# FACTORS AFFECTING PERFORMANCE IN SCIENCES IN ONGATA RONGAI DIVISION, KAJIADO NORTH DISTRICT

BY

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## DECLARATION

This Research project report is my original work and has not been presented for a degree in any other institution for examination.

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The Research project report has been submitted for examination with my approval as University Supervisor.

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## DEDICATION

I would like to dedicate this work to my loving and caring family members who have tirelessly supported me this far. I appreciate their prayers for me throughout my research and course work. I also dedicate this achievement to my dear uncle, David Gitogo and his wife Emily Muthoni for their generous financial support and encouragement.

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## ABSTRACT

Studentsô performance in science subjects in Ongata Rongai division has continued to be poor despite the rationale of teaching sciences and efforts made by various educational stakeholders to improve the studentsô performance in the subjects. The factors causing this poor performance are not clearly known. It is on this basis that the research topic was chosen to help identify the factors influencing the studentsô poor performance in sciences in Ongata Rongai division, so that necessary measures can be taken to improve the studentsô performance in the subjects.

The factors investigated in this study are the studentsô attitude towards sciences, the science teachersô qualifications, availability and use of science teaching and learning resources, the methods of teaching used, studentsô discipline, student ambitions, absenteeism and the relationship between studentsô performance in sciences and mathematics.

Stratified sampling was used to select the schools to constitute the sample. Thus, three strata were used: a boyôs boarding public school, mixed public schools and mixed private schools. To select the school from the division, simple random sampling was used using lottery technique.

One science teacher participated from each selected schools, simple random sampling by the lottery technique was used to select ten form four students from each of the six sampled schools.

Information was collected from the sample by administering questionnaires. The questionnaires were administered with the help of the science teachers in the sampled schools.

Tables and charts were used to organize and summarize the data collected. It was then analyzed and interpreted using descriptive statistics.

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## ACRONYMS

**K.N.E.C** Kenya National Examination Council

**JICA** Japan International Cooperation Agency

**K.C.S.E** Kenya Certificate of Secondary Education

**K.C.P.E** Kenya Certificate of Primary Education

**K.L.B** Kenya Literature Bureau

**IQ** Intelligence Quotient

**STAR** Student/Teacher Achievement Ratio

**CSR** Class Size Reduction

**STVE** Science and Technology in Vocational Education

**CDF** Constituency Development Fund

**QASO** Quality Assurance and Standard Organization

**MSS** Mean Standard Score

**MAST** Mathematics Skill Tests

**ICT** Information, Communication and Technology

**SMASSE** Strengthening Mathematics and Science for SecondaryEducation

# CHAPTER ONE

## INTRODUCTION

### 1.1 BACKGROUND OF THE STUDY

Science subjects like chemistry, physics and biology are very important in the society. In Kenya a lot of emphasis has been put on sciences. The 8-4-4 system of education is a way of preparing pupils for the world of science and technology. Chemistry for instance is very useful because most of the things we use in our daily life like iron sheets and steel products, ceramics, cements, fertilizers, detergents, medicines etc are very different from the materials which are an obvious part of our surroundings.

Practically everything we use has been transformed from a natural state of little or no utility to one of very different appearance and much greater utility. The process by which natural materials are transformed and a detailed description of such changes is what science is all about.

An understanding of the environment and the changes which are possible in it is an indispensable goal in education. Such an understanding is necessary if the consequences of our actions on the environment are to be known. Since life involves very small parts working and fitting together in sequences of changes, everyone has a personal reason for valuing knowledge of such process.

Being practical oriented subjects, sciences require certain facilities as part of the ordinary tools available to facilitate the teaching and learning. The facilities include laboratory chemicals and apparatus, botanical gardens, school museum, text books and qualified teachers.

Sciences require a lot of concepts and thus it can be problematic to students if facilities lack or are not properly utilized and if teacher does not simplify the context and make the subject interesting.

In the process of a studentôs effort to understand the processes involved in sciences well, it is necessary for him to go through a sequential learning process, i.e. the student has to have a clear understanding of the basic science principles and concepts which are done at secondary school level before he/she can proceed to higher levels of learning like universities or technical institutions.

The general objectives of teaching sciences are:

1. Select and handle appropriate apparatus for use in experimental work
2. Make accurate measurements, observations and draw logical conclusions from experiments.
3. Observe and appreciate the need for safety precautions during experimental investigations.
4. Understand and appreciate the use of chemical symbols and formulae in writing equations.
5. Use appropriate scientific terms and language in describing physical and chemical processes
6. Identify patterns in the physical and chemical behavior of substances.
7. Apply the knowledge and skills acquired to solve problems in everyday life
8. Apply principle and skills for technological and industrial development
9. Acquire adequate knowledge in sciences for further education and for training.
10. Apply the knowledge acquired to promote environmental and health practices.

Therefore, to evaluate whether students have learnt the basic science principles and concepts in preparation for higher skills, students are examined by the Kenya National Examination Council-K.N.E.C. For instance to study Medicine in university, students should work hard in sciences.

According to the current secondary school curriculum, among the three science subjects: Chemistry, Biology and Physics, a student is supposed to select any two of the sciences or all the three depending on the studentôs ability and interests. However, in most secondary schools in Ongata Rongai division, the school administrators have made chemistry compulsory alongside mathematics, English and Kiswahili.

Thus, a student is left to make a choice between Biology and Physics or both in addition to Chemistry. It is the head teacher of the school who is responsible for this situation because one of the head teacherôs roles is to interpret the curriculum to his staff, students and the community. [Ministry of Education Science and Technology-2003]

## 1.2 Statement of the problem

Academic achievement in Kenya is established through examinations, which consist of set questions that seek to determine how much an individual perceives the subject as a result of learning. Commendable performance is an indication of effective learning.

Science subjects in conjunction with mathematics work hand in hand in preparing students for various important career opportunities like medicine, chemical engineering, teaching sciences e.t.c. various educational stakeholders like the ministry of education science and technology, parents, teachers, Non-Governmental Organization like Japanese International Cooperation Agency- JICA, have tried to address issues related to teaching and learning of sciences and mathematics e.g reducing the content in the syllabus, organizing in-service program for sciences and mathematics for example, SMASSE [Strengthening Mathematics and Sciences for Secondary Education] program sponsored by JICA.

Despite the rationale for teaching sciences and efforts made to improve performance by student in the sciences, the performance by many students in most schools in Ongata Rongai division has continued to be poor. This performance is attributed to factors which are not clearly known and such the problem of poor performance in sciences will persist with its adverse consequences on the students in the future.

The aim of this research is to identify and discuss the factors that influence the performance of students in sciences in K.C.S.E examination in selected secondary schools in Ongata Rongai division.

## 1.3: Purpose and objectives of the study

### 1.3.1 Purpose of the study

The main purpose of this study is to identify and analyze some of the factors influencing studentsô poor performance in science subject in Ongata Rongai division, Kajiando North district

### 1.3.2 Objectives of the study

The following are the major objectives of this study:

1. To find out the studentsô attitude towards sciences in Ongata Rongai division.
2. To investigate the science teachers qualifications in Ongata Rongai division.
3. To analyze the availability and use of science teaching and learning resources in Ongata Rongai division.
4. To identify the teaching methods used in sciences in Ongata Rongai division.
5. To determine the relationship between studentsô performance in mathematics and their performance in sciences in Ongata Rongai division.
6. To determine whether absenteeism affects performance in sciences Ongata Rongai division.
7. To find out whether indiscipline affects studentsô performance in sciences Ongata Rongai division.

## 1.4 Research questions

1. In Ongata Rongai, is the student attitude towards sciences positive or negative?
2. Do teachersô academic and professional qualifications as well as teaching experience affect studentsôperformance in Ongata Rongai division?
3. Does the availability and use of science facilities such as libraries, laboratories, science equipment, models and teaching aids as well as human resources such as laboratory assistant and heads of science department affect studentsôperformance in Ongata Rongai division?
4. Among the methods of teaching science like lecture, teacher demonstrations, class experiments, outdoor activities and trips, which ones are preferred by teachers in Ongata Rongai division?
5. Does the studentsôperformance in mathematics affect their performance in sciences?
6. Does absenteeism affect student performance in sciences?
7. Does student indiscipline influence student performance in sciences?

## 1.5 Limitations of the study

There could be many factors that are possibly influencing the performance in sciences by students in Ongata Rongai division. All these factors cannot be researched on because of various limitations such as:

1. Inadequate time available to exhaust their study.
2. Financial constraints. Inadequate funding will also necessitate the use of a small sample size especially the number of students per class from the schools sampled in responding to the researcherôs questionnaires.
3. On-going teachers strike in public schools at the time of study.

## 1.6 Delimitations of the study

1. The research involved administering of teachersô questionnaires to science teachers although other related areas like mathematics would have yielded useful information.
2. The study focused on both public and private school. Public schools have been in existence for long and are government funded. They are likely to yield more consistent results. This enabled in drawing a precise conclusion after comparing their finding with those of private secondary schools.
3. The students and teachers included in the sample were those in session in the respective institutions by the time of the study. Those absent were not included in the sample even though they could have had important input.
4. Prior arrangements with the school management from the sampled schools were made to avoid inconveniences especially during the teachers strike.

## 1.7 Assumption of the study

In the study four main assumptions were made:

1. The sample population of the school, science teachers and students were a representative of the entire population of all the schools, science teachers and students taking sciences in the division.
2. All the respondent gave honest and accurate information
3. The quality of graduate teachers from different training institutions of the same level, for example, university is the same.
4. Selecting student in form four to constitute the sample was based on the assumption that they have enough experience in terms of subject content and they are mature enough to portray relatively accurate research findings.

## 1.8 Significance of the study

By identifying and analyzing the factors affecting performance in sciences in Ongata Rongai division, teachers and other educational stakeholders like students, their parents and school managers can be made aware of the problems affecting performance in sciences in Ongata Rongai division.

This will lead to seeking and formulating measures that can be undertaken by these educational stakeholders to control the factors influencing performance in sciences by either eliminating them completely or reducing them so that performances in sciences can be improved.

For instance, the findings will facilitate decisions that need to be made concerning regular in-service of teachers to enable them to handle the teaching of sciences competently and with confidence.

The finding will also serve as a basis for further research in sciences. The findings will also help teacher training institutions to design their training programs with a view of producing better teachers.

Finally, the findings will reveal the role that school administrators especially head teachers and head of departments are supposed to play to improve studentsôperformances in sciences.

## 1.9 Theoretical framework

Jerome Brunner [1960] focuses the teaching of subjectsôconcept in a relaxed manner rather than teaching isolated concepts and facts should be related to generalization and that they should be used in problem solving. The notion that structures could be identified in subjects of instruction and that, facts as well as concepts were related within the structure was given prominence. At the same time, the notion of structure had other benefits too. It gave more assurance of transfer enhanced comprehension of subjects and facilitated recall. This is why there has been interest by curriculum specialists and other educationists to pursue this notion advanced by Brunner.

For instance, once a student grasps the ideas embodied by the basic fundamental mathematics skills in mathematics like multiplication and division of large numbers, he/she is in a better

position to recognize that ónewô similar mathematical skills are not new at all, but variant in a familiar theme. Whether the student knows the formal names of these operations is less important for transfer than whether he/she is able to use them.

Another important theory in this study is Skinners theory of motivation. Skinner came up with a motivation theory of learning whose central argument was that studentsô motivation to undertake a task depends on expected reward. In this regard, a positive perceived reward induces positive motivation and subsequently realizes high achievement. It is also implicit that studentsô high performance is influenced by the teaching experiences of the teacher, available instructional resources and the teaching strategies. The interaction strategies will translate into studentsô high performance.

### 1.10 Conceptual framework

The conceptual framework of factors influencing studentsô performance in science subjects and mathematics includes:

- The type of school
- Student characteristics
- School resources
- Teacher characteristics

The four composite variables i.e. type of school, school resources, teachers and students characteristics influences on studentsô performance in science subjects. The two composite variables i.e. the type of school [whether it is national, provincial, district, day or boarding] and the school resources [laboratory, library, textbooks and specimen], have a direct impact on the student and teacher characteristics. In other words, the type of school and school resources determine the type of teaching experiences and motivation, and this in turn, has an impact on the student characteristics. The interplay of the various studentsô characteristics [gender, attitudes towards sciences and the mathematics, entering behavior in terms of K.C.P.E grades, and the socio-economic status of the student.] eventually determine the quality of performance and achievement in science subjects.

## 1.11 Operational Definitions of Terms

- **Attitude**: will refer to the feelings students have towards sciences
- **Examinations**: will refer to the action of testing or judging by a standard knowledge based on experience. It is the process of testing knowledge or ability by written questions or experimental methods.
- **Laboratory**: will refer to the room in a school equipped with apparatus, chemicals and facilities where science experiments are carried out.
- **Performance**: will refer to the marks obtained in a subject such as chemistry, biology examination expressed in percentages.
- **Practical**: will refer to a teaching/learning approach that stresses the importance of observation and the use of senses in obtaining scientific knowledge. In this method the learners are active participants in the learning process. They manipulate the learning materials and equipment.
- **Teaching experience**: will refer to the number of years a teacher has taught at secondary school level.
- **Theory**: will refer to the teaching/learning which provides a kind of speculative examination, inquiry based on general principles of definitions proceeding to the interpretations in the light of these general ideas. It ignores the use of observation or the use of senses in obtaining scientific knowledge.
- **Discipline:** will refer to the ability to control oneôs behavior or the way one live and work.
- **Resources**: will refer to something that can be used to help achieve an aim especially books, equipment e.t.c.
- **Facilities**: will refer to buildings, equipments, services e.t.c. that are provided for a particular purpose.
- **In-service courses**: will refer to training or courses of study done while someone is still working in a job, in order to learn new skills.
- **Science**: will refer to the three branches of science i.e. physics, chemistry and biology

# CHAPTER TWO

## LITERATURE REVIEW

## 2.1 Introduction

The development of any nation or community depends on the quality of education of such a nation. It is generally believed that the basis of any true development must commence with the development of human resources (Akale, 2007). Hence formal education remains the vehicle for socio-economic development and social mobilization in any society.

Given the importance of education to development, why then is it not taken seriously as indicated by low pass rates? What then determine academic performance of secondary school students? Well, in factual context, many ideas come to our mind if we think why some student performs better than others: is it because they study more? Do they have a higher capacity to learn? Does the personal background, say of life and environment of the student favor his/her performance?

Most programs undertaken to improve educational efficiency in developing countries focuses on changing the educational system itself (Harbison and Hanushek, 1993). Policy planners generally recommend revising the curriculum, increasing the number of schools, and distributing educational material more widely and equitably.

At this standard course of action is not based on empirical data; it overlooks the role of family and personal factors in shaping the academic trajectory of students. Gender and nutritional status of the child and educational level of the parents have also been shown to influence school performance (Harbinson and Hanushek 1993; Lockheed and Verspoor 1992), as has preschool cognitive abilities, a finding from a study of school children in rural Guatemala (Goman and Pollitt 1993.). Of particular importance is that some of these non-educational influences may also be changed through reasonable governmental policies.

Any factor that hinders good performance in sciences will always be of great concern to educational stakeholders because sciences are concerned with ideas relating to the behavior of matter. Although some of these are abstract, their application has had a concrete impact on human life generally manôs environment. (Hein, 1986)

Thus there will always be efforts made to try and emphasize main purpose of including sciences in the school curriculum, i.e. the training of scientific methods and procedures for student to be able to have skills of following a sequential order of steps in solving problems not only in the area of science but also in solving social problems. And to achieve this, any constraints in the process must be identified first and then means to eliminate or reduce them sought.

It is especially important that special reference be made to the status of educational technology in developing countries like Kenya because most schools and colleges in these countries are poorly equipped, both in terms of physical facilities and in terms of the quality of teachers, (Rao, 1975).

**2.2 Students attitude towards science and their performance in sciences**

Teachers and learners generally perceive science to be difficult. Many teachers morale is low because they are overworked and paid poor salaries. Teaching science requires more input than other subjects because the teacher has to prepare for practical work and to care for equipment and the laboratory, yet the same number of periods and classes as teachers of other subjects

It is widely considered that science is alien to many third world pupils. This has been attributed to inadequate perceptions of science and to the difference between school and local knowledge. There are numerous gaps in the perception of science traditional ideas and skills-learning among adults and children. Once the excitement that surrounds the release of Kenya Certificate of Secondary Education (K.C.S.E) results has subsided, it leaves teachers and student in rural areas a dejected lot.

Except for a few of the schools, K.C.S.E performance in science subjects is usually unimpressive. As a result, parents accuse school heads and teachers of incompetence, laxity and for letting them down.

It is important to note that most teachers in district and rural schools are as hardworking and committed as urban, provincial and national ones. Many students who join the schools failed in their Kenya Certificate of Primary Education (K.C.P.E) examination and were unable to join their preferred provincial and district schools.

The students go to school with a negative attitude and are a big challenge to teachers and administrators. Girls in mixed schools fare worse in sciences due to gender stereotyping in sciences and mathematics. Each year, once the K.C.S.E examination results are announced, the gap between the two genders in science and mathematics is always a hot debate, as leaders and educationist lament the poor result in the subjects. Poor results in science subjects by girls may be attributed to gender polarization and perception towards the subjects. ñGirls are expected to be passive and subjective, and more interested in people than ideasò (Helen, 2010).

At the same time, girls have consistently perceived that mathematics and science subjects are not of much use in their future careers. Apparently, they have increasingly shown a more negative attitude towards science and mathematics.

The role of gender stereotyping, is mostly observed when boys and girls learn together in mixed schools. In such scenarios, there is a clear relationship between gender versus student performance and subject preferences. In mixed schools, boys outperform girls in sciences and mathematics. On the other hand, girls in single-sex schools performed better in the subjects than mixed-sex schools.

It can also be noted that in single-sex girlsôschools, the mathematics and science classes are livelier, more cooperative, and that the students have a better working relationship. Thus, it would seem, girls in mixed-sex schools suffer the negative influence of gender stereotyping, which is hypothesized to influence their performance.

Girls in mixed-sex schools report feeling uncomfortable in the masculine environment, and adopt a passive role in class, fearing ridicule for giving wrong answers and asking inappropriate questions. Girls feel that teachers may be insulting and humiliating them or that teachers do little to prevent boys from misbehaving in class**.**

Every student has a favorite subject. It is also true that students have some subjects they feel are just meant to give them a hard time, given a chance, they would not hesitate to scrap the offending subject from the curriculum.

There are many reasons why a student would hate a subject, the major ones being a teachers approach to teaching and learning, the learners natural abilities, discouragement or encouragement from parents and former students, or just baseless myths. As many students progress in their school lives, their dislike for certain subjects becomes more intense as the exposure to more knowledge in the subject increases.

The self-defeating attitude of hating a particular subject can haunt a student for years. Many students find themselves trapped when they have to miss a chance to pursue a career of choice because of their dismal performance in a loathed subject.

### 2.3 Science Teachers' Qualifications and Students' Performance in Sciences

Some science topics are not only considered difficult to teach but also lead, by their nature , to different opinions on how they should be presented to students, and only a competent, well trained science teacher can teach such topics effectively, (Guilleman and Laffite, 1981)

Sciences involve the use of many theories. Only a competent trained teacher will understand that the test of a theory is that it should lead to correct predictions than rival other theories. A quality and a trained science teacher contribute positively to effective teaching-learning process by easily overcoming the major problems of any science teacher (Richard, 1975).

Some of the major problems of any science teacher include; the sequence of the subject content to be followed, what to do with science related courses, what to do with college entrance examinations, how to teach and allow pupils to learn with ósense of discoveryô or appreciation and insight, how to keep himself/herself informed about new books and teaching materials, e.t.c

Regular in-service courses are very essential for teachers to equip them with the most current and relevant science skills, sciences being a wide dynamic area of knowledge. It is especially useful for secondary school teachers among them science teachers to receive some guidance in what

this entails and how to humanize their science teaching for better understanding of the subject matter by the students, (Newton, 1988).

It is important to note that the smaller the pupil-teacher ratio, the higher the annual cost per pupil and in most cases most schools have high pupil-teacher ratio due to the cost involved in training quality teachers, (Pumfrey, 1991).

### 2.4 Inadequacy and use of science teaching and learning resources and students performance in sciences:

Financial constraints are evident in many schools, and finance to a great extent controls the amount and quality of the equipment for any science laboratory, (Archenhold, Jenkins, Wood-Robinson, 1978). Thus the cheap equipment is not always cheap in the long term policy. For instance, some commercial chemicals may be cheap, but for most experimental purposes in any laboratory are useless or they can be dangerous.

The higher pupil-teacher ratio together with lack of adequate facilities for effective science teaching-learning process in most schools offering the subjects means that the teachers are overworked. Due to this, many teachers and head teachers are currently recognizing the attraction of mixed ability grouping in their secondary schools which has a negative implication especially for the progress of the very bright pupils, (Harper and Row, 1975) the biggest difficulty to the science teacher is the provision for the most able children. It is very easy to drift them along producing excellent work and results on the basic materials but not at the same time being fully extended considering the wide nature of the science knowledge area.

It is quiet necessary to have well equipped science laboratories i.e. with adequate facilities because practical in science involve either teacher demonstrations or class experiments where the pupils perform the experiments or class activities. Class experiments are better than other practical because the pupils develop manipulative skills better, (Wachang, 1991)

Apart from the laboratory equipment, finance also control the availability of the relevant and appropriate science teaching and learning materials e.g. science textbooks, commercial models for teaching abstract concepts, worksheets which are necessary for individualizing learning

activities of pupils due to the widespread introduction of mixed ability classes and other business-sponsored science educational audio-visual materials/aids e.g charts. Science requires that pupils should be creative in expression in practicing their experimental skills for better understanding in some science concepts. However, lack of adequate physical facilities is an obstacle to the creative expression required.

In most schools there are large classes in small classrooms and laboratories resulting to less emphasis on project and /or practical work hence pupils think of education generally as memorization of facts, (Hughes, 1975).

Availability of relevant and appropriate science teaching and learning resources to some great extent should always be determined by the science teacher. However, lack of empowerment of individual teachers can lead to inadequacy of such resources, (Clark and Berely, 1990). For instance, it is a well trained science teacher who can effectively determine the competence of science laboratory technician by assessing his/her qualifications before being employed in a school given that all our institutions are formally free to determine the non-academic staff within approved estimates, (Silverman, 1988).

The rhetoric about the importance of science is not accompanied by funding. For example, rural schools do not have science laboratories and equipment partly because of their low economic standards. They cannot raise the necessary resources. For the same reason, rural communities experience difficulties starting and maintaining resource centers**.**

Many schools in rural district schools come from poor families and they are often sent away for school fees. Some eventually drop out, leaving behind huge arrears. School fees payment is the least of the strong sides of the schools and they, therefore, are not able to have basic facilities like adequate classrooms, desks and laboratories for learning science.

The basis of the use of technology and industrialization is effective implantation of mathematics and science curricula at all levels of education. Unfortunately, school performance in the subjects has not been satisfactory. The major reasons cited for the low achievement include lack of equipment, inadequate textbooks and a shortage of teachers. However what is emerging is that even schools with adequate resources also register low grades in mathematics and sciences. As such, what the teacher does with the available equipment and materials is critical.

## 2.5 Teaching methodology and students' performance in sciences

There are many things that hinder the learning and teaching of science. Believe in the information particularly textbooks is entrenched. It is not unusual for teachers to tell students that something is right because a book state so. Whether a practical is done or not, lessons are often statements of facts or absolute truth from books not to be challenged.

Of course, a school laboratory rarely has the resources to challenge such laws and the learner has to believe and memorize. But physical conditions of some schools de-motivate learning and inhibit the learning of sciences. They have dilapidated buildings and lack science equipment, laboratories and library necessary for learning sciences.

There are two main approaches to the teaching of science:

1. **Learner-centered approach:**

This is where the learner is actively involved in the learning process through the guidance of the teacher.

2. **Teacher-centered approach:**

This is where the teacher exposes learners to the knowledge with little learner participation.

Sciences are practical subjects and should be taught by way of discovery through investigation. Learner centered approach is therefore most appropriate. However, learners require the teacherôs guidance. An investigation of the two approaches may be necessary in certain topics. There are four methods which can be used in the teaching of sciences:

- Class experiment
- Teacher demonstration
- Class discussion
- projects

There is no best method of instruction. These methods overlap considerably to ensure those desirable outcomes are attained. It is unwise for the teacher to choose one method as the best and

adhere to it exclusively. A combination of these methods is sometimes necessary in achieving the stated objectives. (Ministry of education 2006)

It is important to note that methodology has a role to play in determining studentsô performance in science subject.

**2.6 The relationship between mathematics and sciences and students performance in them.**

There is a great necessity for secondary school to reflect on integration of sciences. Exciting related topics and development in these subjects should be pointed out. For example, secondary school can provide firm principles of chemistry with physics on good mathematical basis. (Jezowska-Trzebiatowska, 1975)

The fact that any science like chemistry and physics are quantative, means that, really to understand science requires a good knowledge of mathematics as one of its tools. It is an essential part of scientific training in sciences to insist on accuracy and this must by its very nature bring in mathematics. The science teaching-learning process involves a lot of measuring of volumes, weights, lengths, drawing graphs etc. an important factor in the use of measuring is their degree of accuracy.

It should be part of mathematics to indicate what is meant by probable error and what is likely to amount in particular case. In general, error of measurement arises from two weaknesses: the relative inaccuracy of the instrument, and the varying ability of the observer (Gordon, 1965).

# CHAPTER THREE

## METHODOLOGY

### 3.1 Introduction

In this particular study, the survey method was used. This is because it is the most reliable method that can yield information with high level of accuracy since the information could not have been obtained easily from any other source like reports by the researcher on the same subject specifically in Ongata Rongai division.

### 3.2 Research design

It may be impractical to carry out a study in all the schools in Ongata Rongai division when time and financial factors are taken into consideration. Since the schools are widely dispersed and the population of students in the schools is quite high, the time that could be involved in studying the entire populations of student might actually reduce the accuracy of the research findings with respect to the dependent variables. Furthermore the passing of time would reflect a change in the measurement between individuals measured earlier and those measured later in the survey.

Thus a random sample could actually provide greater accuracy than measurement of the entire population since it would not contain the same effect as that for surveying the entire population for long time span of data collection.

### 3.3 Locale of the Study

The performance of sciences by student in Ongata Rongai division is generally poor. However, due to the large number of schools and students in Ongata Rongai division it is impractical to carry out the study influencing this poor performance in all the schools with respect to time and financial constraints. Therefore, only some schools in Ongata Rongai division were sampled for the study.

### 3.4 Target Population

In Ongata Rongai division there is a total of fifteen secondary schools both private and public. All these offer sciences from form one to form four. Of these schools, four are public schools and eleven are private schools. Three of the public schools are mixed day secondary schools. There is one public boyôs boarding school which is a county school. There are five boarding mixed private school and six mixed day private secondary school.

**Table 3.1: Target Population.**

| **Type of school** | **No. of school** |
|---|---|
| Public boys school (county) | 1 |
| Public mixed school (district) | 3 |
| Private mixed day schools | 6 |
| Private mixed boarding schools | 5 |

### 3.5 Sample selection

It was difficult to cover all the schools in this study because they are widely dispersed and therefore only six schools were selected to constitute the sample. Stratified sampling was used to select the schools to be included in the sample. This is because the target population is not homogenous. There were three strata in the study i.e. the boyôs public school, the mixed private school and the mixed public schools.

**Table 3.2: Sampling Frame**

| **Type of school** | **No. of schools** |
|---|---|
| Public boys school (county) | 1 |
| Private mixed school | 3 |
| Public mixed school (district) | 2 |

From the stratum of mixed schools, simple random sampling was used to select the five schools to constitute the sample. The lottery technique was used to select these schools, where fourteen individuals were assigned names of the fourteen schools. Each individual was assigned one name randomly so that no school was left out. Small pieces of paper of the same color, texture and size were numbered 1-14. Each paper bore one number so that no number between 1-14was repeated. The pieces of paper were then folded into same shape and size then placed in a container and mixed thoroughly. Each of the 14 individuals was then allowed to pick one piece of paper at a time. The schools that corresponded to individuals who picked 1, 2, 3, 4 and 5 constituted the sample.

To select the ten students from each of the six sampled schools, simple random sampling using the lottery technique was utilized again. Similar pieces of paper whose total number corresponds to the number of students in form 4 class were used. Ten pieces of paper were written ñYESò and the rest ñNOò. They were then folded, put in a container and mixed thoroughly and then each student was allowed to pick one paper at a time. The students who picked the papers written ñYESò constituted the sample. The head of science department in each of the six sampled schools was the respondent to the teachersô questionnaire.

Thus in the study, one public boys school, three mixed public secondary schools and three mixed private secondary schools constituted the sample. From all these schools, a total of six science teachers and sixty students constituted the sample of respondents to teachersô and studentsô questionnaires respectively.

### 3.6 Data collection instruments

For this particular study, two types of questionnaires were used, i.e. science teachersô questionnaires and studentsô questionnaires.

The teachersô questionnaire sought general information about:

a) The academic and professional qualifications as well as the teaching experience of the science teachers.
b) The adequacy and use of science teaching physical and human resources.

c) The methods they use in teaching sciences
d) The problems they are facing in their teaching of sciences.
e) Their strategies aimed at improving the performance in science by their students in their respective schools.
f) Whether class size affect performance in sciences.

The studentsô questionnaire sought information about:

a) The availability and use of learning resources in sciences
b) Their attitude towards sciences
c) The problems they are facing in learning of sciences
d) Ways by which they think their performance in science can be improved.
e) Whether discipline affects studentôs performance.
f) Whether students interests and ambitions contribute to performance in sciences

### 3.7 Data collection procedures

The questionnaire was formulated and printed in time. The sampled schools were then visited by the researcher. The researcher introduced and explained the aims and significance of the study to the head teachers of each of the six sampled schools.

Pre-testing of the questionnaire was carried out on two of the six schools. The schools were selected by simple random sampling using lottery technique.

To pre-test teachersô questionnaires, one of the science teachers from each of the two schools was selected and ten students from each of the two schools were used to pilot the studentsô questionnaires. The student to participate were selected by simple random sampling using the lottery technique where small pieces of paper equal in number to the number of students in the form four class in the pilot school was used.

The responses to the piloted questionnaire items were analyzed and the items adjusted where the piloting of the questionnaire revealed some deficiency.

The researcher and the head teacher of the six schools that constituted the sample for the study agreed on the day to administer the questionnaire with the help of their respective science teachers. The data was then collected on the dates agreed upon. The researcher then took the responses from the sampled school science teachers and students for analysis.

### 3.8 Methods of data analysis

In order to get to obtain a higher degree of accuracy in analysis of data, all the responses from the participating teachers and students were considered. The data collected was summarized and organized in tables and charts for easy interpretation and analysis.

In this research, analysis was done using simple descriptive statistics. This involved the use of percentages.

# CHAPTER FOUR

## RESULTS

1. **Results from the students' questionnaire:**

a) **Table 1.1: How many science subjects does each of the students' respondents take?**

| | Two sciences | Three sciences |
|---|---|---|
| frequency | 53 | 5 |
| percentage | 91.4 | 8.6% |

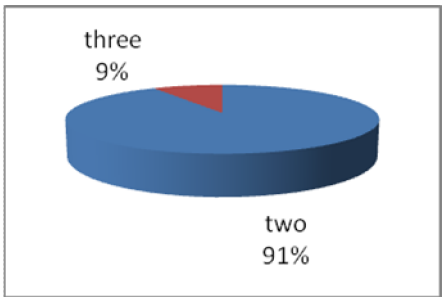



**Figure 1.1 number of science subjects taken by students**

**b) Table 1.2a: does students interest and ambition influences performance?**

| | frequency | Percentage (%) |
|---|---|---|
| Yes | 53 | 93.3 |
| no | 4 | 6.7 |

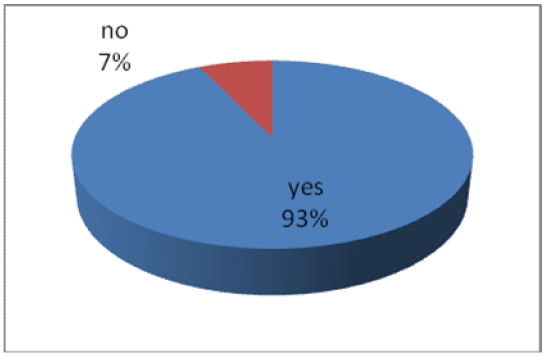
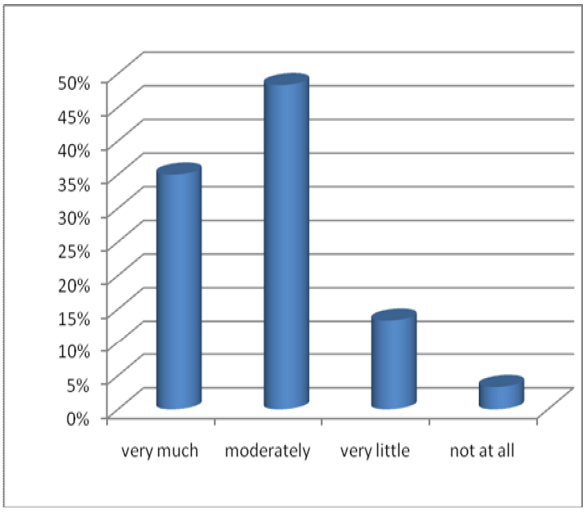


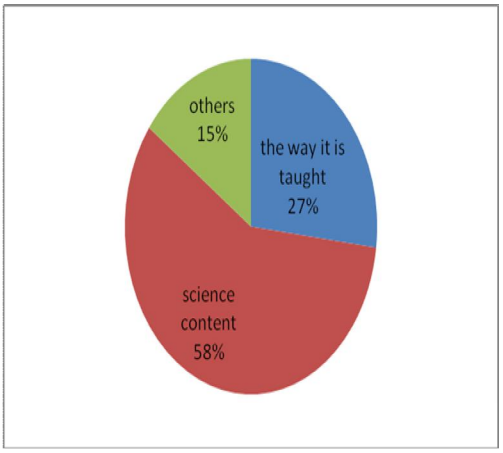

**Figure 1.2a: does students interest and ambition influence performance in sciences?**

**Table 1.2b: Student's attitude towards science:**

| **a) How much do you like sciences?** | frequency | Percentage |
|---|---|---|
| Very much | 21 | 35% |
| Moderately | 29 | 48.3% |
| Very little | 8 | 13.3% |
| Not at all | 2 | 3.3% |
| | | |
| **b) What influences your like for science?** | | |
| Way it is taught | 16 | 26.6% |
| Science content | 35 | 58.3% |
| Others | 9 | 15.1% |
| | | |
| **c) Science are easier than other subjects:** | | |
| Strongly agree | 6 | 10.3% |
| Agree | 22 | 34.5% |
| Undecided | 8 | 13.7% |
| Disagree | 13 | 21.7% |
| Strongly disagree | 11 | 18.9% |

**Fig: 1.2b. How much do you like sciences?** **1.2c: what makes you like sciences?**

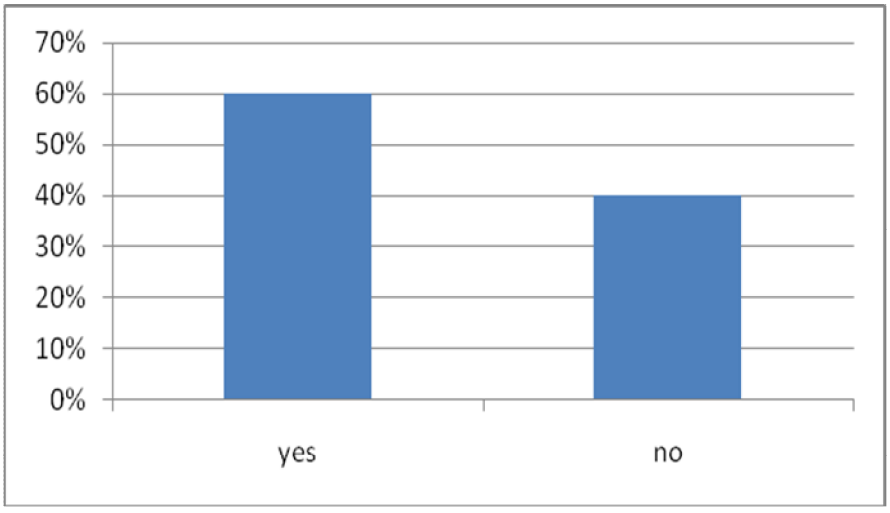



c) **Table 1.3: Did you lack any of the science teachers at any time in the course of your study?**

| | frequency | percentage |
|---|---|---|
| Yes | 36 | 60% |
| No | 24 | 40% |

**figure: 1.3: availability of teachers in the course of study**



d) **Table 1.4 absenteeism affect school performance:**

| | frequency | Percentage % |
|---|---|---|
| Strongly agree | 36 | 63.2% |
| Agree | 18 | 31.6% |
| Partly agree | 2 | 3.5% |
| Strongly disagree | 1 | 1.7% |

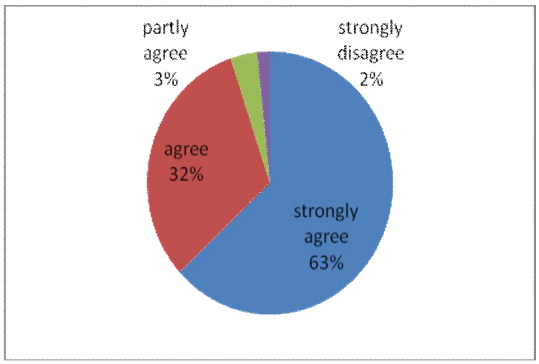



**Figure 1.4: absenteeism affects school performance:**

e) **Table 1.5: availability of facilities**

| a) **Is there library in your school?** | frequency | Percentage |
|---|---|---|
| Yes | 36 | 65.0% |
| No | 19 | 35.0% |
| b) **available books** | | |
| K.L.B | 42 | 70% |
| Oxford | 3 | 5% |
| others | 2 | 3.3% |
| | | |
| c) **Are there laboratories in your sch.?** | | |
| Yes | 46 | 82.1% |
| No | 10 | 17.9% |

| d) **Are there specific labs for each subject?** | | |
|---|---|---|
| Yes | 11 | 22% |
| No | 39 | 78% |

**f) Table 1.6: Does lack of discipline affects student's performance?**

| | frequency | percentage |
|---|---|---|
| Yes | 45 | 80.4% |
| No | 8 | 14.3% |
| undecided | 3 | 5.3% |

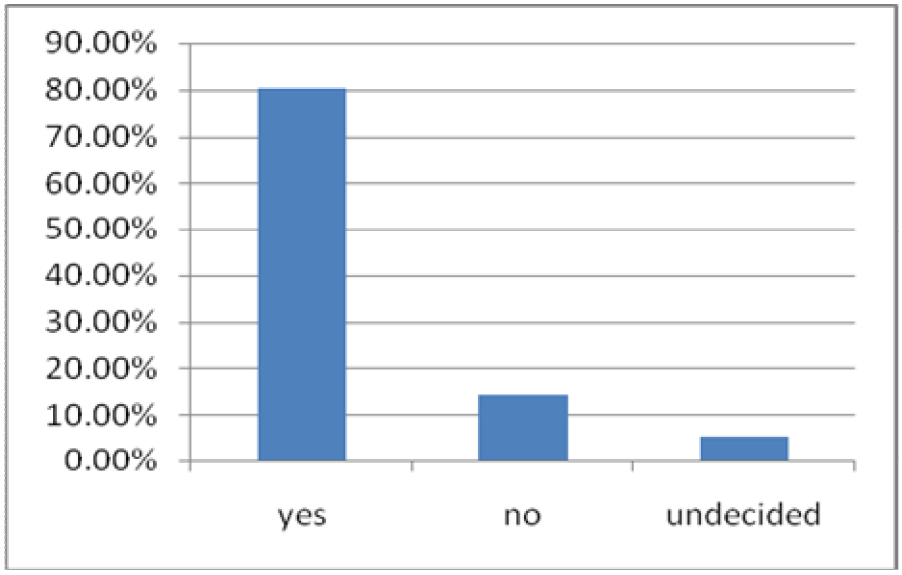



**Figure 1.5: does lack of discipline affects students' performance?**

**g) table 1.7: relationship between mathematics and sciences:**

| Do you have difficulties in science topics that require an extensive use of mathematical concepts and skills | frequency | percentage |
|---|---|---|
| Yes | 41 | 70.4% |
| No | 15 | 24.3% |
| undecided | 2 | 5.3% |

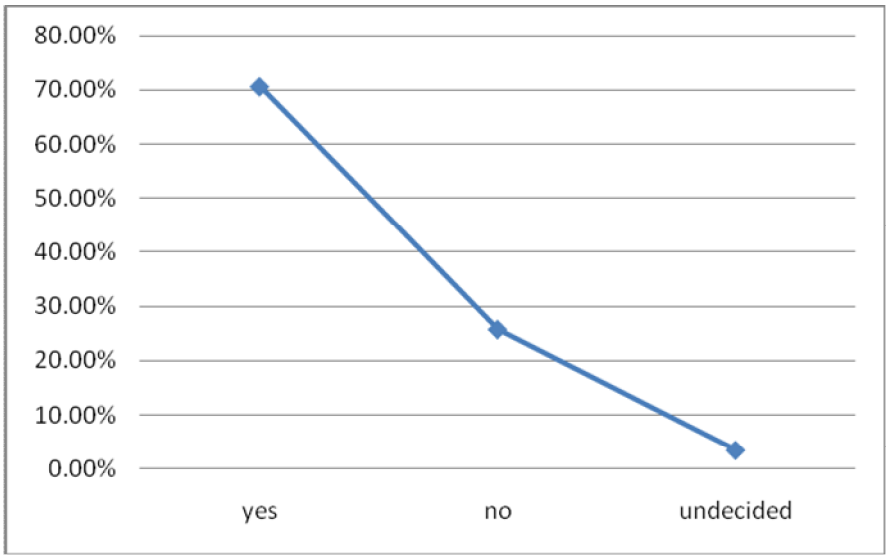



**Figure 1.6: relationship between mathematics and sciences:**

## 2. RESULTS FROM THE TEACHERS QUSTIONNAIRE

### a) Table 2.1: How is the Performance of science subjects compared to others?

| | frequency | percentage |
|---|---|---|
| Good | 4 | 66.6% |
| Poor | 2 | 33.3% |

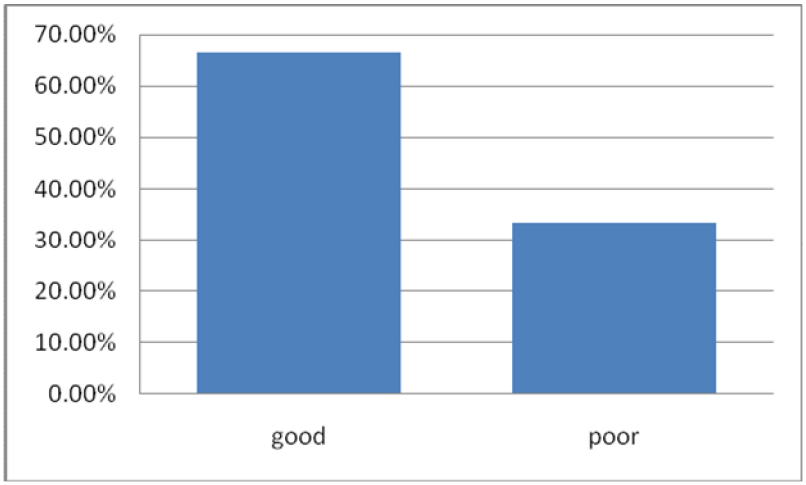



**Figure 2.1: performance of science subjects compared to others**

### Table 2.2: what are the average class sizes in your school?

| | Percentage |
|---|---|
| Between 20-30 | 16.6 % |
| Between 30-40 | 33.3% |
| Between 40-50 | 33.3% |
| Above 50 | 16.7% |

**Figure 2.2: average class sizes**

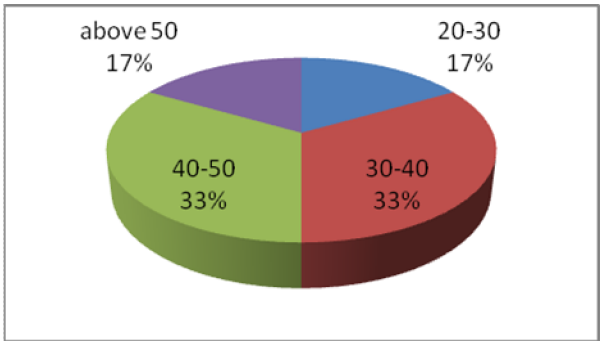



**Figure 2.3: academic and professional qualification of teachers.**

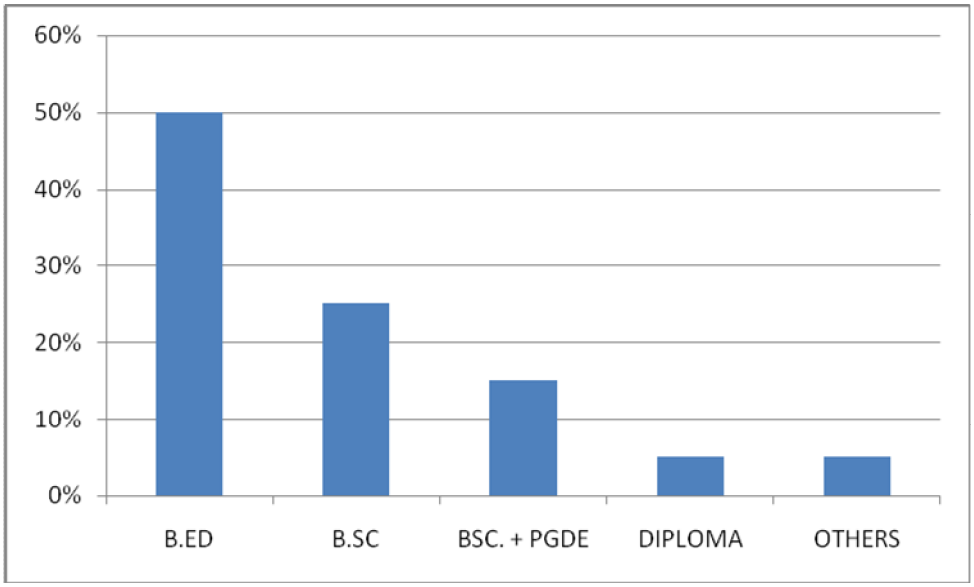
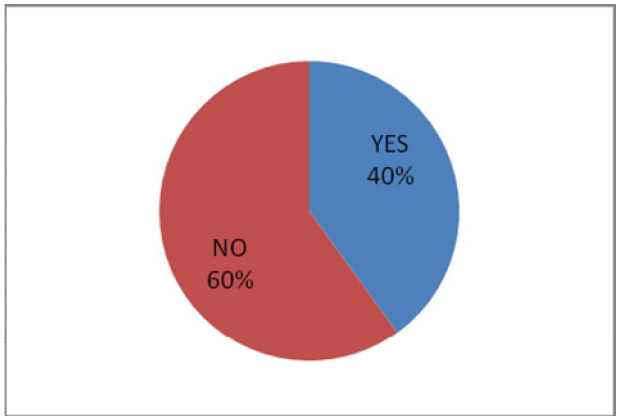


**Figure 2.4: Do you attend in-service courses on science education regularly?**




**Results on availability of facilities and resources**

**Table 2.3: a) laboratories**

| **a) Are there laboratories in your school?** | **Percentage respondent** |
|---|---|
| Yes | 80% |
| No | 20% |
| **b) How equipped are they?** | |
| Well equipped | 20% |
| Fairly equipped | 60% |
| Poorly equipped | 20% |
| **c) How many laboratories are there in your school?** | |
| One | 70% |
| Two | 20% |
| three | 10% |
| **d) Do you use laboratories in teaching sciences?** | |
| Yes | 70% |
| No | 30% |
| e) **students do class practical in**: | |
| Group | 100% |
| Individually | 0% |

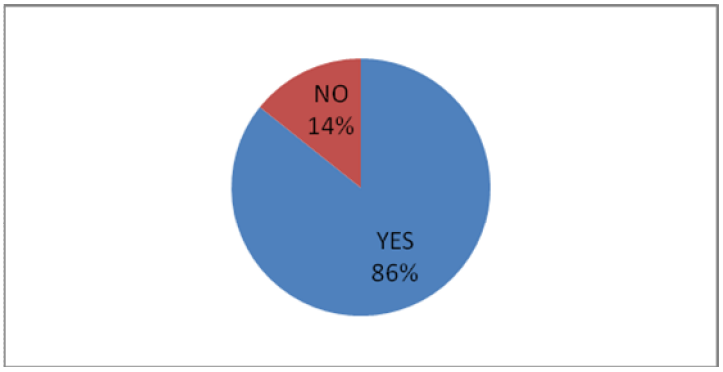
**Table 2.3b) Library**

| a) **Is there a library in your school?** | **Percentage respondent** |
|---|---|
| Yes | 80% |
| No | 20% |
| b) **How well equipped is your library?** | |
| Well equipped | 30% |
| Fairly equipped | 60% |
| Poorly equipped | 10% |
| c) **available books** | |
| K.L.B | 70% |
| Oxford | 20% |
| Others | 10% |

**Table 2.4: teaching methods used:**

| | Percentage respondents |
|---|---|
| Discussion | 40% |
| Experiment | 10% |
| Demonstration | 35% |
| Lecture | 10% |
| Others | 5% |

**Figure 2.5: Do students have difficulties in science topics that require extensive use of mathematical concepts and skills?**



## DATA INTERPRETATION

The study sought to identify factors that contribute to poor performance in science subjects in Ongata Rongai division. The following factors were hypothesized and results obtained:

a) studentôs attitude toward science and their performance
b) Science teacher qualifications and students performance in sciences.
c) Inadequacy and use of science teaching and learning resources and student performance in science.
d) teaching methodology and students performance in sciences
e) The relationship between mathematics and science and students performance in them.
f) The number of tasks/subjects a student does and performance in sciences.

- **The number of subjects a student takes and performance in sciences.**

The result of the study shows that majority of student take a maximum of two sciences only. In this regard 91% of the respondent takes only two science subjects and only 9% take all the three sciences on offer i.e. physics, chemistry and biology,( refer table 1.1). This observation strongly emphasizes the fact that, the number of subjects a student takes affects performance. it is expected that the final grade a student get in K.C.S.E will affect their future career choices, hence most of the student prefer to specialize on those science subjects that are relevant or directly contribute to their career choices.

Although general knowledge gained in this science subjects is crucial in life at large, majority of the student prioritize on performance in their final exam, hence the need to choose only two science subjects. This enables student to give more attention on the chosen science subjects and create more time for them, hence a higher probability of performing much better.

This trend is also influenced by the lack of resources and facilities for science subjects in most of the schools; hence students prefer taking two subjects in an effort to comfortably and economically utilize the limited resources. Most of the schools in the division do not have adequate facilities and resources hence to economize on the few available ones, students are

encouraged to make choices in sciences especially between biology and physics. This is because chemistry is offered as a compulsory subject in most of the schools in the division.

- **The students' attitude toward science and students performance in sciences:**

From the study, results obtained shows that, 48% of the students respondents said that they like sciences moderately. 35% like sciences very much and 13% of the respondents like sciences very little and the remaining 3.3% did not like science at all. This is illustrated in table 1.2b.

When asked what influences their like for sciences, 58% of the respondents stated that they like sciences because of its content. 27% of the respondent like sciences because of the way it is taught. From these findings it is clear that not all students attitude towards science is positive. Their like for science subjects is generally moderate. This to some extent must be contributing to the poor performance in science subjects, since it is generally observable that the higher the like for particular subject, the greater the performance expected. The passion for the subject will result to a greater drive to concentrate on these subjects thus making them to put more effort. This will automatically increase their chances of higher performance in their respective science subjects.

A greater percentage of the respondent stated that they like sciences because of its content. This is quite positive since it obviously shows that their major drive in liking science is what it constitutes in terms of knowledge. This fact will make student have self drive and initiative to search more from books and other sources on what science is all about. The high curiosity will lead student in putting more effort in sciences hence the likelihood of them performing better. This calls for measures to be put in place to enhance studentsôpositive attitude towards sciences.

When asked their opinion on whether sciences are easier than other subjects, only 10% of the student respondents strongly agreed that sciences are easier than other subjects, (table 1.2b). This shows that a greater percentage of students perceive sciences as difficult. This to a great extent must be contributing to poor performance in sciences. Thus there is the need to change the negative attitude in students towards sciences with greater emphasis given to the fact that they can hardly do without sciences in their future careers hence the need to accommodate them among their priorities. This fact again is emphasized by the greater number of the respondent who strongly disagreed that sciences are easier than other subjects, which accounted for 19% of

the respondents. Those that contributed to this view have got the perception that sciences are challenging and difficult to handle meaning that they always view them as uneasy and this may result to poor performance in their exams.

- **science teachers qualifications and students performance in sciences:**

A learning institution becomes competent and relevant in delivery of educational services if it has qualified personnel. The management of such institutions needs to be professionally qualified to guarantee quality service delivery. From the study done it was observed that a good percentage of the respondents were well trained and professionally qualified as teachers. 60% of the respondents are professionally qualified teachers mainly in public schools. The remaining 40% constitutes professionally untrained teachers mostly in private schools ;( figure 2.3).

This is a bit higher percentage bearing in mind the task involved in delivering academically. This also indicate that majority of schools do not have fully professionally trained instructors. This is rampant in private schools which constitute less than 40% of professionally trained teachers with the rest being professionally untrained. Many respondents from such schools were concerned about teachersô mobility/turn over. The constant change of teachers account for the great bulk of problems they encounter in the course of their studies.

The untrained teachers partly hop because their working conditions are made unfavorable by the managersôof such schools who also happens to be unqualified to handle such senior managerial position academically. Such managers tend to economically exploit teachers through meager pay. This forces teachers to look for greener pastures or alternatives means of livelihood. The mobility of teachers translates to poor performance by the student since from the stated responses constant transfer and change of staff negatively affect studentsôconcentration and performance.

Although teachers experience from the respondents is satisfactory with 70% percent having teaching experience of more than three years, a few of the schools recruits inexperienced untrained teacher, and in addition to that assign them candidate classes. In one of the poorly performing school, the researcher got first hand information that a form four leaver handled a candidate class, 2 years after completing his form four exams. It is not expected such a quack teacher to competently handle such a class, and the results are likely to be poor in such school without adequate qualified human resource.

In this regard also, 40 % of the teachersô respondent stated that they did not attend in-service courses on science education, (fig 2.4). These services are crucial in that, they keep teacher updated on their teaching methods for efficient delivery in classrooms. These services are absolutely not their in most of the private schools. They are not offered and this somehow contributes to poor performance in science. Majority of the respondents from public showed that they do attend in-service courses.

- **learning resources and facilities:**

**i) library:**

A school as an institution can hardly do without the basic resources and facilities such as books and laboratory for teaching sciences. 65% of the student respondents stated that they have library in school with 35% stating that they did not have library in their school, (as shown in table 1.5 pt a, b). This means that they are likely not to have school books. They equally stated that they did not access library services such as borrowing books. Actually student respondents in these schools clearly indicated that they did not have books in school.

On counter checking their performance results showed that they are among the poorly performing school in science (appendix table 1-4, school B & F). A good number of schools have this basic facility although not fully equipped. From the teachersô questionnaire 67% of respondents stated that they have libraries which are fairly equipped. None of the respondents both teachers and students indicated that they have a well equipped library. 33% said they have poorly equipped library, (table 2.3 b)

When asked of the available of textbooks, the K.L.B science textbooks are the most common with 50% of the teacher respondent and 70% of studentsô respondents stating that they had enough copies of these books. It can be noted from the study that most of the schools do not have variety of books. Only 5% of studentsô respondents and 33% of teachers said that they have oxford textbooks in addition to the main course books, K.L.B series. It is therefore clear from the study that other reference and supplement resource books are rare and inadequate.

Schools should get more resource varieties and adequate books to meet all the educational demands by students.

**ii) Laboratory facilities:**

Most of the schools sampled have this facility. 80% of the teacherôs respondent said that they have laboratory while 20% stated that they lacked laboratory in their school, (table 2.3 a). Again 82% of the studentsôrespondent said that they have laboratory in their school while 18% stated that they did not have laboratory in their school, (table 1.5 pt c, d). At this juncture a cross examination of the school that lacks laboratory and their performance showed that they performed poorly in K.C.S.E exams, (appendix; table 1-4 school B & C). In one of the school sampled all respondents stated that they have three laboratories specific for each of the three sciences. The performance in sciences for this school is much better compared to the other schools ;( appendix, table 1-4, school A).

Although a great percentage of the respondents stated that they have laboratory, majority of the respondents said that they only had one laboratory where all the three sciences are taught in turn. This illustrates that the teaching of science may not be that efficient from the perspective of sharing a laboratory. The single laboratory may not equally accommodate all the apparatus required for each subject. The constant change of use requires constant modification of set up of the laboratory to best suit each of the subject being taught. The need to share laboratory also calls for a proper schedule of lessons in the timetable so as not to have them crashing in order to allow teaching of sciences. Sometimes this is challenging task to undertake given other factors to also consider.

Only 17% of the respondents stated that they have three laboratories specific for each science subject (table 1.5 c, d). The issue of laboratory availability may not be amusing as such, but the greater factor to consider is how well equipped are the laboratories. When asked how well equipped the laboratories are, only 60% of the teacher respondents stated that they have fairly equipped laboratories while the remaining percentage said they have poorly equipped laboratories (table 2.3 a).

Most of the laboratories are improvised structures meant for other purposes such as classes or halls. They therefore lack essential laboratory fittings such as sink, water taps, fume chambers,

preparatory roomsô benches, and sockets e.t.c. This again means that the lack of this essential fitting will automatically make practicals challenging to both teachers and students. When asked whether practicals are done in group or individually, 80% of both student and 100% of teachersô stated that they do practicals in groups rather than individually, (table 2.3 a). This means that student share apparatus in group experiment. 83% of the respondent stated that they do practicals in group of more than three students. This shows that the facilities available are not adequate for each student otherwise they would have had practicals done individually rather than in groups.

In group experiments, not all students get fully involved in the actual practical work in such large groups, hence the entire students in a group may not comprehensively grasp the skills and concepts involved. Indeed, students are supposed to do practicals individually during exams. This means that due to lack of first hand skills and practice, students may not competently handle the exam practical. this is further emphasized by the fact that, when the respondents were asked whether student ability to do practical influence their performance in science, a 100% of the teacher respondents and 83% of students respondents said yes respectively. This is a fact because the final practical exams are done individually and the student must be conversant on how to manipulate apparatus skillfully.

When asked whether requisition of science textbooks, laboratory equipment and chemicals are honored in time, 67% of the teacher respondents said yes while 33% percent said no. It is notable that honoring requisition in for science resources and equipment affect the frequency of doing practical. Delayed requisition makes it difficult to do practical regularly and finally affecting the performance in science subjects. Lack of a single apparatus or a chemical substance may render a whole practical session irrelevant leading to postponing of such activities to a later date.

There are heads of department in virtually all the schools sampled. When asked whether they hold meetings, 67% of the teacher respondents said yes while 33% said no. Regular meetings should be encouraged in order to identify problems and challenges affecting the teaching of science and how to solve them.

- **teaching methodology and performance in sciences:**

Of the teachers sampled in the study, 83% of the teacher respondent stated that they used three different methods simultaneously and in equal measure in teaching sciences, (table 2.4). These are:

- discussion
- teacher demonstration
- class experiment

15% of the respondent stated that they use lecture and outdoor activities as methods of teaching sciences. The method chosen should be student centered and therefore from the study it is clear the methods used by the majority of the teachers are appropriate. Student performance can be influenced by the teaching methods chosen. Some of these methods although applicable are curtailed by lack of resources and facilities. Class experiment and teacher demonstration are subject to availability of laboratory chemicals and apparatus.

As pointed out earlier, no single method of teaching is effective on its own. This fact is evident from the study findings which show that the teacher respondents use more than one method of teaching to make the learning process efficient. In addition to these findings, the teachersô workload was also considered. 50% of teachers respondent have 20-25 lessons while the other 50% have a workload of 25-30 lessons. This is on average is a favorable workload, but the great disadvantage is that it is rarely stable in many schools especially the private schools. Earlier on, it was noted that the main challenge in some school is the mobility of teachers. when a teacher abruptly leave school the pending workload is more often than not shared by the remaining teachers until a new recruit comes in place which may take time due to many factors in consideration. Other times, the classes are left unattended and this result to a great blow to both the student and teachers in terms of the syllabus coverage.

- **the relationship between mathematics and science:**

The study sought to establish the relationship between mathematics and science. Three questions were asked: two in the studentsô questionnaire and one in the teachersô questionnaire. When asked whether students have difficulties in science topics that require the use of mathematical concepts and skills, 86% of the teacher respondents said yes while 14% disagreed, (fig. 2.5). This clearly indicates that the mathematical concepts and skills directly influence performance in sciences. Students score poorly in questions that require calculation procedures. Thus the ability to apply mathematical concept highly determine the final score by a student in such exams. Such mathematical concepts include plotting graphs, analysis of parameters e.t.c.

The researcher sought to know the students views in this regard by asking them whether they had difficulties in science topics that require use of extensive mathematical concepts and skills. 80.4% percent of the respondent agreed that they have difficulties in science topics that require extensive use of mathematical concepts. Only 14.3 % of the studentsô respondents disagreed while 5.3% were undecided, (table 1.7). This confirms the hypothesis that mathematics knowledge has a direct effect in science performance since most of the topics in science have a lot of mathematical applications.

To further confirm the link between mathematics and science, elsewhere in the questionnaire, students were asked whether calculations in physics and chemistry make them to fail. 44% of the respondent strongly agreed to this hypothesis while 29% of studentsô respondents were undecided. This again put more emphasis to the hypothesis that mathematical concepts and skills contribute to poor performance in sciences.

Furthermore, the students were asked to select the subject they would like made optional among the three sciences offered: physics, mathematics and biology. 54% of the students respondents choose chemistry to be made optional, 28% choose physics while 18% chose biology. From these findings, a greater percentage of the respondents chose chemistry because it is done by virtually all the schools. It being a compulsory subject in most schools, a good number of respondents preferred it made optional. Physics and biology are optional in some schools. The higher number of student who feels chemistry should be made optional indicated that they had substantial challenges in handling it.

The students were also required to give reasons for their choices on which subject they think should be optional. Majority of the respondents pointed out that chemistry had a lot of calculations and is difficult to understand. Those who chose physics also said that they face difficulties in calculations involved in it. A small percentage chose biology to be made optional not because there are any calculations involved but because they faced difficult with spelling in regard to scientific terms.

Thus, based on the mathematical concepts involved in chemistry especially in mole concept, majority of the students felt that it should be made optional indicating that they experience difficulties in such topics or sections that require mathematical concepts and skills.

A cross examination of mathematics and science results in the schools sampled indicate a unique trend of low performance in these subjects ï (appendix; table 5.1 & 5.2). In fact, most of the poorest grades are registered in sciences and mathematics at high frequency. Grades such as D and Eôs are not unfamiliar in successive K.C.S.E exams in these schools (appendix K.C.S.E results). This trend again affects the school mean resulting to general poor performance in these schools.

The only exception to this observation is in biology where such low grades are minimal and relatively high grades are registered. Again this proves that mathematical concepts and skills contribute to poor performance in sciences especially in physics and chemistry where these skills are highly applied.

Biology does not have much of these concepts and if they exist they are easier to undertake. This results in relatively good performance in biology than in the chemistry and physics. All these findings serve to confirm that there is a direct relationship between mathematic concepts and skills in science performance.

- **Class sizes and performance in sciences:**

The study sought to establish whether class sizes affect performance in sciences. 33% of the teachersô respondents indicated that their class size ranges from 30-40 and another 33% of respondents stating that their classes ranges from 40-50 students. A small percentage indicated that their classes are above 50 students, (table 2.2).

Numerous studies have investigated the influence of class size on student attitudes, behaviors, and outcomes. The conventional wisdom among parents, teachers, school administrators, and policy makers is that smaller class sizes translate to improvements in student learning and outcomes. This conventional wisdom, however, has not been universally supported by empirical evidence.

While a number of studies have found support for the importance of class size on student achievement, others strongly refute this claim concluding that class size has little or no impact on objective student outcomes. The difficulties in assessing the causal influence of class size on student outcomes, such as achievement, are:

(1) Class size itself is often not directly observed but rather proxied by pupil-teacher ratios at the state, district, or school level,

(2) Many data sets used to analyze this question are cross-sectional and thus do not allow one to control for fixed student, teacher, class, or school effects, and

(3) Class size itself may be endogenous in a student outcome equation.

# CHAPTER FIVE

## DISCUSSION

The study sought to examine the teachers and student related factors that influence performance in sciences in Ongata Rongai division. This was based on the premise that teachers and student-related factors are influential to performance in sciences. Therefore, these factors need to be understood and properly addressed in order to improve studentsô performance in sciences. Student related factors were measured by looking at the following variables: studentsô primary school Science, their interest in sciences, whether or not they were allowed to choose the subjects they want, availability of reading materials, interest in practical, class sizes, their ambition and attitude toward sciences, cases of indiscipline/truancy, absenteeism, ability to do practical, them having discussion groups and availability of teachers

### 1. Absenteeism

Poor school attendance is often seen to be linked to socio-economic disadvantage (influenced by factors such as poverty, coming from a single-parent family, local authority housing etc. as well as school factors, or a combination of these. Consequently, students who miss school without any valid reason do not constitute a homogenous group and a variety of strategies are needed to tackle the issue. In many cases the causes are also contested between parents/students and the school (Malcolm et al., 2003). Existing international research evidence allows us some insight into the causes of persistent absenteeism, which are divided into the following broad categories:

- background/personality related causes
- educational/school related causes

### (a.) Personality-related Causes

A number of factors that have an impact on absenteeism are linked to the background of the student. Studies carried out in the United Kingdom and Northern Ireland show that often these can be related to the family - parental attitudes or family 'problems' (Kinder et al., 1996, Brown, 1983).Furthermore, Webb and Vulliami (2004) report that among the poor attendees

participating in their study approximately three quarters did not live with their two parents. Overall, students are seen particularly at risk of poor attendance if they come from poorer and low skilled backgrounds, live in local authority housing in inner-city areas (Social Exclusion Unit, 1998).

Exploring teachers' perceptions, Malcolm et al. (2003) found that teachers identified the following factors as contributing to absence from school:

- low parental value on education;
- children as carers
- domestic violence;
- long and a typical working hours of parents;
- Lack of a school uniform or equipment.

In addition, some researchers have identified gender differences among students who miss school without any valid reason. The Social Exclusion Unit (1998) in the United Kingdom and Wagner et al., (2000) in Germany found that boys are more likely than girls to become poor attendees. International research has also identified age differences in that students with poor attendance tend to be older students (Social Exclusion Unit, 1998).

Over and above the factors detailed above, non-attendance can also be attributed to high levels of part-time work (Wagner et al., 2000, McCoy and Smyth, 2004); 'underlying problems with a psychiatric or emotional disturbance base' psychological and behavioral problems, and low self-esteem (Malcolm et al., 2003). It is important that such students be assessed as early as possible in order to address their specific needs as well as maintaining a positive learning environment for other students.

**(b) Education/School-related Causes**

In addition to background-related factors, persistent non-attendance may also be linked to education-related causes. Wagner et al. (1994) in Germany report an almost continuous increase in poor attendance between the age of 13 and 17 years and its delivery is seen to have an impact on disaffection and attendance (Kinder, et al., 1996, Brown, 1983). An OFSTED study in the

United Kingdom found that in some schools poor attendance is centered among pupils who are weak readers indicating a clear link between academic difficulties and absence. Difficulty in ôkeeping up' with school work and learning difficulties experienced by students are also highlighted in other studies as possible causes of absence (Malcolm et al., 2003; National Youth Policy Programme, 1994).

Second, poor school attendance is sometimes also linked to teacher-student relationships, especially if such relationships are not respectful or fair (Kinder etal., 1996). In the same vein, a study in the Irish context identified an impact of positive and negative interaction with teachers on students' perceptions of school and on attendance (Smyth, et al., 2004, Smyth, 1999). Friends and peers are also sometimes seen to have an influence on school attendance. They may promote poor school attendance as a status-seeking activity or as a way of joining in. Furthermore, non-attendance can also be related to teasing or bullying at school (Kinder et al., 1996).

In cases of serious misconduct, schools may practice suspension and expulsion from school. There seems to be a general consensus that the numbers of students disciplined in such a way has risen over recent years (Government of Ireland, 1994). While removing disruptive students may be seen as beneficial for improved classroom climate, excluding disruptive and difficult studentsô schools can significantly contribute to non-attendance (Government of Ireland, 1994).

Other research has identified other key factors in absenteeism (Smyth, 1999), including academic ethos and expectation climate in the school. Absenteeism levels are significantly lower where teachers have high expectations for students, an effect which operates over and above the student's own expectations (ibid, 2000.)

### a) Background of students

Aikenhead (1996) has argued that: ñIt is easy to assert that; to be effective, teaching must take full account of the multidimensional cultural world of the learner, to apply this principle in a particular situation, and to express it in terms of curriculum materials and classroom methods is a formidable task. Aikenhead takes up this challenge in part by exploring the practical implications of cultural border crossings in terms of curriculum materials aimed at teaching Science and

technology for all students no matter what borders they need to cross. Aikenhead (ibid.) argues that Science educators, western and non-western, need to recognize the inherent border crossing between studentsô life-world, subcultures and the subculture of Science, and that we need to develop curriculum and instruction with these border crossings explicitly in mind, before the Science curriculum can be accessible to most students.

In the context of Science education, Aikenhead (1996) identifies several powerful sub-groups that influence studentsôunderstanding about Science: the family, peers, the school, the mass media and the physical, social and economic environment. Aikenhead (1997) and Jegede (1995) argue that, for majority of students their movement between the micro-culture of their family and the micro-culture of school Science is not smooth and often limits their success at Science. Such students experience a discordant culture gap between family and school that moving into the culture of school Science seems virtually impossible. They might avoid (or drop out of) school Science to sustain their self-worth whenever they experience the ñforeignò culture of school Science.

In developing countries, the Science curriculum itself may be a problem for students who strongly believe in their communityôs indigenous belief system. Science education worldwide aims to nurture equitable opportunities for success for all students (UNESCO, 1994) because success at Science depends in large measure on how effectively students can negotiate into culture of school Science; an ingredient for successful border crossing between disparate cultures. Learning Science is to acquire the culture of Science. To acquire the culture of Science, students must travel from their everyday life-world to the world of Science found in their Science classroom.

Studentsôflexibility, playfulness and feelings of ease in the world of Science will help determine the smoothness with which they cross the border into the Science culture. This smooth transition or lack of it will affect the degree of culture acquisition that takes place. Muwanga-Zake (1998) further states that the greatest cultural barrier to learning Science is language.

The problem is that like many other African countries, Kenya has developed Science curricula and content upon western trends and teaches Science mainly in English. Therefore, majority of students may not comprehend what is written or taught and may resort to memorizing. Further

complications arise from the differences between the normally scientific English that demands clarity and common English language usage. Thus language barrier could account for the difficulty that learners and teachers find with Science to a great extent. This in turn, could affect the studentsô achievement in Science subjects, Coleman et al. (1966) and Plowden et al. (1967), Bowles and Ginitis (1976) (as cited in Jepkoech, 2002).

## 2. Teaching methodology and performance in science

Education, according to Coombs (1970) consists of two components. He classified these two components into inputs and outputs. According to him, inputs consist of human and material resources and outputs are the goals and outcomes of the educational process. Both the inputs and outputs form a dynamic organic whole and if one wants to investigate and assess the educational system in order to improve its performance, effects of one component on the other must be examined.

Instructional resources which are educational inputs are of vital importance to the teaching of any subject in the school curriculum. Wales (1975) was of the opinion that the use of instructional resources would make discovered facts glued firmly to the memory of students. Savoury (1958) also added that, a well planned and imaginative use of visual aids in lessons should do much to banish apathy, supplement inadequacy of books as well as arouse studentsô interest by giving them something practical to see and do, and at the same time helping to train them to think things out themselves. Savoury (1958) suggested a catalogue of useful visual aids that are good for teaching history i.e. pictures, post cards, diagrams, maps, filmstrips and models.

He said that selection of materials which are related to the basic contents of a course or a lesson, helps in depth understanding of such a lesson by the students in that they make the lesson attractive to them, thereby arresting their attention and thus, motivating them to learn. He suggested a catalogue of aids which could be used to teach history. He advocated the use of pictures which will help children in grounding their thoughts and feelings. He said that pictures are used as alternatives to real objects where it is impossible to show students the real objects, and they do serve effectively in tan imagined activities.

It is also very vital to have sufficient and adequate human resources in terms of teacher quality for the teaching of all subjects in the school curriculum. Without the teachers as implementing factors, the goals of education can never be achieved. In order to achieve a just and egalitarian society as spelt out in the Nigerian National Policy of Education (1981), schools should be properly and uniformly equipped to promote sound and effective teaching. Suitable textbooks, qualified teachers, libraries which are adequate should also be provided for schools. Scarcities of these, according to Coombs (1970), will constraint educational system from responding more fully to new demands. In order to raise the quality of education, its efficiency and productivity, better learning materials are needed. Knezewich (1975) also stressed the importance of having appropriate personnel plan and adequate physical facilities to support educational effort.

In enumerating the factors that could be responsible for varying intra-and inter-school/academic achievement, Coombs (1970), listed four important factors including the acute scarcity of instructional resources which he said constrained educational systems from responding more fully to new demandsô. He claimed that, in order to do their part in meeting the crisis in education, educational systems will need real resources that money can buy, they will need a fuller share of the nationsô manpower, not merely to carry on the present work of education, but to raise its quality, efficiency and productivity. They will need buildings, equipments and more learning materials.

On human resources, various educators for example, Ukeje (1970) and Fafunwa (1969) have written extensively on the prime importance of teachers to the educational development of any nation albeit simple, complex, developed or developing. From the writings of these educators, one can infer that whatever facilities are available, whatever content is taught, whichever environment the school is situated and whatever kind of pupils are given to teach, the important and vital role of the teacher cannot be over-emphasized. Assuming that necessary facilities are adequately provided for, the environment is conducive to learning, the curriculum satisfies the needs of the students and the students themselves have interest in learning, learning cannot take place without the presence of the teacher.

Teachers represent a large proportion of the input of an educational system. Coombs (1970) observed that ñthe problem of teacher supply is not one of simple numbers. It is first and

foremost a problem of quantity and of getting the right quality. Fayemi (1991) also observed that ñit is a truism that teachers are the hubs of any educational systemò that upon their number, their quality and devotion depends on the success of any educational systemò.

Fafunwa (1979) in his paper ñThe purpose of teacher educationò commented on the importance of teachers when he said: ñThe demand for more and better schools, the need to relate curriculum to the needs of the child and the environment, the crying needs of the child and his other instructional materials, the desirability of training in vocational and technical skills, and indeed the overall problem of preparing the future citizens of Africa who will be fully oriented to their environment cannot be fully accomplished without the aid of competent teachersò (page 36 ï 37).

Fagbamiye (1977) noted that schools with stable, experienced and qualified teachers usually have better school facilities in terms of school buildings, books and equipments than those schools which have difficulty in attracting experienced and qualified staff. Numerous investigations have also been carried out to find the effects of instructional resources on studentsô academic achievement. Eminent scholars have also contributed immensely to report the effect of one variable on the other. Consequently, there have been many reports from these studies which have served as useful guides to the present one.

**The need to diversify the teaching methodology**

Visual learning materials can be quite effective in enriching the classroom experience for students by enabling them to observe situations and processes which are otherwise difficult to portray inside the classroom. There is extensive evidence to support the claim that the use of digital visual materials ï either static images or video ï in the instruction process can raise studentsôattention levels and can also significantly improve their performance in retention and comprehension tasks (Hoban & Ormer, 1970; Katsioloudis, 2007). Such evidence exists across all grades of schooling (ranging from middle school all the way up to university education) and in almost all curricula, although science education seems to have received the greatest amount of research attention (Katsioloudis, 2007).

There is a general consensus among both researchers and practitioners that visual materials are effective in the classroom only when used as a supplement ï and not as a substitute ï to basic teaching tools like textbooks, blackboards and the teacherôs voice (Hoban & Ormer, 1970).

The rationale behind using textbook pages with visual materials is quite simple: textbooks are an integral part of the teaching process in todayôs classrooms and they are the most easily accessible learning materials for the students, both for learning new concepts in class and for recalling what has been learnt later on. By integrating visual materials with content drawn from textbooks, it becomes easy for the teacher to demonstrate relations between the two types of materials, thus placing the former within a familiar context for the students

These findings can be interpreted in the context of previous work on educational psychology which demonstrates that retention of visual information in memory can be significantly improved by displaying such information along with relevant verbal information (Wiseman, MacLeod, & Lootsteen, 1985; Wogalter, Sojourner, & Brelsford, 1997). Although the question of how verbal content influences visual retention has been addressed in several research studies, such studies have been undertaken in very controlled environments where learning is not mediated by a human instructor.

## 3. STUDENTS' ATTITUDE AND PERORMANCE IN SCIENCES

Attitudes affect achievement and achievement affects attitudes (Owiti, 2001). Owiti has revealed that attitude influences performance and performance influences attitude. This study sought to examine how studentsôattitude (positive or negative) influences their performance in sciences. Njuguna (1998) argues that emotional attitudes can have a profound effect on our learning efficiency.

The kind of attitude one holds in a learning situation therefore is of great significance considerable concern in education. Munn et al. (1972) argue that ñattitudes are learnt predispositions towards aspects of our environmentò. They involve the tendency to evaluate something in a positive or negative way. An attitude consists of three basic components, namely:

- Thinking,
- Feeling
- Reacting.

The thinking component involves self belief. The feeling component involves issues related to value, and the reacting component involves the tendency to behave in a certain way. Njuguna (1998) further argues that a human infant is born without any concept of themselves, any attitude or value system. Their self-concept and attitudes towards other objects develops with the development and their interaction with their ñsignificant othersò.

Such persons are teachers, peers and parents. A child who receives positive perceptions and expectations from their significant others develops a positive self-concept. Positive self-concept influences motivation and performance in tasks. If a child is motivated and achieves highly in a task, that child will have positive attitudes towards that task. However, low motivation leads to negative attitudes thus low performance.

Children in our schools fail to benefit from teaching, not because they do not have the ability but because of their self-view, which determines to a great extent what they do or avoid, and what they see or ignore (Njuguna, 1998). Therefore, the home, school and society offer varied and important conditions for the childôs acquisition of values, cultures and or development of self-concept all of which influence academic performance.

One major problem of Science education identified by students is the feeling that school Science is like foreign culture to them (Maddock, as cited in Aikenhead, 1997). Their feelings stem from fundamental differences between the culture of western Science and their indigenous cultures. One may wonder whether the kind of attitudes held towards learning by students is related to the failure or passing usually noted in many examination situations. A clear answer to such an issue may help us to know how to respond to learning situations be they encouraging or discouraging.

Driver and Bell (as cited in Fensham, 1988) say: Learning outcomes depend not only on the environment, but on the knowledge, purposes and motivations that the learner brings to the task. That is, the ideas and beliefs we already hold will be of major influence on the interpretation we place on what we are taught.

According to Driver and Bell (ibid.), ñthe learners have the final responsibility for their learning in that they decide what attention they give to a learning task, construct their own interpretations of meaning for the task and evaluate those meaningsò. Norwich and Jaeger (1989) avert that, ñthere is at best an explicit or implicit assumption that the attitude to school subjects should be related to achievement, if only on the grounds that t positive attitude leads to greater achievementò.

## 4. Effect of discipline on performance in sciences

### Elements of Self-Discipline

When we talk about "self-discipline," we're actually talking about a number of different personality factors. One element of self-discipline is low impulsivity. A child with low impulsivity is able to wait their turn, to avoid interrupting others' conversations and to stay seated and quiet when appropriate. Self-discipline also includes the ability to control one's own thoughts, emotions and actions. Finally, a child's ability to delay gratification is an important element of self-discipline. A child with strong delay of gratification skills can refuse a small, instantaneous reward in exchange for a larger reward later on.

### Self-Discipline & Academics

Recent studies by psychologists have shown that self-discipline is a key to academic success. For instance, a study of eighth-graders found that self-discipline was strongly associated with marking period and final GPAs, student achievement test scores and selection into a competitive high school. Children with high self-discipline also behaved differently in relation to school.

In particular, they were less frequently absent, did more hours of homework, spent less time watching television and began their homework earlier in the day compared to children with low self-discipline. Perhaps most interesting of all, these scientists found that self-discipline was more important than IQ in predicting every outcome.

From the study results it became clear that classroom management is a necessary condition for effective student learning. The school climate established by the educator can have a major impact on learnersô motivation and attitude towards learning. As such, the skills involved in establishing a positive classroom climate are of immense importance. Clearly, learners need order in the classroom if the activities, which take place, are to facilitate effective learning.

The most important point to bear in mind in considering discipline, is that creating the necessary order is more to do with the skills involved in effective teaching in general than it is to with how one deals with learner behavior itself. If the learning activities are well-planned and prepared, if the presentation elicits and maintains learnersô attention, interest and involvement, and if the activities are challenging and offer realistic opportunities for success, then the necessary order will be established as part of these qualities. In essence, skilful teaching lies at the heart of establishing discipline. Most learner misbehavior is quite trivial. The types of learner behavior most frequently cited by educators are:

- Excessive talk or talking out of turn,
- being noisy (both verbal, such as shouting at another learner across the room, and non-verbal, such as letting a disk lid slam shut),
- Not paying attention to the educator,
- Not getting on with the work required,
- Being out of their seats without good cause,
- Hindering other learners, and
- Arriving late for lessons

To a large extent, such problems can be minimized by skilful teaching in general, and by developing conventions and routines for behavior, which are followed. The discipline which prevails in a classroom will not only be influenced by the educatorsô behavior and expectations, but also by the expectations learners bring with them, and, importantly, by the prevailing ethos in

the school. Nevertheless, a well-managed lesson coupled with a relationship based on mutual respect and rapport will do much to minimize pupil misbehavior.

In schools where it is recognized that there are a number of learners with marked emotional or academic difficulties, skilful teaching can ensure that good discipline in lessons will be the norm. Learners misbehave at school for a variety of reasons, e.g. boredom, inability to do the work, low academic self-esteem, emotional difficulties, poor attitudes, etc. The key to establishing good discipline at school lies in learners accepting the educatorôs authority to manage their behavior and their progress in learning.

Learning activities cannot take place effectively in a classroom of thirty learners or more, unless one is given authority to control, manage and direct what is going on as, when and how appropriate. Much of the authority as an educator derives from the status he has in that role, and the respect and esteem for educators generally held in society; this is particularly conveyed to learners by their parents and other sources of influence.

Educators will have some degree of status because of this, most notably with younger learners where they may be perceived as a parent figure to some extent. In order to exercise managerial control, learnersô behavior needs to be rule-governed. Such school rules may be explicitly stated by educators or simply inferred from the educatorôs actions.

## 5. Class size and student achievement:

Reducing class size to increase student achievement is an approach that has been tried, debated, and analyzed for several decades. The premise seems logical: with fewer students to teach, teachers can coax better performance from each of them.

Some researchers have not found a connection between smaller classes and higher student achievement, but most of the research shows that when class size reduction programs are well-designed and implemented, student achievement rises as class size drops.

Several important findings about reduced class size have been scientifically proved and documented, such as:

- Smaller classes can boost student academic achievement;
- A class size of no more than 18 students per teacher is required to produce the greatest benefits;
- A program spanning over several grades will produce more benefits than a program that reaches students in only one or two of the primary grades;
- Minority and low-income students show even greater gains when placed in small classes.
- The experience and preparation of teachers is a critical factor in the success or failure of class size reduction programs;
- Reducing class size will have little effect without enough classrooms and well-qualified teachers; and
- Supports, such as professional development for teachers and a rigorous curriculum, enhance the effect of reduced class size on academic achievement.

**Restructuring classes**

Small classes may vary in other ways, in addition to student-teacher ratio, depending upon school leadership, facilities, and teaching staff, as well as official policy. The typical model is one teacher in one classroom teaching an assigned number of students, but other models have been implemented.

Project STAR (Student/Teacher Achievement Ratio), (Finn 2002), defined two categories of reduced size classes:

- Classes of 13 to 17 students taught by one teacher; and
- Classes of 22-26 taught by a teacher and a teacherôs aide.

Project STAR defined large classes as 22-26 students taught by one teacher.

**Gains in student achievement**

The landmark 1978 study by Glass and Smith strongly endorsed reduced class size as a reform likely to produce improvements in academic achievement. The researchers reviewed 80 research reports on the relationship between class size and achievement, obtaining more than 100 comparisons from ñwell-documentedò studies of smaller and larger classes using rigorous statistical analyses. The meta-analysis showed:

- As class size decreases, achievement increases
- Benefits begin to emerge as class size falls below 20 students.

The most influential contemporary evidence that smaller classes lead to improved achievement is Tennesseeôs Project STAR. Because this program set up randomly selected control and experimental groups of students, researchers could compare students who had four years of small class participation to students who had none. This meant that researchers could more reliably evaluate the impact of the class size reform. Project STAR (Finn, 2002) found:

- Students in smaller classes did better than those in larger classes.
- Minority and inner-city children gained the most from smaller classes; and

The more years spent in reduced classes, the longer lasting the benefits.

**Gains over time**

Nye et al (2001) explored the relationship between the number of years that students participated in Project STAR small classes and their level of achievement. After one year, the students in smaller classes had significantly higher achievement scores on the Stanford Achievement Test reading and mathematics subtests than students in larger classes. The gap in scores widened after two years, indicating that the effects of small classes are cumulative.

Nye et al (2001) also conducted a follow-up study of Project STAR students, which showed the positive effects of small classes maintained over time. The researchers compared the mathematics achievement of 9th grade students who had been in small classes for at least one year during grades K-3 with that of 9th grade students who had been in larger classes in the third

grade (and in earlier grades, depending on the year in which they were assigned to the study). In general, students who participated in small classes for at least one year continued to show higher scores on standardized mathematics tests at grade 9.

Fidler (2001) looked at the impact of smaller classes over time within the California CSR (Class Size Reduction) program. The study examined the Stanford Achievement Test reading, language, and mathematics subtest scores of students in grades 4 to 6 who had completed at least one year of the CSR program in the Los Angeles Unified School District. The analysis found that the longer students participated in CSR, the greater their achievement gains. Specifically, students who participated in CSR program for three years or longer had greater gains than students who participated for just one year. These gains were modest, but statistically significant.

**Implications**

Even in light of findings that suggest no relationship between class size and student achievement, the preponderance of the evidence supports positive effects and academic gains when class size reduction programs are well-designed and properly implemented.

Student achievement, however, is not the only factor in play. The possible benefits of smaller classes must be weighed against other factors. To reduce class size in a meaningful way, school might need to hire more teachers, add more classes, and purchase more suppliesð or all of the above. Questions of class size can figure in decisions from teacher contracts to school construction. Hiring more teachers can be especially difficult. Public schools already are straining to fill positions as an aging workforce edges closer to retirement and fewer young people enter the profession

Some researchers (e.g., West & Woessmann, 2003) believe that schools would do better to hire fewer teachers with better credentials than to hire more teachers without regard to the level of credentials and experience. They argue that the quality of the teacher, rather than the size of the class, drives student achievement. In short, the stakes are high when undertaking these initiatives since debates continue about the ability of reduced class size to fuel student achievement, making it critical to approach the issue armed with credible research that helps inform decision-making.

## 6. Student motivation and performance in sciences:

In discussion about attitude and performance, it was noted that positive self-concept influences motivation and performance in tasks. If a child is motivated and achieves highly in a task, that child will have positive attitudes towards that task. However, low motivation leads to negative attitudes thus low performance. Thus positive attitude and motivation are interlinked.

The best lessons, books, and materials in the world, won't get students excited about learning and willing to work hard if they're not motivated. Motivation, both intrinsic and extrinsic, is a key factor in the success of students at all stages of their education, and teachers can play a pivotal role in providing and encouraging that motivation in their students. Of course that's much easier said than done, as all students are motivated differently and it takes time and a lot of effort to learn to get a classroom full of kids enthusiastic about learning, working hard, and pushing themselves to excel.

Even the most well-intentioned and educated teachers sometimes lack the skills to keep kids on track, so whether you're a new teacher or an experienced one, try using these methods to motivate your students and to encourage them to live up to their true potential. The following measures can be taken to improve on student motivation:

- **Create a threat-free environment.**

While students do need to understand that there are consequences to their actions, far more motivating for students than threats are positive reinforcements. When teachers create a safe, supportive environment for students, affirming their belief in a student's abilities rather than laying out the consequences of not doing things, students are much more likely to get and stay motivated to do their work. At the end of the day, students will fulfill the expectations that the adults around them communicate, so focus on can, not can't.

- **Change your scenery**

A classroom is a great place for learning, but sitting at a desk day in and day out can make school start to seem a bit dull for some students. To renew interest in the subject matter or just in learning in general, give your students a chance to get out of the classroom. Take field trips,

bring in speakers, or even just head to the library for some research. The brain loves novelty and a new setting can be just what some students need to stay motivated to learn.

- **Use positive competition.**

Competition in the classroom isnôt always a bad thing, and in some cases can motivate students to try harder and work to excel. Work to foster a friendly spirit of competition in your classroom, perhaps through group games related to the material or other opportunities for students to show off their knowledge.

- **Offer rewards**

Everyone likes getting rewards, and offering your students the chance to earn them is an excellent source of motivation. Things like pizza parties, watching movies, or even something as simple as a sticker on a paper can make students work harder and really aim to achieve. Consider the personalities and needs of your students to determine appropriate rewards for your class.

- **Give students responsibility.**

Assigning students classroom jobs is a great way to build a community and to give students a sense of motivation. Most students will see classroom jobs as a privilege rather than a burden and will work hard to ensure that they, and other students, are meeting expectations. It can also be useful to allow students to take turns leading activities or helping out so that each feels important and valued.

- **Allow students to work together.**

While not all students will jump at the chance to work in groups, many will find it fun to try to solve problems, do experiments, and work on projects with other students. The social interaction can get them excited about things in the classroom and students can motivate one another to reach a goal. Teachers need to ensure that groups are balanced and fair, however, so that some students arenô doing more work than others.

- **Give praise when earned.**

There is no other form of motivation that works quite as well as encouragement. Even as adults we crave recognition and praise, and students at any age are no exception. Teachers can give students a bounty of motivation by rewarding success publicly, giving praise for a job well done, and sharing exemplary work.

- **Help students find intrinsic motivation**.

It can be great to help students get motivated, but at the end of the day they need to be able to generate their own motivation. Helping students find their own personal reasons for doing class work and working hard, whether because they find material interesting, want to go to college, or just love to learn, is one of the most powerful gifts you can give them.

- **Manage student anxiety.**

Some students find the prospect of not doing well so anxiety-inducing that it becomes a self-fulfilling prophecy. For these students, teachers may find that they are most motivated by learning that struggling with a subject isn't the end of the world. Offer support no matter what the end result is and ensure that students don't feel so overwhelmed by expectations that they just give up.

- **Make goals high but attainable.**

If you're not pushing your students to do more than the bare minimum, most won't seek to push themselves on their own. Students like to be challenged and will work to achieve high expectations so long as they believe those goals to be within their reach, so don't be afraid to push students to get more out of them.

- **Give feedback and offer chances to improve.**

Students who struggle with class work can sometimes feel frustrated and get down on themselves, draining motivation. In these situations itôs critical that teachers help students to learn exactly where they went wrong and how they can improve next time. Figuring out a method to get where students want to be can also help them to stay motivated to work hard.

## 7. Primary School Science Influence on Performance in sciences

The study sought to establish whether or not primary school Science influences performance in sciences at secondary level. Fifty-one percent students and 48% of teachers interviewed did not agree that primary school Science affects performance in sciences. The student respondents (51%) disagreed with the statement that primary school Science influences performance in sciences in secondary schools.

They were of the view that the general Science taught in primary school is split into specific disciplines at secondary level where advanced concepts are introduced and therefore could not establish the link between the general Science taught in primary to sciences taught at the secondary level.

The pattern of Science education becomes more complex at the secondary level with the introduction of subjects such as Physics, Biology and Chemistry as noted by the science and technology in vocational education (STVE) report.

On the other hand, 43.5% and 48% of the student and teacher respondents respectively agreed that primary school Science influences performance in sciences. Basing on the study, this is a significant observation, because if prior knowledge is correct, it should be used as a building block for new knowledge (Good et al., 1997, p. 401).

The link provides continuity and demystifies Sciences at secondary level hence effective primary foundation in Science provides requisite background for students studying sciences at secondary level.

## 8. Student characteristics and performance in sciences:

The study also sought to establish whether or not student characteristics such as interest in sciences, ability to do practicals, ambitions and attitude influence performance in sciences.

### h) Students Interest in sciences

The study sought to establish whether or not studentsô interest influences performance in the subjects, (table1.2a). It was found that majority (93%) of the respondents agreed that studentsô interest influences performance in sciences. This is so because having interest in sciences cultivates studentsôpositive attitude towards the subject, hence enabling the student to work hard.

Respondents mentioned doing self study on the subject, asking for assistance from teachers in areas of difficulty, forming discussion groups, high scores in the subject, dedicating more revision time for the subject, having a personal time table which guides studentsôprivate studies, and working under less supervision, as some of the attributes that trigger improved performance in sciences. The study established that interest in sciences influences performance because it provides the drive within students to participate in the learning process. On the other hand, only 7% (students) disagreed with student interest as affecting performance in sciences.

### ii) Students' Ambition

Most students have got a personal ambition/dream for the future career and, therefore, work towards accomplishing the ambition. Therefore, the study sought to establish whether studentsô ambition influences performance in sciences. The study found that majority (76.5%) of the student respondents indicated that student ambition influences performance in sciences. Majority of the respondents argued that most students have already set the target that they want to achieve, such that the desire within them acts as a drive to work hard for success or an achievement.

Thus, great performance in the subject will be achieved if studentsôambitions are linked to it. For example, students opting for nursing or becoming doctors by profession will be more interested in studying biology than those opting for mechanical or electrical engineering and

thus, influencing performance of the subject. It emerges from the study that ambition contributes to performance; it cultivates independence, building the desire to study thus posting good results. The author noted that the career dreams of learners influence their output.

### iii) Students' Ability to do Practicals

Practical forms paper three of K.C.S.E science exams. Personal experience in the learning process accounts for 80% of knowledge retention. Practicals help students to put what they have learned in theory into reality thus, making the subject livelier. The study sought to establish whether students ability to do practicals influence performance. Of the respondents, 75.5% of the students and 84% of teachers agreed that ability to do practicals influence performance in sciences. Ability to do practicals contributes to the performance in the subject.

Majority of the respondents argued that science practicals are far much better than the theory papers and therefore, students who are able to perform practicals efficiently are well placed in terms of subject performance. Students also enjoy the marvels of Science while learning at the same time participating (Siringi, 1998).

It has been noted from the candidatesô scripts that students do not perform adequate practicals in Sciences as required by the syllabus. The candidates failed in questions whose answers were dependent on experiments (K.N.E.C, 2011). This observation concurs with the findings of the study, that students should be capable of doing practicals because they contribute positively to performance in practical exams at the same time improving their response to theoretical questions that are dependent on experiments.

## 9. Factors Influencing Knowledge Acquisition and performance in sciences

The study sought to establish whether knowledge acquisition factors such as availability of reading materials, having study time tables and planning, discussion groups, attending symposiums and exhibitions influence performance in sciences. Availability of reading materials especially science textbooks influences performance ideally. Reading materials provided to the students help to boost performance because students will read wide in areas where they do not understand. In addition they will read ahead of their teachers hence enabling quick integration of

the concepts. A study done by Muruguru (2000), on studentsô performance in exams, showed that availability of text books in schools contributes to high achievement. Some of the reasons advanced by respondents to support the observation showed that text books help students to read widely on areas which have already been covered but not well understood and those that are not covered. Besides widening studentsôscope, text books also help to familiarize students with new terms and diagrams that are crucial during examination as well as increasing studentsô confidence in the subject thereby improving the performance in sciences.

The author notes that the actual problem is that students are unwilling to go an extra mile to build on the knowledge acquired in the classroom. Students having study timetables and planning proper management of time greatly improves studentôs performance since time wasted cannot be recovered. Kurgat (2008,) notes that poor planning of personal study time may cause students to lose concentration. He advocates for proper planning as a useful study skill as it eliminates distractions and indecision in their study.

Elsewhere in the questionnaires, majority of the students stated that they can improve their performance in science by having a personal time table. Personal timetable enables them to allocate time to every subject and therefore, they will be committed to the timetable. Students who plan their time well do not procrastinate.

It was also established that planning comes in terms of priorities. For instance, some students allocate time according to the difficulty of the subjects whereby Sciences (Biology, Chemistry and Physics) are given much time than humanities to enhance proper understanding. Sciences, for example should be allocated much time because it has several concepts which are hard and takes a little bit long to be integrated.

**a) Students Having Discussion Groups for sciences**

Group discussions are very important in studies since they help individuals/students to express their opinions freely in areas of weakness and therefore, the need to be. Thus, the study sought to establish whether students having discussion groups in sciences influence performance. As a result, the study established that 80% of the student respondents respectively attribute good performance to group discussions. This is because discussion groups help slow learners to sharpen their minds and be able to integrate complicated terms and concepts that they didnôt

understand in class. In addition, group discussion plants the virtue of commitment to members because everybody has to contribute to the discussion hence, widening their scope of knowledge.

It is through discussion groups that students are able to express themselves in areas of difficulty and be able to learn new ideas from each other hence, building their capacity in the subject which affects performance. Dr. William Glasser, who specializes in educational counselling, has estimated that we remember 10% of what we read, 20% of what we hear, 30% of what we see, 50% of what we see and hear, and 70% of what we discuss with others (Bakke, 2005).

It emerges that discussion as a medium for knowledge acquisition is vital. The author is of the opinion that study discussion groups be embraced more to promote good performance especially among weak students.

**b) Students Attending Symposiums and Exhibitions**

Attending of symposiums and exhibitions by students leads to their exposure, innovativeness and creativity which are required in the learning process (SMASSE, 2008). Majority of the students and teachers respondents suggested that attending symposiums and science contests will highly boost performance in sciences. This is due to the exchange of ideas that students have with their colleagues pertaining different topics. Symposiums help students to be aware of different scientific concepts and questions that normally give them problems.

On the other hand, science contests cultivate the idea of innovativeness and creativity which motivates the students and therefore, stimulates their attitude, ambition and interest towards the sciences hence, affecting their performance. Originality and creativity amongst students is developed through activities such as symposiums and exhibitions because students are able to gather ideas which perfect their thoughts thus better understanding of the concepts.

Exposure to different learning environments promotes interest, attitude and ambition in the student influencing their performance. The study agrees that attendance of symposiums and exhibitions are among factors that promote good performance in sciences.

## 10. Inadequacy and use of science teaching and learning resources and students performance in sciences:

### I) Insufficient teachers in secondary schools

The study sought to establish whether lack of teachers influence performance in sciences. 60% of the student respondents indicated that they had lacked science teachers at any one time in the course of their study, (table 1.3).

In considering the issue of insufficient teachers in secondary schools today, Aleke (2001) stated that developing a society or a nation encompass both provision of physical infrastructures and carefully raising of manpower.

She observed, the manpower development is important for societal development, indeed its possibility and success wholly rests on education. For this reason, teachers have to be sufficient in order to ensure the societal development. Having said this Ukeje (1966) observed that teachers are the hubs of educational system and the success of any educational system depends on their numbers quantity and devotion.He further stated that important positions in the society are headed by teachers such that, their quality and quantity have to be determined by the degree of excellence designed in execution of teaching.

Considering the important of teachers in educational system, Oleutan (1983) opined that for teaching-learning process to be effective knowledge of subject matter as well as skills in teaching are important. Furthermore, Kanno (1997) states that the acquisition of both knowledge and skills provide the teacher with basic tools that will enable him to meet all the challenges of the ability to teach in a manner that makes the learner not only to learn the concept taught, but also find them stimulating and interesting.

Commenting on the standard of education, Oti (2002) noted that, about 80% of the causes of our educational backwardness has been attributed to the insufficient teachers and unqualified teachers in our educational institutions especially in secondary schools level. Based on this statement Kalu (2002) traces the fallen standard of education to lack at incentive in the educational system. That the regular cry by the teachers about government lack of concern for

the needs of the teaching profession is the main bone of contention. She further stated that poor attention to teachers problems have resulted to teachers giving on strike to register their dissatisfaction. This ugly situation has contributed to the fallen standard of educational system and in consequently leads to poor performance especially in sciences.

Furthermore, another factor causing insufficient teachers can be attributed to the death of teachers of different categories and it is one of the major problems that are contributing to insufficient teaching in secondary schools. Oti (2002) lamented on unquantitative nature of teachers in schools. He concluded that institutions, which are responsible for training of teachers, should take urgent steps to sensitize the educational system by producing quantity and quality teachers.

In fact, insufficient teacher have led to World Bank publication (1975) which noted that shortage of staff is another problem of academic performance in secondary schools. The scarcity of teachers is found virtually, in all subject areas. Shortage of manpower in secondary schools is noticeable in different categories. For instance, it has led to lack of effective leadership and shortage of educational administrators in our rural secondary schools.

**II) Inadequate infrastructures in secondary schools**

Many schools suffer from inadequate infrastructural facilities and social services. Our educational system is still plagued with serious problems of basic infrastructures. Basic infrastructures, science and technical equipment, furniture, libraries are evidently inadequate. Therefore, in view of Amadi (2001) noted that inadequacy of these infrastructures constitute another source of frustration and disillusionment among teachers. She further advises the industry of education and Educational Boards to make these materials available to schools.

Aliobu (2005) stressed that since education is generally accepted as the most important instrument for change that the fundamental change in the intellectual and socio-economic outlook of any society is as a result of education has continued to be accorded very high priority in the sectoral allocation of resources.

The problem of inadequate classroom is a major issue in the school system. The problem of enrollment and supply of infrastructural facility in the schools are more pronounced in academic performing secondary schools and this has led Begmand (1976) to attribute this to a number of factors. In the first place, very often, some average rural community, like urban areas for further education.

The implication of this is that such parents do not pay attention to the needs of the rural schools. As a result of this, rural schools are left for the lower class of the rural populace to maintain. Secondly he observed that some of these rural schools were built later than the urban schools. These schools are isolated in remote areas and parents from such area find it difficult to contribute towards the maintenance of such schools, and this affects their interest in education.

King (1976) was of the view that people in urban areas with old schools are helped by the government and other individuals in order to maintain their schools than rural people. He further stated that people in the urban areas are always concerned about learning environment of their children and complain when they feel that the environment is not conducive for them.

In most secondary schools, there are no enough books, except in some schools in the urban areas. When books are not in the library it becomes very difficult for the poor parents to afford money to buy textbooks for their children in the school. Therefore, this problem of inadequate textbooks is one of the problems affecting the academic performance of secondary school students and it finally results to poor performance in sciences

### III) Rural schools and settlement pattern

Most of the rural secondary schools are based on self helped projects. They rely on government and commercial labour for the survival of their schools. In view of settlement pattern Okafor and Onokerhoraye (1986) observed that, there are many localities where their population is too low to support some infrastructural aid and social services. And, in contributing to the nature of settlement pattern in rural areas Amadi (2001) noted that teachers are quite reluctant to live in such areas. So schools located in them often suffer shortage of teachers. In these circumstances, educational institutions are attracted to areas with large settlements, while those with poor settlement are neglected.

The neglect of our rural areas has caused a lot of harm to our academic performance in schools. This is because people in the rural area find it difficult to provide for themselves if government does not provides for them. In view of this, Nwabor (2002) observed that one of the greatest problems of rural schools is the attitude of some parents who live in these rural areas. That, those who are little but rich do send their children to urban schools to study, and when this happens anything concerning the rural schools is not their concern. If eventually, they send them to these rural schools, there will be constant problems, reasons being that, some of them attack school authorities for beating their children when they misbehave. He further stated that in this situation, teachers are always the target of the parents, stressing that the nature of rural schools is nothing to write home about, especially in secondary schools where a little bet higher learning takes place. Then the schools or community that can not support or provide its basic needs is bound to suffer.

Virtually, no head of school is completely satisfied with the accommodation of the school. Certainly, most heads are concerned about building big structures in their schools but because they are handicapped by space, it becomes difficult to achieve their aim.

Based on the above findings Barry and Tyre (1978) noted that schools helps to develop communities in some rural areas. That is enough structures are built in the schools, they will uplift the community and the students that study in those schools and the schools will have enough community and effective teaching and learning will also take place. They further, noted that for this to be achieved, enough space or land should be made available for establishment of schools.

Most schools need space to build their library, laboratory and also for expansion of their agricultural section. But those things are not possible because of unavailability of space. The problem of space is both internal and external. Externally, people living around to the school always constitute a problem to the school especially when space is concerned. They always interfere with school land and claim that it is their own.

As a result of this, spaces which the school could have been used for building are taken by the rural dwellers or villagers for their private use. Consequently, some students could not afford to

go to school every day because of the distance of the schools from where the students are living. Therefore, the un-proximity of their settlement from their schools cause uncompromising problem to the rural secondary school students in their academic performance especially in sciences.

### 11. The number of tasks and subjects done by a student

The result of the study shows that majority of student take maximum of two sciences only. In this regard 91% of the respondent takes only two science subjects and only 9% take all the three sciences on offer i.e. physics, chemistry and biology,( refer table 1.1 above). This observation strongly emphasizes the fact that, the number of subjects a student takes affects performance.

This is because studying many subjects will require extra time and energy from the learners in order for them to be able to cover all subjects comprehensively. While at the same time leaving little or no time for the students to relax and integrate what they have learned or studied especially those difficult science concepts. This therefore, lowers the performance of the subject.

K.N.E.C requires students to be examined in a minimum of seven subjects. On the other hand, taking the required number of subjects will create enough time for the student to effectively handle each subject and therefore, he/she will be left with ample time to integrate some technical concepts for instance, those found in physics chemistry and biology which will help to improve the performance in the subject.

With respect to the study, the number of tasks and subjects done by students is instrumental to their performance in sciences. Hence students should be guided in choosing tasks and how many to handle (curricula and co-curricula) so that they are not overburdened.

## 12. The relationship between mathematics and sciences and students performance in them:

Mathematics has an age-old relationship with physics, chemistry, biology and other natural sciences. In other words, mathematics serves in many of the branches of science. This relationship is explained by Bell (1987) who viewed mathematics as the ñQueen and Servantò of the sciences.

Many topics in the science subjects (biology, Chemistry and physics) are inter-related. There are overlaps or areas of intercession in the content areas. Atomic structure is taught in physical chemistry as well as modern physics. Fermentation is a topic taught both in biology and chemistry. Many laboratory equipment used in one subject area can also be used in others.

However, many topics in the science subjects cannot be understood without sound knowledge of mathematics. Setidisho (1996) asserted that mathematics is a fundamental science which is necessary for understanding of most other fields. Probably, no subject forms such a binding force among the various branches of science - physical, biological and social as mathematics (Adetoye & Aiyedun, 2003). Mathematics is the language of science and central intellectual discipline of the technological societies (Kalejaye, 1985; odeyemi, 1995). A student needs basic knowledge of mathematics like change of subject to understand density which appears under major topics like Ecology in Biology, diffusion in Chemistry and Floatation in Physics.

Measurement and other mathematical techniques are vital in the work of the physicist. The physicist uses the mathematical device called the graph to give a clear picture of the relationship between different values, for example, between temperature and presence of saturated water vapor in the atmosphere. The laws of physics are stated in the form of algebraic formulae. Chemists also use logarithms, a mathematical technique in calculating the degree of acidity of a substance called pH value.

It would appear difficult to apply mathematics to the infinitely varied world of living things. e.g biology, the source of life. Mathematics, despite this apparent difficulty in its application in life sciences serves in biology. It serves in genetics that is concerned with heredity. The geneticist uses the theory of probability to calculate the percentage of individuals with like or unlike traits in succeeding generations.

There is a term in education called ópportunities to learnô Ground and Cebulla (2000) defined opportunities to learn with regards to mathematics and science as the extent of students have opportunity or chance to learn mathematics or any of the science subjects. This also bears directly on studentsô mathematics and science achievement. Brophy (2000) explained that in maximizing opportunity to learn, attention should not be given to wide coverage of the syllabi, but there should also be conscious efforts to teach content and skill involved deeply. It can then be inferred that students who do well in mathematics have better opportunity to perform better in sciences than their counterparts that do not.

The classroom practitioners, notably the professional teachers of science and even non-science teachers believe that no student can make a headway in science and technology without a basic knowledge of mathematics and according to Taylor (1970) and Herbert, (1978) fewer people seem to be aware that mathematics carries the main burden in all of scientific reasoning and is the core of the major theories of physical science. In recent years all fields of science have become more and more quantitative. The distinguishing feature of mathematics is its quantitative character. All sciences depend on investigations and all investigations depend on measurements and measurement is a branch of mathematics (Rice, 1967 and Barnes, 1978).

Most investigators in the sciences are of the opinion that competence in mathematics is an essential part in the study of most courses in chemistry and physics. Barnes (1978) studied mathematics skills test (MAST) for chemistry as a predictor of success in beginning college chemistry for science majors.

These facts are evident from the results of the sampled schools, (Table 5.1 & 5.2, appendix), shows a close link/similarities among the scores obtained in mathematics and sciences especially in chemistry and physics.

## CONCLUSION AND RECOMMENDATIONS

The study findings revealed that, the student related factors affecting performance of sciences in Ongata Rongai division are:

- Primary school Science which provides a requisite background for sciences at secondary school level thus influencing performance in K.C.S.E,
- Interest in sciences (theory and practical) provides a force within learners to participate in the learning process,
- Their ability to carry out the practical effectively promotes good performance
- Ambition and attitude contribute to students output as it cultivates independence among students influencing performance positively.
- Absenteeism
- indiscipline
- Availability of resources and facilities

Based on the findings, the author recommends the following:

Since students lack a clear understanding on the relationship between subject selection and career choices, guidance should be offered to students so as to change their attitude and the perceptions they possess towards sciences and careers. This can be made possible by making guidance and counseling departments operational and active in schools to help learners have insight on sciences as a career subject.

A practical resource-based learning approach along with the theory is encouraged to vary stimuli hence building the concentration span of the students and have students do varied projects on concepts learned in class. There is need to encourage the use of discussion groups amongst students to boost knowledge acquisition and retention. It was noted that absenteeism is a major drawback to improving performance. Schools should therefore curb absenteeism by liaising with parents on mode of installments of school fees payment and assisting studentsô access bursaries, for instance, foundations and constituency development fund (CDF).

It was revealed in the study that practical science exam if highly scored improves the K.C.S.E science grades. Teachers should be encouraged to assess learners regularly on practical skills. Perhaps more practical lessons should be availed and documented so that teachers should plan for them and regular inspection done by QASO officers to ensure the actual order/process is adhered to.

Regarding the departmental meetings most of the teacher respondent stated that they hold meeting once in term. It is recommended that, meetings be held at least thrice in term. The first meeting should be at the beginning of the term. This is necessary so as to lay out strategies on how to accomplish goals and objectives of the term. Another meeting is necessary in the middle of the term in order to evaluate the progress as far as the achievement of the goals and objectives are concerned. At the end of the term, another meeting is crucial in order to assess the extent to which goals and objectives were achieved. This is also a moment at which strengths and weaknesses of the department in terms of efficiency in realizing the targets set can be measured. all the same there need be no limit in the number of times members of department meets as long it deem fit to have such meetings at any time in the course of the term.

The meeting should involve all the stakeholders in science department. The meeting aim to harness the communication among the stakeholders as well as building team work amongst them. A laboratory technician should be available in all schools to facilitate the practical work. Science teachers alone cannot be able to teach, prepare practical sessions and keep accounts regarding the laboratory essentials simultaneously. Laboratory maintenance is crucial and to increase on efficiency in practical work a laboratory assistant is necessary.

**Library**:

Library is an essential facility in school. School books should be under the custody of a librarian. Without a library, it would be difficult to have studies done effectively. A cross examination of the results of the sampled schools shows, those schools that did not have library performed poorly. Lack of library means that there is no borrowing of books and in worse scenario there lacks books in such schools. A library should be well equipped with varieties of course books, revision books and reference textbooks.

To improve on the reference resource materials, a bank of past papers should be set in the library. This will make it possible for the learners to access revision questions in preparation for exams and for general private assessment. Note books, pens and other essential accessories should be available in the school library. This will ensure quick replacement of filled up books and lost items. This again goes ahead to save on time required to obtain such facilities if they were to be sourced externally.

**Student-teacher relationship:**

Most of the studentsô respondents had problems with the teachers approach to teaching. In one of the sampled school, 99% of the respondent complained of teachers being lazy, harsh uncaring, biased and unfriendly. This characteristic view of the students towards the teacher cannot result to right atmosphere required for learning to take place. The learning atmosphere in classes should be conducive for learning. The students should not view teachers as intimidating, uncooperative and harsh. A teacher should be professionally close to students and create the right environment for learning.

Teachers should be knowledgeable and devoted to their career as it is expected. A student should is not expected to complain of teachers laziness and when this happens, there must be a concrete basis for it. This should not happen in learning institution. Student may know a lazy teacher by their failure to attend classes, failure to mark assignment in time and failure to give the required assistance.

Other student respondents stated that, some teachers just rush through the topics and fails to explain difficult concepts. It is therefore recommended that, a formal professional relationship be enhanced in all schools to boost student performance. Again majority of the student respondents stated that they have the problem of inadequate teachers in school. This results to high workload and merging of classes, thus reducing on the efficiency in teaching. Therefore, enough teachers should be recruited to meet all the academicals demand in all schools.

**Student attitude:**

The student attitude should be improved by all means. It is evident from the study that, student attitude affects performance. As a result, all possible ways should be employed to ensure a consistent positive attitude trend develops in school. Positive attitude will cultivate a positive drive to study and this will boost their performance. Positive attitude by students will also make them to have the right approach to study in that they will view everything from a perspective of possibility.

Many of the students fail in a particular subject not because they cannot make it in that subject but because of the pre-conceived ideas that the subject is difficult to understand. This is common in mathematics, chemistry and physics. There are rumors that there are hard calculations in these subjects and therefore many students operate from such heresies and face the subject with an attitude that it is difficult. Counseling sessions should therefore be introduced in schools to offer guidance to students on how to tackle such subjects. Subjectsô experts and professionals should also be invited regularly in school to offer counsel to students on how to perform well in sciences and mathematics.

**Individual differences:**

Elsewhere in the student questionnaires, the issue of individual differences came to light as one of the major factor contributing to poor performance. Majority of the student respondents indicated that they faced challenges in learning sciences in that the teacher ignores individual abilities of students. In such cases the teacher treats the entire class equally. Those who cited this concern indicated that most teachers concentrated on bright students or fast learners moving at their pace and ignoring slow learners. The issue of rushing the syllabus was also raised.

Therefore, measures should be put in place to enable all students benefit in learning regardless of the existence of individual differences. Teachers should also be able to cater for such variations in ability level amongst the students. The issue of peer pressure influence also arises due to individual differences. As a form of defense mechanism, some student may want to behave like other students. It becomes unfortunate when wrong traits spread across the student body. Cases of general indiscipline may arise as a result. To avoid this from taking place, guidance and

counseling should be provided to students regularly to make them understand their worth as independent individual beings.

To improve on performance in sciences, constant revision should be done regularly. Evaluation is crucial so as to gauge the level of understanding by students. All exams done should be revised and further revision explored on the examined and related topics.

Symposiums should also be encouraged in schools. This will bring together student from different schools and background and facilitate their understanding that the concepts they learn in class are learnt elsewhere under similar environment. Exchange of ideas will help them to know that teachers are trained the same and their mode of delivery is almost similar. The issue of may be our teacher is ôbadô or does not teach well cannot arise when the student happen to have this interactive sessions.

Team work among teachers and student should also be encouraged. Discussion groups amongst student will promote their interaction and exchange of ideas hence the chances of their performance will increase. Team teaching among the teachers can effectively take place where a particular teacher specializes on the topics or subjects one is good in most. This will strengthen the level of understanding by student hence higher performance.

It is also recommended that extra tuition or remedial classes be availed in school. Their main objective should be to enhance the level of understanding by student through constant revision and exercises. The issue of individual differences can also be properly sorted out through these measures. Such programs should be mainly for the slow learners and those that experience difficulties in specific areas. Consultations with the teacher concerned will help identify the areas that need to be revisited.

The modes of teaching should be diversified to include outdoor activities such as academic trips, project works and practical. This will serve to supplement classroom work and facilitate change of environment by learners hence curb boredom in classes. Such diversified activities will also serve to bring students closer to real life experience with the concepts covered within the class. Such activities will also raise the studentôs interests and ambitions in the science subjects.

Discipline should be observed to the letter. Without discipline no success can be achieved academically. From the study majority of both teacher and student respondents strongly agreed that discipline affects performance. Discipline and good performance goes hand in hand. The school authority should emphasize and ensure comprehensive discipline is followed. Thus proper rules and regulations applying to both teachers and students should be well outlined. Other rules should be put in place with regard to the other school stakeholders. Rules on visiting day and hours should be provided to parents and others visitors to avoid interruption of learning programs.

In order to make learning effective, technological options of enhancing teaching should be explored and applied in teaching. ICT as a tool to educate should be used in teaching and learning. Learning through research in the internet will boost the levels of understanding by student besides raising their interests in the subject. A computer laboratory is therefore a necessity in school to improve on the performance.

Students should also have the right role models and mentors in the course of their study. They will act as motivators towards achieving their targets and goals. They can also be a dependable source of guidance and counseling in an effort to facilitate their good performance.

Causes of absenteeism should be known in each school and ways to curb them formulated. The causes may be as varied as the school themselves hence a particular cause in one school may not necessary apply in others. Thus school should develop ways of curbing absenteeism so that students participate in learning as expected. This will reduce cases of some student lagging behind others in syllabus coverage. The resulting variation in such a case is uneven performance by students some ending up failing in exam after missing school for the better part of the term.

Student should be motivated and rewarded for every effort they show in performance. This will help sustain a high tempo in terms of the interest to study. A spirit of competition will also be cultivated amongst the student. They will tend to compete for the rewards on offer hence the end result will be improved performance. This can be achieved through prize giving organized in schools, at zonal level and district levels on the so called education day.

In school in particular, recognition and award of well performing students should be ensured. Simple tasks such trips for the well performing students, privileges such as wearing badges,

promotion to leadership position will all serve to improve studentsô performance. Other creative appropriate ways of motivating student can also be effected.

The issue of large class sizes can be solved by having enough qualified staff and facilities especially classrooms. Once this is done it will become easy to have average class sizes with appropriate numbers to effectively manage.

**Implications for further research**

The author recommends that further research be done on other factors that influence studentsô performance which include:

- Studentsôability to manage time wisely
- Availability or lack of field trips and exhibition
- Employing study discussion groups and symposium
- The impact of holiday tuitions and remedial classes on performance
- The effect day schooling on school performance

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**Appendixes:**

**Table 5.1: K.C.S.E 2010 RESULTS ANALYSIS**

**The mean standard score for sciences (MSS)**

| **SUBJECT/ School sampled** | **MATHS** | **PHYSICS** (Optional- entry in brackets) | **CHEM** | **BIOLOGY** Optional(entry in brackets) | **CAT.** | **ENTRY** (Compulsory maths & chem.) |
|---|---|---|---|---|---|---|
| **A** | **6.3** | **6.8** (26) | **6.5** | **7.2** ( 43) | Private | **50** |
| **B** | **1.9** | **2.7** (14) | **2.6** | **2.9** (36 ) | Private | **50** |
| **C** | **2.3** | **2.9** (38) | **2.4** | **3.0** (106) | Private | **124** |
| **D** | **2.9** | **4.3** (41) | **3.7** | **4.7** (95) | Public | **124** |
| **E** | **3.9** | **6.7** (17) | **4.2** | **5.2** (29) | Public | **46** |
| **F** | **2.7** | **4.3** ( 14) | **2.6** | **3.6** (38) | public | **51** |

**KEY: CAT- category**

**TABLE 5.2: K.C.S.E 2011 RESULTS ANALYSIS**

**The mean standard score for sciences (MSS)**

| **SUBJECT/ School sampled** | **MATHS** | **PHYSICS** (Optional- entry in brackets) | **CHEM** | **BIOLOGY** Optional(entry in brackets) | **CAT.** | **ENTRY** (Compulsory: maths & chem.) |
|---|---|---|---|---|---|---|
| **A** | **5.3** | **7.3** (28) | **6.0** | **7.4** (56) | Private | **70** |
| **B** | **1.7** | **2.7** (14) | **2.4** | **2.5** (42 ) | Private | **55** |
| **C** | **1.9** | **2.7** (24) | **2.7** | **3.2** (80) | Private | **103** |
| **D** | **3.7** | **4.9** (42) | **4.7** | **5.5** (77) | Public | **118** |
| **E** | **5.6** | **7.1** (19) | **5.3** | **5.7** (24) | Public | **43** |
| **F** | **3.1** | **4.8** ( 12) | **3.3** | **4.1** (35) | public | **47** |
| **Mean for the schools** | 3.6 | 4.9 | 4.0 | 4.7 | | |

**KEY: CAT- category**

**TABLE 6.1: MOCKS 2010 RESULTS ANALYSIS**

**The mean standard score (MSS)**

| **SUBJECT/ School sampled** | **MATHS** | **PHYSICS** (Optional- entry in brackets) | **CHEM** | **BIOLOGY** Optional(entry in brackets) | **CAT.** | **ENTRY** (Compulsory maths & chem.) |
|---|---|---|---|---|---|---|
| **A** | **3.1** | **6.1** (26) | **3.7** | **6.1** ( 43) | Private | 50 |
| **B** | **1.5** | **1.8** (14) | **1.9** | **2.1** (36 ) | Private | 50 |
| **C** | **1.3** | **3.2** (38) | **3.3** | **5.3** (106) | Private | 124 |
| **D** | **2.1** | **5.0** (41) | **4.0** | **4.2** (95) | Public | 124 |
| **E** | **2.6** | **5.7** (17) | **3.6** | **3.8** (29) | Public | 46 |
| **F** | **1.9** | **6.4** ( 14) | **3.8** | **2.9** (38) | public | 51 |

**TABLE 6.2: MOCKS 2011 RESULTS ANALYSIS**

**The mean standard score (MSS)**

| **SUBJECT/ School sampled** | **MATHS** | **PHYSICS** (Optional- entry in brackets) | **CHEM** | **BIOLOGY** Optional(entry in brackets) | **CAT.** | **ENTRY** (Compulsory: maths & chem.) |
|---|---|---|---|---|---|---|
| **A** | **5.3** | **5.2** (28) | **4.5** | **6.1** (56) | Private | **70** |
| **B** | **1.9** | **2.3** (14) | **2.8** | **3.1** (42 ) | Private | **55** |
| **C** | **1.5** | **4.6** (24) | **1.8** | **3.8** (80) | Private | **103** |
| **D** | **3.1** | **5.0** (42) | **4.1** | **6.6** (77) | Public | **118** |
| **E** | **1.5** | **4.1** (19) | **2.5** | **5.3** (24) | Public | **43** |
| **F** | **1.8** | **5.2** ( 12) | **1.8** | **3.5** (35) | public | **47** |
| **Mean for the schools** | 3.8 | 4.9 | 4.0 | 4.7 | | |