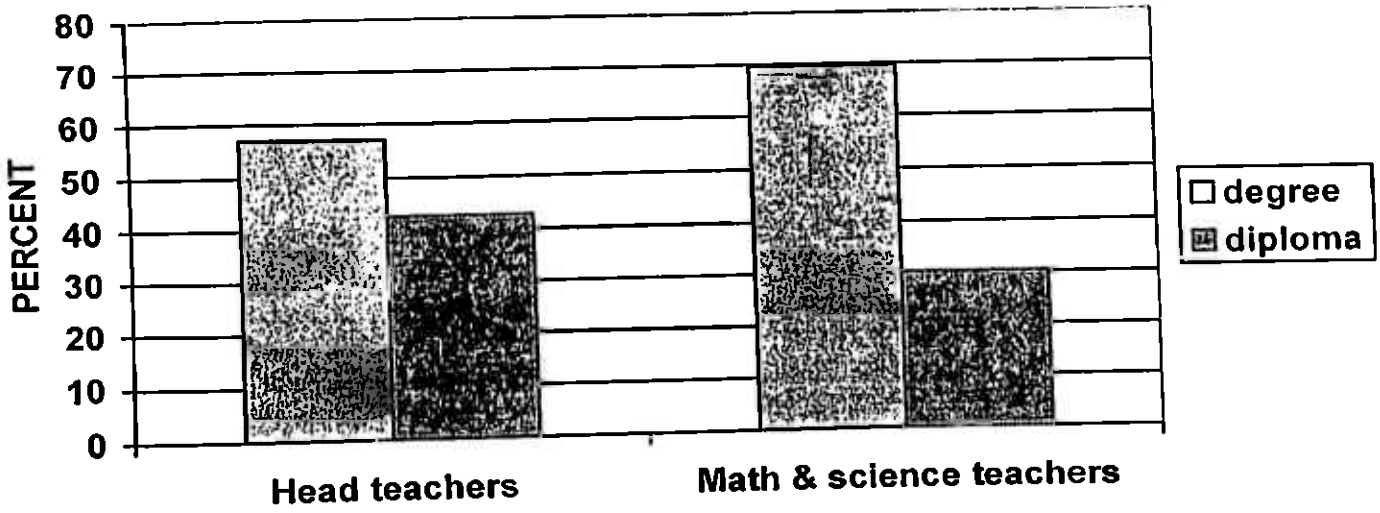

Figure 2 shows the professional qualification of the school head teachers and those of the mathematics and science teachers. The head teachers were either bachelor degree holders (57.14%) or diploma certificate holders (42.86%). The mathematics and science teachers also fitted into the two categories: bachelor degrees holders (69.70%) and diploma certificate holders (30.30%). Amongst the mathematics and science teachers who were bachelor's degrees holders, 6.06% had bachelors of science degree and one of them possessed a post graduate diploma in education. 60.61% of the entire group of math and science teachers was professionally qualified with bachelor degree in education.

The ages of the head teachers and that of the mathematics and science teachers were amongst the variables considered by the study. Their distribution among the teacher population is as shown in figure 3.

Figure 3: Age of the head teachers and math and science teachers

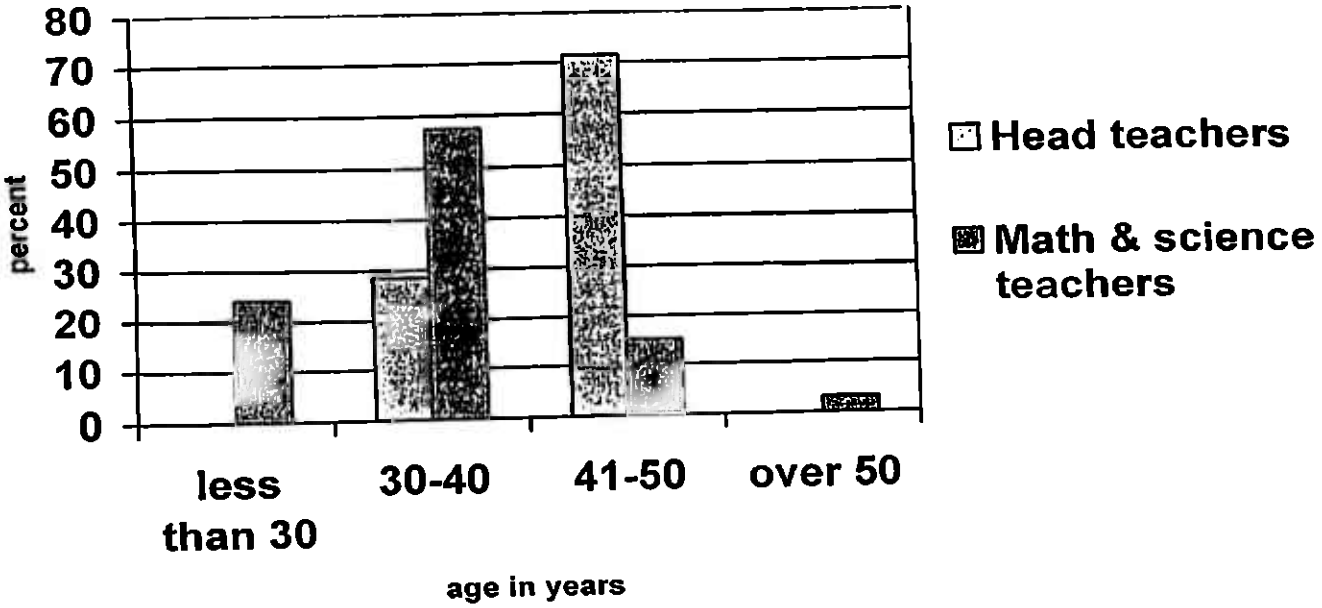

Figure 3 shows the ages of the head teachers a well as those of the mathematics and science teachers in the study. 71.43% of the head teachers were aged between 41-45 years while 28.57% were in the 31-35 years age bracket. The ages of the mathematics and science teachers ranged from less than 30 years to more than 50 yrs. Majority of the mathematics and science teachers were in the 30-40 years bracket. This indicated that the majority of the teachers were quite young.

The schools that were included in the sample could be categorized into four groups: provincial girls' boarding, provincial mixed boarding, district girls' boarding, and district boys' boarding schools. Figure 4 presents the distribution of these schools within the sample.

Figure 4: The categories of the public schools included in the sample

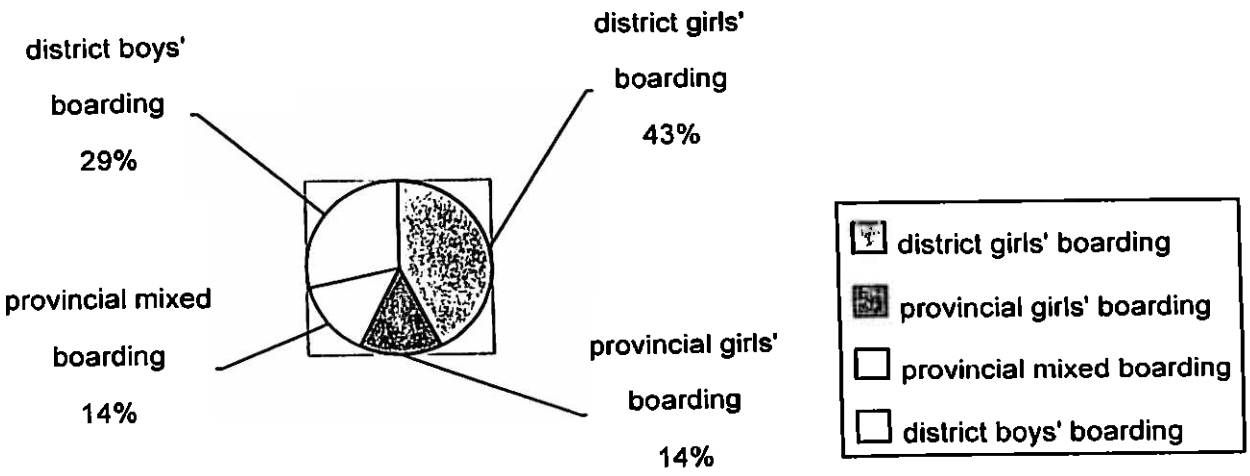

Figure 4 shows the categories of the schools that were included in the sample. These schools were distributed as follows: district girls' boarding schools 3(42.8%), district boys' boarding 2(28.57%), provincial girls' boarding 1(14.29%) and provincial mixed boarding 1(14.29%).

Within these seven public schools, there were mathematics and science teachers who had varying subject combinations. These were distributed as follows in descending order: school 4 had the highest number with 11 teachers, school 6 had 9, and school 1 had 7 while schools 2, 3, 5, and 7 had the least number with 5 teachers each. Table 4 shows the distribution of these teachers by subject combination and school.

Table 4: Mathematics and science teachers by their subject combination and school

Subject combination	School							%
	1	2	3	4	5	6	7	
Math & Physics	2	2	1	2	1	1	1	21.2
Math & Chemistry	1	2	1	3	1	1	1	21.28
Math & Biology	1	0	0	0	0	1	0	4.26
Physics & Chemistry	0	0	0	2	0	1	1	8.51
Chemistry & Biology	1	2	0	2	0	1	1	10.64
Biology & Agriculture	1	1	1	0	1	1	1	12.77
Math & Drawing design	0	0	0	0	0	2	0	4.26
Other combination	1	0	2	2	2	1	0	17.02
Total per school	7	7	5	11	5	9	5	100

Table 4 shows the distribution of math and sciences teachers by school and subject. Teachers with mathematics and chemistry combination were 21.28%, a similar percentage of the total number with mathematics and physics. Mathematics and biology were 4.26%, the same with mathematics and drawing design. These teachers were teaching an average of 21 lessons per week in school 6, 22 lessons in schools 1 and 2, 23 lessons in school 4 and 5, 24 lessons in school 7 and a maximum of 30 lessons in school 3. Teachers with mathematics and drawing design combination had the lowest number of lessons in the division with 18 lessons only per week. Teachers who taught mathematics and physics or mathematics and chemistry or mathematics and biology had to teach 21 lessons per week. Those with a combination of physics and chemistry or biology and agriculture taught 23 lessons a week. Their colleagues whose

subject combinations were either chemistry and biology or biology together with other combinations with mathematics or science had 24 lessons per week.

4.2.2: Performance in mathematics and sciences by school in kcse in igoji division.

For purposes of this study, data on the performance in mathematics and sciences by the seven public secondary schools in Igoji division was obtained from the DEO's office, Meru central district. The results were based on the 12-point scale grading system used by the KNEC. According to this grading system, the best grade is A (equivalent to 12 points) and the worst is E (equivalent to 1 point). In order to establish if there were any relationships at all between the performance in KCSE by the seven public secondary schools and the variables under study, cross tabulation and Pearson's product moment correlation coefficient ρ(rho), were used to indicate the degree of the relationships between the student's performance in mathematics and sciences and other variables under study.

Table 5: Mean scores and letter grades attained in mathematics and sciences in KCSE by school

School.	Year								Overall mean Grade	
	2002		2003		2004		2005			
	M	G	M	G	M	G	M	G	M	G
1	_____		2.8638	D	3.0150	D	2.6945	D	2.8578	D
2	5.0763	C-	4.3075	D+	4.8775	C-	4.7360	C-	4.7493	C-
3	2.0306	D-	3.1173	D	3.2533	D	3.3153	D	2.9291	D
4	6.3683	C	6.2555	C	7.1950	C+	7.1608	C+	6.7449	C+
5	_____		2.0333	D-	2.7800	D	4.0450	D+	2.9528	D
6	2.5925	D	2.1914	D-	2.6200	D	2.4930	D-	2.4742	D-
7	2.4003	D-	2.7493	D+	3.2650	D	4.1950	D+	3.1524	D

M = Mean score. Source: DEO's office, KCSE analysis (2002-2005)

G= Mean Grade.

Table 5 shows the overall performance in mathematics and sciences in KCSE examination by schools in Igoji division over the period under study (2002-2005) was low. The mean grades obtained by the majority of the schools ranged between poor (D-) and satisfactory (C-) on a twelve point scale, where (A) is the best grade and (E) the worst grade obtainable. Only school 4, out of the seven recorded good performance, with a mean grade of (C+) in mathematics and sciences. School 2 recorded satisfactory performance (C-), while the rest of the schools: 1, 3, 5, 6 and 7, recorded poor performance (D). Good and satisfactory performance came from one provincial girls' boarding (school 4), and a district boys' boarding (school 2) respectively. Poor performance came from three district girls' boarding (schools 1, 3, and 5) one provincial mixed boarding (school 6) and one district mixed boarding school (school 7).

A summary of performance in mathematics and sciences in KCSE by the seven public secondary schools in Igoji is presented in table 6 below.

Table 6: summary of performance in mathematics and sciences in KCSE in Igoji division public secondary schools (2002-2005)

School type	LEVEL OF PERFORMANCE		
	POOR	SATISFACTORY	GOOD
Provincial girls' boarding	———	———	1
Provincial mixed boarding	1	———	———
District boys' boarding	———	1	———
District girls' boarding	3	———	———
District mixed boarding	1	———	———
TOTAL	5	1	1

From the table 6, out of the five schools that recorded poor performance, three were district girls' boarding. Even the provincial mixed boarding school in the division didn't rise to the occasion despite its elevated status.

4.2.3: Availability of physical facilities within the public secondary schools in Igoji division.

The study sought to establish the level of availability of physical facilities within the division and to answer the research question: what is the relationship between the level of availability of physical resources within the school and the students' performance in mathematics and sciences in KCSE in Igoji division? For the purpose of this study, physical facilities included the following facilities: the sciences laboratories, libraries, play grounds/ fields, dining halls, water

reservoirs, dormitories and ablution blocks. The results of the availability of the above mentioned physical facilities are represented in tables 7 to 14 below.

Table 7: Availability of sciences laboratories by school

Availability of sciences laboratories					
Adequate		Inadequate		Unavailable	
N	%	N	%	N	%
1	14.29%	4	57.14%	2	28.57%

N = Number of head teachers.

% = Percentage of the head teachers who chose the response.

From table 7, it can be observed that majority or 57.14% of the schools had inadequate science laboratories. It is also observed that 28.57% of the schools did not have a single science laboratory. These were schools 3 and 5. Their performance was also noted to be poor. Schools 1, 2, 4, and 6 had laboratory facilities, which were not adequate. Out of these four schools, school 4 had laboratories, which were in good condition. The performance of school 4 was also noted to be good. School 7 had adequate laboratory that was well maintained, but the performance of the school was poor. School 1 had a laboratory, which was poorly maintained, not to mention that its performance was also poor.

Libraries were another physical facility that the study sought to determine their availability amongst the seven public schools. These are important facilities in any school because students have a source of supplementary information to enrich what the teachers have already taught.

Table 8: Availability of library by school

LEVEL OF AVAILABILITY OF THE SCHOOL LIBRARY					
ADEQUATE		INADEQUATE		UNAVAILABLE	
N	%	N	%	N	%
0	0	3	42.86	4	57.14

N = Number of head teachers.

% = Percentage of the head teachers who chose the response.

Table 8 presents the findings of the study on the level of availability of the school library. It was observed that school 1, 2, 3, and 5 did not have a room that they could designate as the school library. The performances of these schools except for school 2 were poor. School 4 had an inadequate library facility, whose condition was quite good. The performance of this school was also good. School 6 and 7 had very tiny rooms that did not have a space to accommodate 20 students. Apart from that, that tiny room in school 6 was in a state of disrepair with a few shelves that contained more newspapers than books. The performances of these two schools were also poor. Eshiwani (1983), in a study carried in western province, Kenya which consisted of primary and secondary schools underscored the role of a library facility in boosting pupils' performance.

There is a saying that goes like this, 'work without play makes Jack a dull boy'. This saying is very true, medical doctors keep telling us of the importance of physical exercises on the proper functioning of the body systems. It is important to note that even a serious mathematics and sciences student needs space to play so that he/she can relax and therefore be in a position to concentrate to the maximum during the lesson. This study sought to determine the level of

availability of play fields. The assumption was that if these fields are there, students will utilize them for physical exercises and relaxation. Table 9 shows the level of availability of this facility.

Table 9: Availability of play fields or grounds in schools within Igoji division

LEVEL OF AVAILABIILITY OF PLAY GROUNDS OR FIELDS					
ADEQUATE		INADEQUATE		UNAVAILABLE	
N	%	N	%	N	%
4	57.14	2	28.57	1	14.29

N = Number of head teachers.

% = Percentage of the head teachers who chose the response.

Table 9 presents the results from observation done on the schools' playgrounds. Four schools, representing 57.14% of the sampled schools had adequate playgrounds; however, their condition was not good. Amongst the four, schools 4 had good performance and school 2 had satisfactory performance but schools 6 and 7 performed poorly. Schools 1 and 3 had inadequate playing fields that were in a sorry state, school 5 lacked a field completely. The performance of schools 1, 3 and 5 was poor. These results suggest that there is a relationship between availability and non-availability of playing fields and students' performance in mathematics and sciences.

The research study also looked into the availability of dining halls in the school. Table 10 summarizes the findings concerning this facility.

Table 10: availability of the dining hall by school

LEVEL OF AVAILABILITY OF THE DINING HALLS					
ADEQUATE		INADEQUATE		UNAVAILABLE	
N	%	N	%	N	%
3	42.86	0	0	4	57.14

N = Number of head teachers.

% = Percentage of the head teachers who chose the response.

Table 10 contains results of the study concerning the availability of the dining hall facility by the schools. It was observed that all the schools had an adequate kitchen, but not all had a dining hall. Schools 2, 4, and 6 were found to have adequate dining halls that were in good condition, except that the dining hall for school 6 had most of its benches and tables in a state of disrepair. Out of these three schools, school 2 and 4 had satisfactory and good performance respectively. The other school: school 1, 3, 5 and 7 lacked a dining hall facility altogether. These three schools also posted poor performance in mathematics and sciences in KCSE examinations. This observation points to a relationship between availability of the dining hall facility and performance in mathematics and sciences.

The other physical facilities that the study considered were the classrooms. This is where the teaching and learning process takes place. Therefore the availability or non-availability of this facility could influence learning in one way or another. The findings on the availability of this facility are presented in Table 11.

Table 11: availability of classrooms by school

School	1	2	3	4	5	6	7
No of classrooms	8	8	4	12	4	8	4
No of streams	2	2	1	3	1	2	1

From table 11 above, each of the schools was observed to have classrooms that were in the multiples of four. This implies that none of the classes from form 1 to form 4 had been combined in any of the schools. Observation revealed that except for school1 and 3, which had semi-permanent buildings, the rest had permanent structures. Its only one school: school 4 that had classrooms that had ceilings. This means that student in other schools used to experience some disturbance during the rainy season as the rains poured on the iron sheet roofs, or elevated temperatures during hot seasons. All the seven schools had adequate students' desks, chairs, proper ventilation, chalkboards and lighting.

The study also sought to establish if there was a relationship between the availability of dormitories and students' performance in mathematics and sciences. Table 12 summarizes information on the availability of dormitories.

Table 12: Availability of dormitories

LEVEL OF ADEQUACY OF THE STUDENTS' DORMITORIES			
ADEQUATE		INADEQUATE	
N	%	N	%
4	57.14	3	42.86

N = Number of head teachers.

% = Percentage of the head teachers who chose the response.

From table 12, four schools had adequate dormitories while the other three did not have adequate. Observation revealed that only dormitories in school 4 were in good condition while those of school 2, 3, 5, 6 and 7 could be described as fair. Dormitories in school 1 were in poor condition and very congested. Fewer students than their capacity occupied schools 4, 5 and 7 dormitories, while those of school 2, 3 and 6 were having optimum numbers of occupants but not congested.

Water is a very important natural resource. Actually, there is a saying that water is life. In order for a school to operate well, it needs water, and a lot of it for that matter because of the numbers of people that will require its use within the school compound. This therefore means that schools needs efficient and adequate means of storing water for use. Table 13 presents the findings of the availability of this facility in the schools.

Table 13: Availability of water reservoirs

LEVEL OF AVAILABILITY OF WATER RESERVOIRS			
ADEQUATE		INADEQUATE	
N	%	N	%
3	42.86	4	57.14

N = Number of head teachers.

% = Percentage of the head teachers who chose the response.

From table 13, it was observed that three schools had adequate means of storing water: schools 4, 5, and 7. Schools 1, 2, 3 and 6 lacked adequate means of

water storage and as a result were not prepared for periods of water shortage when pipes get blocked or burst. Schools 2 and 3 in particular had very small storage containers/tanks that were inadequate.

Ablution blocks are essential facilities for the proper and comfortable functioning of the students. The study sought to find if there was a relationship between the adequacy of this facility and students' performance. Table 14 presents the findings on the level of availability of the ablution blocks.

Table 14: Availability of ablution blocks

LEVEL OF AVAILABILITY OF ABLUTION BLOCKS IN SCHOOL			
ADEQUATE		INADEQUATE	
N	%	N	%
5	71.43	2	28.57

N = Number of head teachers.

% = Percentage of the head teachers who chose the response.

Table 14 shows that 71.43% of the schools had adequate ablution blocks while 28.57% did not have adequate ablution blocks. Schools 1, 2, 4, 6, and 7 had adequate ablution blocks, while 3 and 5 did not have adequate. Amongst those schools that had adequate ablution blocks were schools 4 and 2, which had good and satisfactory performance respectively. However, school 1, 6 and 7 didn't do well in the examinations. Schools 3 and 5, which had inadequate ablution blocks, performed poorly in KCSE. This suggests a relationship between performance and availability of ablution blocks.

4.2.4: Students' socio-economic status in Igoji public secondary schools.

The study also sought to answer the research question, which was: What is the relationship between the students' socio-economic status and the students' performance in mathematics and sciences in KCSE in Igoji division? For the purpose of this study, the students' socio-economic status was categorized into: participation of their parents in various school economic activities and the frequency of interruption of classes due to students being sent home for school fees.

Table 15: Participation of parents in supporting the school

Category	Good		Average		Poor	
	N	%	N	%	N	%
Fees payment	0	0	5	71.43	2	28.57
Buying reference books	0	0	5	71.43	2	28.57
Sponsoring educational trips	0	0	3	42.86	4	57.14
Supporting school projects	1	14.29	5	71.43	1	14.29
Providing basic necessities	1	14.29	6	85.71	0	0

N = Number of head teachers.

% = Percentage of the head teachers who chose the response.

From table 15, 71.43% of the head teachers rated parents' fees payment as poor; these were head teachers of school 5 and 6. On buying of reference books for their students, head teachers of school 3 and 5 rated parents' participation as poor while the other 5 gave parents an average mark. Parents were also rated in as far as providing funds for educational trips. Parents of school 1, 3, 5 and 7 were rated as poor while the school head teachers saw the efforts of those of

schools 2, 4, and 6 as average. Parents from school 4 were rated as good on supporting school projects while those of school 7 were poor in this aspect. The rest were rated as average on this aspect. On the aspect of providing basic necessities to the students, only parents from school 4 were viewed as good, all the rest were indicated as average. On the overall, school 4, which was also having good performance ranked their parents' participation highest, closely followed by school 2 which also had satisfactory performance. This seemed to imply that the level of participation of parents in school economic activities might have a relationship with students' performance in KCSE.

The frequency of interruption of classes as students are sent home to bring school fees arrears can be taken as an indicator of the economic status of the student. If a student keeps being sent home throughout the year, there are many lessons that he/she will miss and hence affect his/her academic performance. The mathematics and science teachers were asked to rate how often their classes got interrupted as their students were sent home for fees. Their responses are summarized in table 16.

Table 16: Frequency of interruption of classes due to fees problems

FREQUENCY OF INTERRUPTION OF CLASSES					
VERY OFTEN		RARELY		NEVER	
N	%	N	%	N	%
25	75.76	6	18.18	2	6.06

N = Number of mathematics and sciences teachers.

% = Percentage of mathematics and science teachers who chose the option.

Table 16 presents the responses of the mathematics and science teachers on class interruption due to fees problems. On the overall, 75.76% responded that classes were interrupted very often, 18.18% indicated that this occurred rarely, while 6.06% indicated that this never took place in their schools. Schools 3, 6 and 7 recorded the highest frequency followed schools 1, 2, and 5. The class registers bore testimony to this fact as many students had been marked absent for protracted periods of time, some running into months of absence from school. School 4 had the lowest frequency of students being sent home for fees. From those responses, it was evident that school 4 and 2, which had done better than the rest of the schools in the division, also had few incidences of class interruption due to fees problems. However, schools 1 and 5 performed poorly even though incidences of class interruptions were not as high. These observations implied that there was a relationship between the frequency of interruption of classes and students' performance in mathematics and sciences.

4.2.5: Availability of mathematics and sciences teachers.

For the purpose of this study, availability of mathematics and sciences teachers was examined under the following headings: teacher to pupil ratio, adequacy of mathematics and sciences teachers, teacher's workload, number of students per practical group and the frequency of evaluation in. These variables were taken to be indicators of the level of availability of the science and mathematics teachers.

Table 17: Ratio of mathematics and science teachers to students in Igoji division public secondary schools

SUBJECT	TEACHER TO STUDENTS RATIO									
	1:10		1:20		1:30		1:40		>1:40	
	N	%	N	%	N	%	N	%	N	%
Mathematics	0	0	0	0	0	0	3	42.86	4	57.14
Physics	2	28.57	0	0	0	0	1	14.29	4	57.14
Chemistry	0	0	0	0	0	0	3	42.86	4	57.14
Biology	0	0	0	0	0	0	2	42.86	5	71.43

N = Number of head teachers.

% = Percentage of the head teachers who chose the response.

Table 17 shows the ratio of mathematics and sciences teacher to students in the division. Three schools had a ratio of 1:40 in mathematics and four schools had a ratio of above 1:40. Physics had the lowest ratio of 1:10 in two schools while biology recorded the highest number of schools with a ratio greater than 1:40.

The head teachers were also requested to provide information concerning the availability of the mathematics and sciences teachers on their schools. Their responses are summed up in table 18.

Table 18: Availability of mathematics and sciences teachers in Igoji

SUBJECT	Availability of mathematics and sciences teachers					
	OVERSTAFFED		ADEQUATE		INADEQUATE	
	N	%	N	%	N	%
Mathematics	0	0	6	85.71	1	14.29
Physics	1	14.29	4	57.14	2	28.57
Chemistry	0	0	5	71.43	2	28.57
Biology	0	0	5	71.43	2	28.57

Table 18 shows the level of adequacy of mathematics and sciences teachers in public secondary schools within Igoji division. One head teacher indicated that there was overstaffing of the physics teachers in the school. Mathematics teachers were adequate according to six head teachers while chemistry was also reported to have adequate teachers by 5 head teachers.

Another aspect that the study examined was the number of students per class and the number of students per stream in the schools studied. The study established that one school had three streams, three schools had two streams and the other three were single streamed. Table 19 contains this information per school.

Table 19: students per class and the students taking each science subject by school in Igoji division public secondary schools

CATEGORY	SCHOOL						
	1	2	3	4	5	6	7
Girls per class	89	0	40	140	26	16	0
Boys per class	0	99	0	0	0	35	54
No of streams	2	2	1	3	1	2	1
Physics students	1	30	2	61	9	16	4
Biology students	80	50	23	103	29	40	49
Chemistry students	84	80	23	122	29	56	55

Table 19 shows the number of students per class. The number of students per stream was lowest in school 5 and 6 with an average of 26 students, while school

7 recorded the highest number with 54 students. Chemistry was the most popular subject in all the schools studied, followed by biology. Physics was the least popular subject with as few as one student in school 1, two students in school 3, four students in school 7 and 9 students in school 5. The mathematics and science teachers gave similar information as the head teachers on the numbers of students. 39.39% of the mathematics and science teachers indicated that the number of students per class was 41-50, while a similar percentage of them gave the number as 41-50. 6.06% of these teachers gave a higher number of more than 50 per class. Schools 4 and 2 whose performance was good and satisfactory respectively had an average of 47 and 50 students per stream respectively. This number of students per class was somewhere between the highest and the lowest, which suggests that there might be a relationship between performance and an optimum number of students per class.

Table 20 presents the summary of the mathematics and sciences teachers' responses on the number of lessons they taught each week.

Table 20: Mathematics and sciences teachers' workload by school in Igoji division public secondary schools

Lessons per week	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
10-15	0	0	0	0	0	1	0	1
16-20	0	1	0	1	1	1	0	4
21-25	3	4	2	4	1	2	0	16
26-30	2	0	2	0	3	1	3	11
≥ 31	0	0	1	0	0	0	0	1

The average number of lessons ranged between 21-25 lessons per week. School 4, which had good performance in mathematics and sciences, had a majority of its teachers with 21-25 lessons per week; the same trend was also noted with school 2 whose performance was satisfactory. This seemed to imply that there are an optimum number of lessons per week for good results to be attained.

Apart from teaching during the normal class time, 93.94% of the teachers in the sampled teachers indicated that they taught extra time. 28 teachers indicated that they taught after 4 o'clock and on weekends for an average of three hours per week. 24.4% of the teachers taught during the school holidays, 8.89% during lunch hour and 2.22% early in the morning before normal teaching time.

Table 21: Average number of students per group in sciences practical lessons by school

NUMBER OF STUDENTS	SCHOOL						
	1	2	3	4	5	6	7
Physics	4	3	2	4	5	4	5
Chemistry	5	9	10	5	15	5	8
Biology	10	5	4	9	8	7	5
AVERAGE	6	6	5	6	9	5	6

From table 21, schools 3 and 6 had the lowest number of students per group with 5 students. School 5 had the highest number with 9. Schools 1, 2, 4 and 7 had six students per practical group. School 4 which had posted good performance in KCSE and school 2 with satisfactory performance both had an average of six students per practical group. However, students from schools 1 and 7 did not

perform well even though they had a similar number of students per practical group. These findings point to a likelihood that performance in sciences could be related to the number of students per group in a science practical lesson. Teachers were also required to give information on the number of times they evaluated students during the term. A summary of their responses is presented in table 22.

Table 22: Frequency of evaluation in mathematics and sciences by school

	SCHOOL						
FREQUENCY	1	2	3	4	5	6	7
Once per week	1			1	2	1	
Once per month	4	4	2	4	3	4	3
Twice per month			3				
Once per term		1					

From table 22, teachers from school 1, 4, 5, and 6 indicated that they evaluated their students per week. Therefore, by the end of the term they evaluate close to twelve times. These constituted of 5(14%) of the science and mathematics teachers. Most of the teachers evaluated once per month. The pattern of evaluation seemed quite uniform in all the schools.

4.2.6: Mathematics and sciences teachers' characteristics.

This study attempted to establish the mathematics and science teachers' characteristics and to provide an answer to the research question, which sought to determine the relationship between the teachers' experience, academic and

professional qualifications and the students' performance in mathematics and sciences. These results are discussed under the following sections: academic qualifications of the teachers, professional qualifications of the teacher, teachers' experience and the rank of the mathematics and science teacher within the school.

Table 23: Academic qualifications of mathematics and sciences teacher by school

ACADEMIC QUALIFICATION	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Degree	3	4	5	5	2	4	0	23
Diploma	2	1	0	0	3	1	3	10

From table 23, mathematics and sciences teachers fell mainly under two categories. Those with a bachelor degree were 70% while the rest who had diplomas were 30%. Schools 2, 3, 4, and 6 had high numbers of teachers with degrees compared to other schools. Out of these four schools, school 2 and 4, which performed better than the rest were included. This implied that there could be a relationship between the teachers' academic qualification and the students' performance.

Professional qualifications of the mathematics and science teachers are summarized in table 27. Teachers with a bachelor of education and those with a diploma in education were taken to be professionally qualified, while those who had a Bachelor of Science degree were taken not to be qualified as teachers

because even if they have the necessary content, they had not studied teaching methods.

Table 24: Professional qualification of the mathematics and sciences teachers by school in Igoji division

PROFESSIONAL QUALIFICATION	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Diploma	2	1	0	0	3	1	3	10
B, Sc	1	0	0	0	1	0	0	2
B. Ed	2	4	5	5	1	4	0	21

From Table 24, it is seen that schools that had a high number of professionally qualified teachers to degree level were 2, 3, 4, and 6. Amongst these four schools, schools 2 and 4 did better than schools 3 and 6. Schools 1, 5 and 7, which had teachers with lesser qualifications (diplomas), but professionally qualified, performed poorly. Schools 1 and 5, which had a teacher each, who was not trained as a teacher performed poorly. This implies that there could be a relationship between the professional qualification of the teacher and students' performance in mathematics and sciences.

The study sought information on the teachers' professional experience. Teachers were required to provide information on the numbers of years they had served. The average number of years of service for each school was calculated. A summary of their responses is presented as table 25.

Table 25: Teaching experience of the mathematics and science teachers by school in Igoji division public secondary schools

	SCHOOL						
	1	2	3	4	5	6	7
No of teachers included	5	5	5	5	5	5	3
Average Experience (yrs)	4.8	7.8	2.4	5.8	2.1	12.8	16

Table 25 shows the number of teachers included in the study from each school and the average teaching experience per school in years. School 5 had teachers with the lowest teaching experience while school 7 recorded the highest with each teacher having an average of 16 years teaching experience. Teachers with an average teaching experience of 5 to 8 years were stationed in those schools that did comparatively better than the rest: schools 2 and 4. Schools 1, 3 and 5 had teachers whose average experience was between 2 to 5 years. These three schools performed poorly in KCSE. Teachers in school 6 and 7 had an average teaching experience of 12 to 16 years. These two schools also performed poorly in mathematics and sciences. This seemed to imply that there could be a relationship between an optimum number of years of service by the mathematics and science teacher and students' performance.

Table 26: Rank of the mathematics and science teacher by school

TEACHER'S RANK	SCHOOL						
	1	2	3	4	5	6	7
Head of Department	2	3	3	1	2	2	0
Class teacher	3	2	2	4	3	3	3

Table 26 shows the rank that the sampled mathematics and sciences teachers occupy within their schools. The results imply that the mathematics and science teachers were also progressing well in their professional development. There was a fair distribution of heads of departments and class teachers in all the 7 school.

4.2.7: Availability of key teaching and learning resources.

This study attempted to establish the level of availability of teaching and learning resources for the proper teaching of mathematics and sciences, and the relationship that these have on the students' performance in mathematics and sciences. The results of the study are presented beginning with table 27.

Table 27: Textbook to students' ratio per subject and per school

SUBJECT	SCHOOL						
	1	2	3	4	5	6	7
Mathematics	1:2	1:4	1:3	1:3	1:4	1:4	1:3
Physics	1:2	1:4	1:2	1:2	>1:5	>1:5	>1:5
Chemistry	1:3	1:4	1:5	1:3	>1:5	1:5	1:5
Biology	>1:5	1:4	1:5	1:2	>1:5	1:3	1:5

Table 27 shows the textbook to students' ratio in each subject per school. Mathematics had the lowest textbook to students' ratio of 1:4 or less in all the 7 schools. School 4 had the lowest textbook to students' ratio of 1:3 and it also had good performance. Schools 1, 2 and 3, had a ratio of 1:4. Amongst these was school 2 whose performance was satisfactory. Schools 5, 6 and 7 had a ratio of

1:5 and above. These schools also did poorly in mathematics and sciences. This suggests that the lower the textbook to student ratio, the better the performance.

Table 28: Availability of calculators by school

AVAILABILITY	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Adequate	3	1	2	5	0	2	3	16
Inadequate	2	4	3	0	4	3	0	16
Unavailable	0	0	0	0	1	0	0	1

Table 28 presents the responses of mathematics and sciences teachers on the availability of calculators amongst the students. Schools 4 and 7 had 100% adequacy of calculators. School 4 performed well, but school 7 did not. Inadequacy of calculators was highest in school 5, whose performance was also poor. This suggests that there could be a relationship between availability of calculators and students' performance.

Table 29: Availability of mathematics tables by school

AVAILABILITY	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Adequate	3	3	2	5	0	2	1	16
Inadequate	2	2	3	0	4	3	2	16
Unavailable	0	0	0	0	1	0	0	1

From table 29, school 4 emerged with 100% adequacy of math tables. It also did well in KCSE. The other schools with the exception of school 5 had a similar distribution between adequate and inadequate math tables. On the overall, 16 of

the teachers indicated that math tables were adequate, while a similar number indicated they were inadequate. Schools 3, 6 and 7 had more teachers indicating that tables were inadequate. These three schools also performed poorly in KCSE, an indication that there could be a relationship between performance and availability or non-availability of mathematics tables.

Table 30: Availability of personal reference books by school

AVAILABILITY	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Adequate	1	0	2	2	0	0	0	5
Inadequate	3	2	3	3	1	2	1	15
Unavailable	1	3	0	0	4	3	2	13

Table 30 presents teachers' Reponses on availability of students' personal reference books. Schools 1, 3 and 4 indicated a higher level of adequacy than the others. Amongst these, school 4 also had good performance. This suggests a possible relationship between availability of personal reference books and performance.

Table 31: Availability of models by school

AVAILABILITY	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Adequate	1	1	0	2	0	1	0	5
Inadequate	4	4	3	1	0	4	3	19
Unavailable	0	0	2	2	5	0	0	9

From Table 31, it is observed that 19 (57.58%) of the teachers indicated that models were inadequate while 5(15.15%) were of the view that they weren't adequate. Schools 1, 2, 4 and 6 recorded higher levels of adequacy than the rest. School 4 and 2 also posted good and satisfactory performance respectively. School 5, which lacked models also didn't do well in KCSE. This seems to suggest that there could be a relationship between performance and availability of models.

Table 32: Availability of charts by school

AVAILABILITY	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Adequate	1	0	0	2	0	1	0	4
Inadequate	4	2	4	2	1	2	3	18
Unavailable	0	3	1	1	4	2	0	11

Table 32 shows the responses of math and science teachers pertaining to the availability of charts within their schools. Schools 1, 4 and 6 recorded a relatively higher level of adequacy than all the others.

The study also sought to establish the level of availability of common laboratory reagents. These are very necessary for they are required for virtually every experiment that is undertaken in the school. Table 33 shows the responses of the teachers.

Table 33: Availability of common laboratory reagents

AVAILABILITY	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Adequate	3	4	3	4	1	5	0	21
Inadequate	2	1	2	1	3	0	3	12
Unavailable	0	0	0	0	1	0	0	1

From table 33, the number of teachers who indicated that common laboratory reagents were adequate totaled 21, while 12 of them indicated that the reagents were inadequate. School 5 ranked lowest in adequacy while school 6 had 100% adequacy.

Table 34: Adequacy of measuring cylinders by school

AVAILABILITY	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Adequate	4	4	4	5	2	5	3	27
Inadequate	1	1	0	0	2	0	0	4
Unavailable	0	0	1	0	1	0	0	2

Table 34 shows the responses of math and sciences teachers on availability of measuring cylinders. These are apparatus that are used in all the science subjects. 27(81.82%) recorded the item as adequate, while 4(12.12%) indicated it as inadequate. School 4, 6 and 7 recorded 100% adequacy of this item. School 5 had the lowest level of adequacy of this item.

Mathematics and science teachers also rated the availability of the gold leaf electroscope within their schools. This is an important apparatus for the teaching of electrostatics in physics. Their responses are summarized in table 35.

Table 35: Availability of gold leaf electroscope by school

AVAILABILITY	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Unavailable	1	1	2	5	3	5	2	19
Inadequate	3	1	3		1		1	9
Adequate	1	3			1			4

Table 35 shows that the gold leaf electroscope was a rare item in the schools within Igoji division. Only three schools had indicated it was adequate or unavailable. 19(57.58%) of the teachers indicated that there was adequate electroscope. School 4 which performed well also ranked highly in adequacy of the electroscope.

Table 36: Availability of Bunsen burners by school

AVAILABILITY	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Adequate	1	1	2	5	3	5	2	19
Inadequate	3	1	3	0	1	0	1	9
Unavailable	1	3	0	0	1	0	0	5

From table 36, 19(57.58%) of the teachers indicated that Bunsen burners were adequate, while 9(27.27%) of their colleagues said they were inadequate. The remaining 5(15.15%) were of the view that there were no burners in the schools.

Schools 1, 2 and 5 were particularly indicated as deficient in these items. School 4 and 6 had 100% adequacy. School 4 also performed well in KCSE, although school 6 did poorly. This implies that there could be a relationship between availability or non-availability of Bunsen burners and the performance of the students in mathematics and sciences.

Table 37: Availability of microscopes by school

AVAILABLITY	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Adequate	0	2	0	3	2	2	0	9
Inadequate	4	3	5	2	3	3	3	23
Unavailable	1	0	0	0	0	0	0	1

From table 37, 23(69.7%) of the respondents were of the view that microscopes were not adequate in their schools whereas 9(27.27%) indicated that microscopes were inadequate. Only school 1 recorded a case of unavailable. School 2, 4, 5 and 6 recorded high levels of adequacy while school 1, 3 and 7 had low levels of adequacy. School 2 and 4 also recorded satisfactory and good performance. However, school 5 and 6 didn't perform well despite having adequate microscopes. This seems to imply that there could be a relationship between adequacy of microscopes and students' performance.

Table 38: Availability of test tubes by school

AVAILABILITY	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Adequate	3	4	3	5	3	5	3	26
Inadequate	2	1	2		2			7

Table 38 presents teachers' responses on the availability of test tubes in the schools that they taught. None of the schools indicated test tubes as unavailable. School 4, 6 and 7 had 100% adequacy of test tubes seconded by school 2. School 4 also did well in KCSE while school 2, which also had a relatively high level of adequacy of test tubes performed satisfactorily. School 6 and 7, did not perform well even though they had adequate test tubes.

The level of availability of pipettes was also examined and the results are presented in table 39.

Table 39: Availability of pipettes by school

AVAILABILITY	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Adequate	2	4	2	5	3	4	0	20
Inadequate	3	1	3	0	2	1	3	13

Table 43 shows that 20(60.61%) of the respondents indicated pipettes as adequate in their schools while 13(39.39%) viewed them as inadequate. School 4 recorded 100% adequacy and also performed well in KCSE. School 2 and 6 came second in adequacy of pipettes. This seems to suggest a relationship exists between adequacy of pipettes and students' performance.

Table 40: Availability of litmus paper by school

AVAILABILITY	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Adequate	5	5	5	4	3	5	3	30
Inadequate				1	1			2
Unavailable					1			1

From table 40, it can be seen that 30(90.91%) of the respondents indicated that litmus papers were adequate in their schools. Only one school 5 had an incidence of unavailability. School 4 also recorded a case whereby one of the teachers felt that this item was inadequate.

Table 41: Availability of centrifuge by school

AVAILABILITY	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Adequate				1	1			2
Inadequate				2	2			4
Unavailable	5	5	5	2	2	5	3	27

Table 41 contains the results of the responses from math and science teachers, which indicate that, the level of availability of centrifuges was quite low. 27(81.82%) of the respondents indicated that there were no centrifuges in their schools. Only school 4 and 5 recorded an incidence of availability of centrifuges. School 4 had performed well in KCSE, but school 5 did not.

Table 42: Availability of lenses by school

AVAILABILITY	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Adequate	5	2	2	4	1	4	2	20
Inadequate	0	3	3	1	4	1	1	13

Table 42 presents teachers' responses on the availability of lenses. No school recorded lenses as unavailable. School 1 had 100% adequacy of lenses and was closely followed by school 4 and 6. School 5 had the lowest level of adequacy of lenses. On the overall, 20(61%) of the teachers indicated that lenses were adequate in their schools while 13(39%) indicated that lenses were inadequate.

Table 43: Availability of stop clocks/ watches by school

AVAILABILITY	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Adequate	2	3	1	4	1	3	1	15
Inadequate	3	1	3	1	4	2	2	16
Unavailable	0	1	1	0	0	0	0	2

From table 43, 15(45.45%) of the respondents indicated that stop clocks/watches were adequate, while 16(48.48%) viewed them as inadequate. Only 2(6.06%) of the respondents indicated the item as unavailable. School 4 had the highest level of adequacy followed by school 3. School 4 performed well in KCSE. This could suggest a possible relationship between the availability and non-availability of stop-clocks/ watches and performance.

Another item that the study sought to determine its adequacy was the measuring scale. All science subjects use this apparatus to measure the chemicals for experiments. Results on the adequacy of this apparatus are shown in table 48.

Table 44: Availability of measuring scales by school

AVAILABILITY	SCHOOL							TOTAL
	1	2	3	4	5	6	7	
Adequate	2	1	0	4	1	1	0	9
Inadequate	3	3	3	1	2	4	3	19
Unavailable	0	1	2	0	2	0	0	5

Table 44 shows the responses of the teachers concerning the adequacy of measuring scales in their schools. 9(27.27%) indicted that measuring scales were adequate, 19(57.58%) viewed them as inadequate while 5(15.15%) indicated that there weren't any measuring scales in their schools. School 4 recorded the highest level of adequacy. This school also had good performance in KCSE. Schools 3 and 7 had the highest levels of inadequacy; their performance was also poor. This implies that there is a relationship between availability or non-availability of measuring scales and performance in mathematics and sciences.

4.3: Data analysis

This section attempts to establish the relationship that exists between students' performance in mathematics and sciences in KCSE and the variables under study. This is done by use of Pearson's product moment correlation coefficient-r.

This section looks at the relationship that exists between performance and: availability of physical resources, the socio-economic background of the students, the ratio of mathematics teachers to students, the teachers' characteristics (experience, academic and professional qualification) and the teaching and learning facilities.

4.3.1: Objective 1: To determine the extent to which the level of availability of physical facilities affects pupils' performance in mathematics and sciences in kcse in Igoji division.

This section tries to determine the relationship that exists between the various physical facilities and the students' performance in mathematics and sciences in KCSE within Igoji division. The physical facilities considered were: science laboratories, libraries, and playgrounds, dining halls, classrooms, dormitories, water reservoirs and ablution blocks.

In order to determine the nature of the relationships that exists between these physical facilities and the students' performance in mathematics and sciences, the Pearson's product moment correlation coefficient-r was calculated for each of the items using the formula:

$$r_{xy} = \frac{\Sigma xy}{\sqrt{(\Sigma x^2)(\Sigma y^2)}}$$

Table 45: Pearson's correlation coefficient-r on the availability of laboratories and performance in mathematics and sciences

Statistical measure	Adequacy score, X	Performance score, Y
Mean	5.1429	3.6944
$\Sigma(X - X)^2$	68.7572	
$\Sigma(y - y)^2$		14.0367
Σxy	13.1403	
Pearson's- r	0.4230	

Table 45 above shows that there was a correlation between students' performance in mathematics and sciences and the availability of science laboratories. This implies that those schools that had adequate laboratories did better in these subjects than those that lacked. Schools in Igoji division had a general shortage of this vital facility. Only 14.29% had adequate laboratories while 28.57% lacked this facility completely. School 4 and 2, which had laboratories, performed better than schools 3 and 5 whish did not have a laboratory.

Table 46: Pearson's product correlation coefficient-r between the availability of libraries and performance in mathematics and sciences

Statistical measure	Adequacy score, X	Performance score, Y
Mean	3.1429	3.6944
$\Sigma(X-X)^2$	50.857	
$\Sigma(y-y)^2$		14.0367
Σxy	14.9834	
Pearson's- r	0.5608	

From the above table 46, it is evident that there was a positive correlation between the availability of the school library and performance in mathematics and sciences. This means that those schools that had a library facility performed better than those that lacked this facility. School 4 was the only one that had a relatively well-stocked library. Its performance was also better than the performance of the other schools that lacked one. This finding agrees with the finding of Eshiwani (1983) in a study of western province where he found a relationship between performance and availability of the school library.

The Pearson's correlation coefficient was also calculated for the playing fields. The study aimed at establishing whether this facility was related in any way with the students' performance in mathematics and sciences. The results of this analysis are presented in table 47.

Table 47: Pearson's correlation coefficient-r between performance in mathematics and sciences and availability of playing fields

Statistical measure	Adequacy score, X	Performance score, Y
Mean	5.5714	3.6944
$\Sigma(X-X)^2$	59.714	
$\Sigma(y-y)^2$		14.0367
Σxy	13.1288	
Pearson's- r	0.4535	

Table 47 shows that there was a correlation between the performance of the students in mathematics and sciences and the level of availability of playing grounds/fields. The Pearson's coefficient-r was 0.4535. This means that those schools that had a higher level of availability of this facility did better than those that had lower levels of availability of the facility.

The study also attempted to establish if there was any relationship between the level of availability of the school dining hall(s) and the students' performance in mathematics and sciences in KCSE examination. The Pearson's product moment correlation coefficient was calculated and the results of this analysis are presented in table 48.

Table 48: Pearson's correlation coefficient-r between availability of dining hall(s) and students' performance

Statistical measure	Adequacy score, X	Performance score, Y
Mean	4.5714	3.6944
$\Sigma(X-X)^2$	133.4649	
$\Sigma(y-y)^2$		14.0367
Σxy	28.4084	
Pearson's- r	0.6563	

Table 48 shows that there was a positive correlation between the availability of the dining hall(s) and the students' performance. Those schools that had adequate dining hall(s) also performed better than those that had inadequacy of this facility.

Table 49: Pearson's correlation coefficient-r between students' performance and classrooms

Statistical measure	Adequacy score, X	Performance score, Y
Mean	18.1429	3.6944
$\Sigma(X-X)^2$	1761.6948	
$\Sigma(y-y)^2$		14.0367
Σxy	29.9081	
Pearson's- r	0.1900	

From table 49, there was a positive correlation of 0.19 between the classrooms and the students' performance. This implies that those students who used well maintained, ventilated and well-lit classrooms outperformed their colleagues who were in classes that were lacking in those aspects.

Table 50: Pearson's correlation coefficient-r between students' performance and dormitories

Statistical measure	Adequacy score, X	Performance score, Y
Mean	7.1429	3.6944
$\Sigma(X-X)^2$	277.2477	
$\Sigma(y-y)^2$		14.0367
Σxy	24.2297	
Pearson's- r	0.3884	

Table 50 shows a positive correlation between the students' performance and the adequacy of the dormitories in the school with a Pearson's correlation coefficient of 0.3884. Those schools that had dormitories that were well maintained and beds not congested did well in mathematics and sciences than the rest.

Table 51 presents the analysis on the level of availability of water reservoirs in the school and the schools' performance in mathematics and sciences in KCSE.

Table 51: Pearson's product correlation coefficient-r between adequacy of water reservoirs and students' performance

Statistical measure	Adequacy score, X	Performance score, Y
Mean	3.8571	3.6944
$\Sigma(X - X)^2$	6.8571	
$\Sigma(y - y)^2$		14.0367
Σxy	3.4846	
Pearson's- r	0.3552	

There was a positive correlation between students' performance in mathematics and sciences and the availability of water reservoirs in the school. This means that it is necessary for schools to have adequate means of water storage.

Table 52: Pearson's product correlation coefficient-r between adequacy of ablution blocks and students' performance

Statistical measure	Adequacy score, X	Performance score, Y
Mean	4.4286	3.6944
$\Sigma(X - X)^2$	6.0406	
$\Sigma(y - y)^2$		14.0367
Σxy	3.0135	
Pearson's- r	0.3273	

From table 52, it is evident that there was a positive relationship between the level of availability of ablution blocks and performance. School 4 and 2 were found to have adequate and well-maintained ablution blocks and also performed better than the rest in KCSE in mathematics and sciences.

These findings imply that those schools, which had adequate physical facilities such as laboratories, exposed their students to practical sessions during science lessons due to availability of these facilities, had a source of reference materials due to availability of libraries, could play more freely due to the availability of play fields, and had uninterrupted flow of water due to availability of water reservoirs. The availability of these physical resources Contributed in one way or another in assisting the student to study without interruption, hence ensuring a smooth flow of studies. Conversely, those schools with inadequate facilities suffered disadvantages because there were gaps that were begging to be filled. It's not uncommon to find students taking late lunch in those schools that lack adequate means of water storage due to shortage of water.

These findings are in agreement with those of Eshiwani (1993) who concluded that presence or absence of facilities determines the difference between high achieving and low achieving schools. These findings agree with those of Mwamwenda and Mwamwenda (1987) who carried out a study on the effect of schools' physical facilities on performance of standard 7 pupils in examination in Botswana. They too concluded that availability of physical facilities had a direct link with the performance of pupils in examination: the more adequate the facilities, the better the performance.

4.3.2: Objective 2: To determine the extent to which the socio-economic status of the students affect their performance in mathematics and sciences in igoji division.

In order to determine whether there existed any relationship between the socio-economic background and the students' performance in mathematics and sciences, the study utilized the Pearson's product moment correlation coefficient-r. This coefficient was calculated for each of the aspects, which fell under this objective. This was achieved by the use of the formula:

$$r_{xx} = \frac{\Sigma xy}{\sqrt{(\Sigma x^2)(\Sigma y^2)}}$$

Table 53: Pearson's product correlation coefficient-r between parental participation in sponsoring school trips and students' performance

Statistical measure	Adequacy score, X	Performance score, Y
Mean	13	3.6944
$\Sigma(X - X)^2$	52	
$\Sigma(y - y)^2$		14.0367
Σxy	25.9938	
Pearson's- r	0.9621	

Table 53 shows there was a positive correlation of 0.9621 between parents' participation in sponsoring school trips and students' performance I mathematics and sciences. Those students who hailed from families that had parents who were able to sponsor students to go on educational trips also did well in KCSE.

Table 54: Pearson's product correlation coefficient-r between class interruptions due to fees problems and students' performance

Statistical measure	Adequacy score, X	Performance score, Y
Mean	4.4286	3.6944
$\Sigma(X - X)^2$	6.0342	
$\Sigma(y - y)^2$		14.0367
Σxy	-8.2032	
Pearson's- r	-0.8913	

Table 54 shows that there was a negative Pearson's correlation of 0.8913 between the frequency of students being sent home and performance in mathematics and sciences in KCSE. Those schools that recorded a lower frequency of students being sent home like school 2 and 4 performed better than their counterparts who were frequently sent home due to non-payment of school fees.

Table 55 shows the results of the analysis of the relationship between performance in mathematics and sciences and the availability of students' personal reference books.

Table 55: Pearson's correlation coefficient-r between availability of students' personal reference books and students' performance

Statistical measure	Adequacy score, X	Performance score, Y
Mean	3.9	3.6944
$\Sigma(X-X)^2$	20.34	
$\Sigma(y-y)^2$		14.0367
Σxy	3.8413	
Pearson's- r	0.2273	

There was a positive Pearson's correlation of 0.2273 between the students' performance and availability of personal reference books. This means that those students who had personal reference books to supplement what the school could offer in terms of text books also performed better in mathematics and sciences.

The study also looked at the availability of students' personal files and analysis was done to determine the relationship that existed between their availability and students' performance in sciences and mathematics. This analysis is presented in table 56.

Table 56: Pearson's correlation coefficient-r between availability of students' personal files and students' performance

Statistical measure	Adequacy score, X	Performance score, Y
Mean	3.2	3.6944
$\Sigma(X-X)^2$	3.12	
$\Sigma(y-y)^2$		14.0367
Σxy	3.8510	
Pearson's- r	0.5819	

Table 56 shows that there was a positive correlation between the availability of the students' personal files and performance in mathematics and sciences with a correlation coefficient of 0.5819. This implies that those students who were able to afford files to keep their past papers did better than those who lacked.

These findings indicate that those students who hailed from families that did not have the ability to pay fees promptly, buy reference books, purchase personal files and pay for their educational trips were disadvantaged when compared to their colleagues who had no such problems.

These findings are in agreement with those of Magori (1990) who found that socio-economic factors were strongly related with students' performance. Yator (2003) also found a significant relationship between performance and parents' participation in paying of fees.

4.3.3: Objective 3: To establish the teacher to pupil ratio, and its effect on the students' performance in mathematics and sciences in igoji division

Data that was gathered also indicated the ratio of teachers to students in the division. This data was also analyzed by calculating the Pearson's product moment correlation coefficient-r.

Table 57: Pearson's product correlation coefficient-r between the number of students per stream and students' performance

Statistical measure	Adequacy score, X	Performance score, Y
Mean	41.1429	3.6944
$\Sigma(X - X)^2$	752.8571	
$\Sigma(y - y)^2$		14.0367
Σxy	47.5973	
Pearson's- r	0.4630	

Table 57 shows that there was a positive correlation of 0.4630 between students' performance and the number of students per stream. Data gathered on the teachers' workload was also analyzed and the results are presented in table 58.

Table 58: Pearson's product correlation coefficient-r between the teachers' workload and the students' performance

Statistical measure	Adequacy score, X	Performance score, Y
Mean	23.5714	3.6944
$\Sigma(X-X)^2$	53.7142	
$\Sigma(y-y)^2$		14.0367
Σxy	-3.7678	
Pearson's- r	-0.1372	

Table 58 shows that there was a negative correlation of 0.1372 between the students' performance in mathematics and sciences, and the number of lessons that a teacher taught per week. Teachers who taught many lessons per week taught students who performed poorer than students of those teachers that had fewer lessons per week.

The study also looked at the relationship that existed between the students' performance in mathematics and sciences and the average number of students in a science practical lesson. Analysis on this is presented in table 59.

Table 59: Pearson's correlation coefficient-r between the number of students per practical group and performance

Statistical measure	Adequacy score, X	Performance score, Y
Mean	6.1429	3.6944
$\Sigma(X-X)^2$	10.857	
$\Sigma(y-y)^2$		14.0367
Σxy	-0.239	
Pearson's- r	--0.0194	

There was a negative correlation of 0.0194 between the students' performance in mathematics and sciences and the average number of students per group in a practical class. This implied that the performance of the student decreased as the number of students per group increased and vice versa.

This means there was a relationship between the mathematics and sciences teachers to students' ratio and the performance of the student in mathematics and sciences. These findings are in agreement with those of a study done in Maseno division by Ayoo (2002), which established a significant relationship between teacher to student ratio and the students' performance in mathematics.

4.3.4: Objective 4: To examine the relationship between mathematics and sciences teachers' characteristics (age, teaching experience, academic and professional qualifications) and students' performance in mathematics and sciences in igoji division.

The information obtained on each of the teachers' characteristics: academic qualifications, professional qualification and were analyzed using the Pearson's product moment correlation coefficient-r to determine whether there was a relationship between these teachers' characteristics and the students' performance in mathematics and sciences. Analyses of these findings are presented starting with table 60.

Table 60: Pearson's product correlation coefficient-r between the teachers' academic qualifications and performance

Statistical measure	Qualification score, X	Performance score, Y
Mean	4.6286	3.6944
$\Sigma(X-X)^2$	0.7542	
$\Sigma(y-y)^2$		14.0367
Σxy	3.4323	
Pearson's- r	0.3242	

Table 60 shows that there was a positive Pearson's coefficient of 0.3242 between the teachers' academic qualification and the students' performance in

mathematics and sciences. This means that the higher the teachers' academic qualification, the better the students' performance and vice versa.

Table 61: Pearson's product correlation coefficient-r between teachers' professional qualifications and performance

Statistical measure	Qualification score, X	Performance score, Y
Mean	2.2571	3.6944
$\Sigma(X-X)^2$	3.4172	
$\Sigma(y-y)^2$		14.0367
Σxy	3.0247	
Pearson's- r	0.4367	

There was a positive Pearson's correlation of 0.4367 between the teachers' professional qualification and the students' performance in mathematics and sciences. This implies that those students who were taught by teachers with high professional qualifications also performed well in KCSE.

The other aspect that the study looked at pertaining to the teachers' characteristics was the teaching experience of the mathematics and science teachers. The analysis is presented in table 62.

Table 62: Pearson's correlation coefficient-r between the teachers' teaching experience and students' performance

Statistical measure	Qualification score, X	Performance score, Y
Mean	7.3857	3.6944
$\Sigma(X - X)^2$	165.6887	
$\Sigma(y - y)^2$		14.0367
Σxy	-5.7770	
Pearson's- r	-0.1198	

From table 62, it's seen that the teachers' experience on the job was found to be negatively correlated with the students' performance with a correlation coefficient of -0.1198. This means that those teachers who had a high teaching experience taught in schools that were not performing well, and vice versa.

Table 63: Pearson's correlation coefficient-r between the teachers' age and the students' performance in mathematics and sciences

Statistical measure	Age score, X	Performance score, Y
Mean	34.7143	3.6944
$\Sigma(X - X)^2$	59.4286	
$\Sigma(y - y)^2$		14.0367
Σxy	-4.7915	
Pearson's- r	-0.1659	

Table 63 shows that there was a negative correlation between teachers' age and the students' performance. The Pearson's coefficient was -0.1659 on this aspect. This means that those students that were taught by young teachers did better than those taught by their older colleagues.

This implied that the teachers' characteristics such as their age and teaching experience were negatively correlated with the students' performance in mathematics and sciences. However, teachers' characteristics such as the teachers' academic and professional qualifications were positively correlated with the students' performance in mathematics and sciences.

4.3.5: Objective 5: To determine the extent of availability of teaching and learning resources and their effect on students' performance in mathematics and sciences in igoji division.

In order to determine the level of availability of the teaching and learning resources by each school, each item was examined separately and the value of the Pearson's product moment correlation coefficient-r calculated. The various resources looked at were: textbook to student ratio, availability of mathematics tables, models, charts, laboratory reagents, measuring cylinders, electroscopes, burners, microscopes, test tubes, pipettes, litmus paper, centrifuge, lenses, stop watches, measuring scales and teachers' guides. These findings are presented beginning with table 64.

Table 64: Pearson's correlation coefficient-r between the text books to student ratio and performance

Statistical measure	Availability score, X	Performance score, Y
Mean	4.1429	3.6944
$\Sigma(X-X)^2$	22.857	
$\Sigma(y-y)^2$		14.0367
Σxy	12.5918	
Pearson's- r	0.7030	

Table 64 shows that there was a positive correlation between the textbooks to students' ratio and performance in mathematics and sciences. The Pearson's coefficient was 0.7030. Schools with low textbook to student ratio did better than those that had high text book to student ratio.

Table 65: Pearson's correlation coefficient-r between availability of mathematics tables and performance

Statistical measure	Availability score, X	Performance score, Y
Mean	3.9	3.6944
$\Sigma(X-X)^2$	3.14	
$\Sigma(y-y)^2$		14.0367
Σxy	4.6921	
Pearson's- r	0.707	

From table 65, it is clear that there was a correlation between the students' performance in mathematics and sciences and the availability of mathematics tables, with a Pearson's correlation coefficient of 0.707.

Table 66: Pearson's correlation coefficient-r between availability of models and performance

Statistical measure	Availability score, X	Performance score, Y
Mean	2.7714	3.6944
$\Sigma(X-X)^2$	4.7542	
$\Sigma(y-y)^2$		14.0367
Σxy	1.6946	
Pearson's- r	0.2074	

Table 66 shows a positive Pearson's correlation coefficient-r of 0.2074 between performance in mathematics and sciences and the availability of teaching models. Those schools that had high levels of availability of models performed well compared to those that lacked.

The relationship between the level of adequacy of the teaching charts and the students' performance in mathematics and sciences was also examined. Table 67 shows the results of the analysis.

Table 67: Pearson's correlation coefficient-r between availability of charts and performance

Statistical measure	Availability score, X	Performance score, Y
Mean	2.6	3.6944
$\Sigma(X-X)^2$	3.52	
$\Sigma(y-y)^2$		14.0367
Σxy	2.0339	
Pearson's- r	0.2894	

There was a positive Pearson's correlation coefficient of 0.2894. This means that those schools that had adequate charts to illustrate abstract aspects in mathematics and sciences performed well compared to those that lacked.

Table 68: Pearson's correlation coefficient-r between availability of laboratory reagents and performance

Statistical measure	Availability score, X	Performance score, Y
Mean	4.5143	3.6944
$\Sigma(X-X)^2$	5.0343	
$\Sigma(y-y)^2$		14.0367
Σxy	2.2213	
Pearson's- r	0.2642	

Table 68 shows that there was a positive Pearson's product moment correlation coefficient-r between the performance of the students and the availability of common laboratory reagents.

Table 69: Pearson's correlation coefficient-r between availability of measuring cylinders and performance

Statistical measure	Availability score, X	Performance score, Y
Mean	4.5429	3.6944
$\Sigma(X-X)^2$	2.0573	
$\Sigma(y-y)^2$		14.0367
Σxy	1.7114	
Pearson's- r	0.3185	

There was a positive Pearson's correlation coefficient-r of 0.3185 between the availability of measuring cylinders and the students' performance in mathematics and sciences. This implies that those schools which recorded high levels of availability of measuring cylinders also performed well compared to the others. School 5 which had the lowest level of availability of the measuring cylinders performed poorly compared to schools 4, and 7 which had 100% adequacy of this item.

Analysis on the relationship between performance and availability of gold leaf electroscopes is presented in table 70.

Table 70: Pearson's correlation coefficient-r between availability of electroscopes and performance

Statistical measure	Availability score, X	Performance score, Y
Mean	2.2143	3.6944
$\Sigma(X-X)^2$	2.5685	
$\Sigma(y-y)^2$		14.0367
Σxy	4.3617	
Pearson's- r	0.7264	

Table 70 shows a positive Pearson's coefficient of 0.7264 between performance in mathematics and sciences in KCSE. School 4 which had the highest level of availability of electroscopes and also performed better than the rest.

Table 71: Pearson's correlation coefficient-r between availability of Bunsen burners and performance

Statistical measure	Availability score, X	Performance score, Y
Mean	3.7857	3.6944
$\Sigma(X-X)^2$	6.6886	
$\Sigma(y-y)^2$		14.0367
Σxy	1.3659	
Pearson's- r	0.1410	

The analysis established a relationship between performance and its availability. There was a positive Pearson's correlation coefficient of 0.1410 between these two variables as shown in table 71. This indicates that those schools that had high levels of availability of this item also performed well in KCSE.

Table 72: Pearson's correlation coefficient-r between availability of microscopes and performance

Statistical measure	Availability score, X	Performance score, Y
Mean	3.2857	3.6944
$\Sigma(X-X)^2$	1.7485	
$\Sigma(y-y)^2$		14.0367
Σxy	2.2216	
Pearson's- r	0.4484	

When the Pearson's correlation coefficient was calculated, there was found a positive relationship of 0.4484 between the availability of microscopes and the students' performance in mathematics and sciences in KCSE. Those schools that had high levels of availability of microscopes like school 2 and 4 performed comparatively better than the other schools in the study.

The Pearson's correlation coefficient was also calculated for the availability of test tubes in the sampled schools. Table 73 shows the analysis on this item.

Table 73: Pearson's correlation coefficient-r between availability of test tubes and students' performance

Statistical measure	Availability score, X	Performance score, Y
Mean	4.6	3.6944
$\Sigma(X - X)^2$	0.96	
$\Sigma(y - y)^2$		14.0367
Σxy	1.8862	
Pearson's- r	0.5138	

The analysis on the relationship between availability of test tubes and the students' performance showed that those schools that had enough test tubes performed better in mathematics and sciences than those that lacked these.

Table 74: Pearson's correlation coefficient-r between availability of pipettes and performance

Statistical measure	Availability score, X	Performance score, Y
Mean	4.1429	3.6944
$\Sigma(X - X)^2$	2.6938	
$\Sigma(y - y)^2$		14.0367
Σxy	2.4265	
Pearson's- r	0.3946	

Table 74 shows a positive correlation between the availability of pipettes and performance. This indicates that those schools that had enough pipettes also performed well compared to those that lacked or had inadequacy of pipettes.

Table 75: Pearson's correlation coefficient-r between availability of litmus paper and performance

Statistical measure	Availability score, X	Performance score, Y
Mean	4.7714	3.6944
$\Sigma(X-X)^2$	1.1263	
$\Sigma(y-y)^2$		14.0367
Σxy	-0.0824	
Pearson's- r	-0.0207	

Table 75 shows that the availability of this item was negatively correlated with the students' performance in mathematics and sciences. This means that those schools that had enough litmus papers also did poorly in KCSE.

Table 76: Pearson's correlation coefficient-r between availability of centrifuge and performance

Statistical measure	Availability score, X	Performance score, Y
Mean	1.4	3.6944
$\Sigma(X-X)^2$	2.8	
$\Sigma(y-y)^2$		14.0367
Σxy	2.7989	
Pearson's- r	0.4465	

Availability of centrifuges was positively correlated with the students' performance in mathematics and sciences. The Pearson's coefficient was 0.4465. School 4 which scored highly on this item also performed well in KCSE when compared to schools 1, 3, 5, and 6 which lacked the item.

The study also sought to determine the level of availability of lenses in the schools. Pearson's coefficient was calculated for this item. The results of this analysis are presented in table 77. As can be seen from the table there was a correlation between the availability of stop watches and students' performance in mathematics and sciences.

Table 77: Pearson's correlation coefficient-r between availability of stop watches and performance

Statistical measure	Availability score, X	Performance score, Y
Mean	3.7571	3.6944
$\Sigma(X-X)^2$	1.6973	
$\Sigma(y-y)^2$		14.0367
Σxy	2.6426	
Pearson's- r	0.3513	

The correlation coefficient between these two variables was 0.3513. This implies that the higher the number of watches a school had, the better the performance.

Analysis was also done on the availability of measuring scales in the sampled schools. The results are presented in table 78.

Table 78: Pearson's correlation coefficient-r between availability of measuring scales and performance

Statistical measure	Availability score, X	Performance score, Y
Mean	3.2286	3.6944
$\Sigma(X - X)^2$	3.7943	
$\Sigma(y - y)^2$		14.0367
Σxy	4.8183	
Pearson's- r	0.6602	

From table 78, it is evident that the availability of measuring cylinders was positively related to the students' performance in mathematics and sciences. The Pearson's coefficient was 0.6602. This indicates that the students' performance was influenced by the availability of measuring scales within the school, and that the higher the level of availability of the measuring scales, the better the students' performance in mathematics and sciences.

The study also sought to determine the level of availability of teachers' guides and the students' performance in mathematics and sciences. The results of the analysis are shown in table 79.

Table 79: Pearson's correlation coefficient-r between availability of teachers' guides and performance

Statistical measure	Availability score, X	Performance score, Y
Mean	3.3286	3.6944
$\Sigma(X - X)^2$	9.6542	
$\Sigma(y - y)^2$		14.0367
Σxy	7.1463	
Pearson's- r	0.6139	

The results of the analysis on the availability of teachers' guides and students' performance show that there was a positive correlation of 0.6239 between performance and availability of guides. This implies that those schools where teachers had adequate teachers' guides performed better than those that had shortage of this item.

On the overall, there was a positive correlation between students' performance in mathematics and sciences and the level of availability of the teaching and learning materials within the school. This implies that those schools that had a higher level of availabiiity of teaching and learning facilities performed better than those that had lower levels of availability. Therefore, the answer to the research question was that there was a relationship between the availability of teaching and learning facilities and students' performance in mathematics and sciences.

These findings are in agreement with those of Yator (2003), who in a study of Baringo district found that the availability of such facilities as textbooks, charts, maps and atlases influenced students' performance in KCSE. Njuguna (2004) in a study of Thika district also found that students' performance was related to the availability of the teaching and learning resources.

4.4: Brief summary of the chapter.

This chapter attempted to establish if there was a relationship between students' performance and the variables under study. The results of the findings indicated that:

- The study found that physical facilities affected performance of students in KCSE. Schools that had adequate physical facilities recorded better performance than those that didn't have.
- The study established that the students' socio-economic background was related to the students' performance In KCSE. Those schools that had students whose parents paid fees *promptly and who* were able to supplement the teaching and learning resources supplied by the school performed better than their colleagues from poor backgrounds.
- The study found that the availability of mathematics and science teachers was strongly related to the students' performance in mathematics and sciences in KCSE. Those schools that had adequate teachers performed better than those that had fewer teachers handling many classes.
- The study found that there was a positive correlation between the teachers' academic and professional qualifications. Those teachers that

had higher qualifications taught students who performed better than those of their lesser qualified colleagues.

- The study found that the teachers' experience and teachers' age were negatively correlated with the students' performance. Those students that were taught by young teachers performed better than their counterparts who had elderly teachers.
- The study found that there was a relationship between the performance of the student and the availability of teaching and learning resources. Those schools that had high levels of availability of teaching and learning resources performed better than those that had shortage of these resources.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter consists of the following sections: summary of the research study, conclusions of the study, recommendations and suggestions for further research.

5.1 Summary of the study

The purpose of this study was to find out the factors that influence students' performance in mathematics and sciences in KCSE examination in public secondary schools in Igoji division of Meru central district. The information for this study was solicited from a random sample of mathematics and science teachers and seven head teachers from all the seven public secondary schools in Igoji division.

Using the survey method and the research questions described in detail in chapter three as a guide, two sets of questionnaires were developed: one for the head teachers and another for the mathematics and science teachers, and an observation schedule to collect data from 33 mathematics and science teachers and seven head teachers from the seven public secondary schools in Igoji division. The data gathered was then analyzed. Profile plots, comparative bar charts and pie charts were generated. Cross tabulation, and Pearson's product moment correlation coefficient, were used to establish whether relationships

existed between performance in mathematics and sciences and the variables under study. The main findings of the study were:

5.1.1 Physical facilities

The study established that 14.29% had adequate laboratory, while 28.57% did not have a laboratory facility. Only 42.86% of the schools had a library facility, which was inadequate. 57.14% of the schools had adequate playgrounds, while a similar number didn't have any. All the studied schools had adequate classrooms while 57.14% lacked a dining hall and reservoirs. The study also found that dormitories were inadequate in 41.86% of the schools.

5.1.2 Socio-economic status

According to the study, 71.43% of the head teachers rated average parents' participation in paying fees, buy books for their children and support school projects. 14.29% of the head teachers rated as good parents' participation in supporting school projects and in providing basic necessities for their students. On payment of fees, 75.75% of the teachers rated the parents as poor.

5.1.3 Availability of teachers

Majority of the head teachers viewed the mathematics and science teachers as adequate. Only physics was indicated as being overstaffed by 14.29% of the head teachers. On teachers' workload, 48.48% of the sampled teachers taught 21-25 Lessons per week. The average number of students' per practical group was 6 students in the three sciences: physics, chemistry and biology.

5.1.4: Characteristics of mathematics and science teachers

70% of the teachers had a first degree while their counterparts, who comprised 30% of the sampled teachers, had diploma certificates. Out of those who had a bachelor degree, 21 had bachelor of education degree, while 2 had Bachelor of Science degree.

5.1.5: Availability of teaching and learning resources

Most of the schools had a textbook to student ratio of 1:4 in mathematics. Those schools that performed poorly had a textbook to student ratio of 1:5 and above. Only two schools recorded 100% adequacy of calculators. One school had 100% adequacy of mathematics tables. 57.58% of the schools had inadequate models, and one recorded 100% adequacy of common laboratory reagents. 81.82% had adequate measuring cylinders and 57.58% lacked a gold leaf electroscope.

5.2: Conclusions of the study

This study investigated the patterns of resource allocation and their impact on students' performance in mathematics and sciences in KCSE in public schools located within Igoji division. The resources that were studied were: physical, fiscal and human resources. This section of the report presents some of the key conclusions of the findings. The following conclusions were arrived at within the framework of the limitations of the study.

5.2.1: Availability of physical facilities

It was found that the level of availability of physical facilities such as laboratories, libraries, classrooms, dormitories, water reservoirs, playing fields, ablution blocks and dining halls either enhanced or hindered performance in mathematics and sciences. High levels of availability of these facilities gave rise to good performance, whereas low level of availability led to diminished performance in these subjects. Those schools that had a comfortable and spacious dining hall, adequate laboratories, adequate play grounds, adequate water storage facilities, a library and dormitories that were not congested performed better than those schools that lacked these physical facilities.

5.2.2 Socio-economic status

It was found that the schools where parents had high levels of participation performed better than those schools where the level of participation was low. Parents who paid school fees promptly helped save time for their children who would otherwise be sent home to collect school fees hence losing valuable class time. Those students who were in schools where parents provided funds for educational trips did comparatively better than those whose parents had lower levels of participation.

Schools that had parents who had high levels of participation in supporting school projects also performed better than those that ranked parents' participation as low.

5.2.3 Availability of teachers

Those schools that had a number of six students per practical group during science lessons performed relatively better than the other schools which had more students per practical. This implies that when many students were working on a single apparatus, they learnt little less than those who were fewer per practical group. Schools which had high numbers of mathematics and science teachers, hence lower teacher to students' ratio outperformed those that had fewer mathematics and science teachers. Also, those schools that had teachers handling many lessons did not perform as well as those with teachers having a moderate number of lessons.

5.2.4: Characteristics of mathematics and science teachers

Students who were taught by teachers with professional qualifications: bachelor of education and diploma in education performed better than those taught by Bachelor of Science graduates. Teachers who had an average teaching experience of less than 5 years as well as those with more than 8 years of service taught in those schools that were not performing well compared to their colleagues with a teaching experience of 6-8 years who taught in schools that performed relatively better.

5.2.5: Availability of teaching and learning resources

Schools that had high levels of adequacy of teaching and learning resources performed better than those that had inadequate resources. Schools 2 and 4, which had satisfactory and good performance, had both got high levels of

availability of teaching and learning resources as compared to the other schools studied. This indicated that performance in mathematics and sciences was correlated with the availability of teaching and learning resources.

5.3 Recommendations

In order for schools to improve their performance in mathematics and sciences, the following measures ought to be instituted:

1. Educational authorities need to be in the forefront to ensure that those schools that are being registered as new schools have the basic physical facilities, teaching and learning resources as well as qualified human resources before they are registered.

2. Teachers who have taught for many years should be encouraged to keep on updating themselves academically so as to be well versed in the new developments in their fields of specializations.

3. Schools should devise methods of fund raising so that those facilities that are existing within them can be upgraded while those that are lacking can be provided.

5.4 Suggestions for further research.

The researcher recommends that:

(a) A similar study can be replicated on a larger sample. The sample could be drawn from other parts of Meru district or from other districts that were geographically different altogether.

(b) A similar study can be done in single sex schools to determine the relationship between the gender of the learner and the variables under study.

(c) Another study can be done having both private and public secondary schools so as to determine the nature of resource allocation between the two sets of schools.

(d) A similar study can be done using qualitative data gathering methods such as the interview method.

(e) A similar study can be done but this time with the students as the main respondents.

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APPENDIX 1

HEAD TEACHERS' QUESTIONNAIRE

PART A

BACKGROUND INFORMATION

Please complete the following questions by filling in the appropriate answers in the spaces provided. Put a tick [✓] where necessary. The information provided to the researcher through this questionnaire shall be kept confidential and shall only be used for the purposes of this research only as promised in the letter of introduction.

(1) Your gender is

(a) Male [ ]

(b) Female [ ]

(2) What is your highest professional qualification?

(a) A-level [ ]

(b) Diploma [ ]

(c) Degree [ ]

(a) M.Ed [ ]

(b) M.Sc [ ]

(c) PhD [ ]

(d) Other, (specify). _____

(3) Your age is

(a) 31 – 35 years [ ]

(b) 36 – 40 years [ ]

(c) 41 – 45 years [ ]

(d) 46 – 50 years [ ]

(e) 51 – 55 years [ ]

(4) Please indicate the category of your school

(a) Provincial Girls boarding [ ]

(b) Provincial Boys boarding [ ]

(c) Provincial mixed boarding [ ]

(d) District Girls boarding [ ]

(e) District Boys boarding [ ]

(f) District mixed boarding [ ]

(e) Any other, (specify)_____

PART B:

HUMAN RESOURCES

(5) Please fill the following table by indicating the number of teachers in your school teaching the following combinations.

Subject combination	**Number**
Mathematics and Physics	
Mathematics and Chemistry	
Mathematics and Biology	
Physics and Chemistry	
Physics and Biology	
Chemistry and Biology	
Biology and agriculture	
Mathematics and Drawing and Design	
Any other combination with mathematics or science subjects	

(6) Please indicate the average number of lessons per week for each with the teachers in the following subject combinations.

Subject combination	Number of lessons per week
Mathematics and Physics	
Mathematics and Chemistry	
Mathematics and Biology	
Physics and Chemistry	
Physics and Biology	
Chemistry and Biology	
Biology and agriculture	
Mathematics and Drawing and Design	
Any other combination with mathematics or science subjects	

(7) In your opinion, does availability of teachers influence students' performance in mathematics and sciences in KCSE? Please explain your answer

_____

_____

(8) Indicate the teacher to pupil ratio in your school for the following subjects.

	Teacher to student ratio				
	1:10	1:20	1:30	1:40	Above 1:40
Mathematics					
Physics					
Chemistry					
Biology					

(9) Indicate the level of adequacy of the following categories of teachers in your school

	Overstaffed	Adequate	Inadequate
Mathematics			
Physics			
Chemistry			
Biology			

PART C
TEACHING AND LEARNING RESOURCES AND PHYSICAL FACILITIES

(10) Indicate the level of adequacy of the teaching and learning resources in the following subjects in your school

SUBJECT	ADEQUATE	INADEQUATE	NOT AVAILABLE
MATHEMATICS			
PHYSICS			
CHEMISTRY			
BIOLOGY			

(11) What is the level of adequacy of the following facilities in the school?

	Adequate	Inadequate	Not available
Science laboratory			
Playing fields			
Dining hall and kitchen			
Library			

PART D

INFROMATION ON STUDENTS

(12) Please indicate the number of students per class in your school

	No. of boys	No. of girls	No. of streams
Form 1			
Form 2			
Form 3			
Form 4			

(13) How many students take the following subjects in form 4?

a. Physics _____

b. Biology _____

c. Chemistry _____

(14) What is the level of participation of parents in the following table:

	Good	Average	Poor
Payment of fees			
Buying of reference materials			
Providing funds for educational trips			
Supporting school projects			
Providing with basic necessities			

APPENDIX 2

QUESTIONNAIRE FOR THE MATHEMATICS AND SCIENCE TEACHERS

This questionnaire is for research purposes only as explained in the letter of introduction. Please put a tick (✓) or fill in the information as your response to all the following questions. Do not include your name anywhere on this paper.

PART A: BACKGROUND INFORMATION

(1) You are

(a) Male [ ]

(b) Female [ ]

(2) Your age is

(a) Less than 30 years [ ]

(b) 30-40 years [ ]

(c) 41-50 years [ ]

(d) Over 50 years [ ]

(3) Your present highest academic qualification is;

(a) Degree [ ]

(b) Diploma [ ]

(c) A-level [ ]

(d) O-level [ ]

(e) Other, (specify)_____

(4) Indicate your present professional qualification;

(a) Diploma [ ]

(b) B.sc [ ]

(c) B.ed [ ]

(d) M.sc [ ]

(e) Med [ ]

(f) PhD [ ]

(g) Other, (specify)_____

(5) What is your current position in the school?

(a) Head of department [ ]

(b) Class teacher [ ]

(c) Other, (specify)_____

(6) How long have you served in this position? _____

(7a) Have you attended any in-service course in the last six months?

(a) Yes [ ]

(b) No [ ]

(b) If your answer to 7a above is yes, please give details_____

_____

(8) How many years have you served in the current working station?

(a) Less than 5 [ ]

(b) 5-10 [ ]

(c) More than 10 [ ]

PART B: INFORMATION ABOUT THE WORKING LOAD AND THE SCHOOL

(9) How many lessons do you teach in a week?

(a) 10-15 [ ]

(b) 16- 20 [ ]

(c) 21-25 [ ]

(d) 26-30 [ ]

(e) 31 and above [ ]

(10a) Do you teach extra time?

(a) Yes [ ]

(b) No [ ]

(b) If your answer to number 10a above is yes, please give details.

_____

_____

(11) What is the average number of students in your classes?

(a) Less than twenty [ ]

(b) 20-30 [ ]

(c) 31-40 [ ]

(d) 41-50 [ ]

(e) Above 50 [ ]

(12) During practical lessons (science), what is the average number of students per group? _____

(13) How many times do you evaluate your students?

	Mathematics	Physics	Chemistry	Biology
Per Week				
Per Month				
Per Term				

14 (a) Do you usually teach after 4.00 pm or during weekends?

Yes [ ] No [ ]

(b) If your answer to 14a above is Yes, approximately how many extra hours do you teach?_____

PART C: TEACHING AND LEARNING RESOURCES

(15) Please fill the following table indicating the textbook to student ratio for the following subjects that you teach.

	TEXTBOOK TO STUDENT RATIO				
	1:2	1:3	1:4	1:5	Above1: 5
Mathematics					
Physics					
Chemistry					
Biology					

(16) What is the level of availability of the following learning resources amongst your students?

Item	Adequate	Inadequate	Unavailable
Calculators			
Mathematical tables			
Personal reference books			
Students personal files			

(17) How often are your classes interrupted when students are sent home for school fees?

(a) Very often [ ]

(b) Rarely [ ]

(c) Never [ ]

(18) The following table shows some of the items needed for proper teaching and learning of mathematics and sciences please fill it.

Item	Adequate	Inadequate	Not available
Teachers' guides			
Models			
Charts			
Common laboratory reagents			
Measuring cylinders			
Gold leaf electroscope			
Bunsen burners			
Microscopes			
Test tubes			
Pipettes			
Litmus paper			
Centrifuge			
Lenses			
Stop clocks/ watches			
Measuring scales			

APPENDIX 3

OBSERVATION SCHEDULE

1) Number of classes in the school_____

2) Physical appearance of the classrooms_____

3)

Facility	Availability			Condition		
	Adequate	Inadequate	Unavailable	Good	Fair	Poor
Laboratory						
Library						
Pupils' desks						
Ventilation in classrooms						
Lighting in classrooms						
Chalk boards						
Play grounds						
Dormitories						
Water reservoirs						
Ablution blocks						
Dining hall						