

**FACTORS THAT CONTRIBUTE TO STUDENTS' POOR
ACHIEVEMENT IN KCSE BIOLOGY IN SECONDARY
SCHOOLS OF MIGORI DISTRICT, KENYA**

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BY

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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We confirm that the work reported in this thesis was carried out by the candidate under our supervision as University Supervisors.

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DEDICATION

To my father, the late Washington Owiti and my mother Susan. You brought out the best in me.

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ABBREVIATIONS AND ACRONYMS

BTQ	- Biology Teachers' Questionnaire
CDF	- Constituency Development Fund
C.R.E	- Christian Religious Education
D.E.O	- District Education Officer
KCSE	-Kenya Certificate of Secondary Education
KNEC	- Kenya National Examinations Council
M.o.E.	- Ministry of Education
P.T.A.	-Parents, Teachers Association
SEPU	- School Equipment Production Unit
SMASSE	- Strengthening of Mathematics and Sciences in Secondary Education
SPSS	- Statistical Package for Social Sciences
SQ	- Students' Questionnaire
TSC	- Teachers' Service Commission
UNESCO	- United Nations Education, Scientific and Cultural Organization

ABSTARCT

Biology is a very potent tool for social and economic changes in contemporary world, though students constantly display low achievement in the subject at KCSE level in Migori district. The knowledge gap on factors responsible for the low achievement in biology is a problem to all since appropriate intervention strategies cannot be devised to curb the problem. Therefore, the purpose of this study was to find out those factors that contribute to students' poor achievement in the subject at KCSE level. It sought to answer the following questions:

- i). what pedagogical practices hamper the effective teaching and learning of biology?
- ii). to what extent are resources available and how are they used?
- iii). what learning conditions constrain students' achievement in biology?
- iv). what teaching and learning characteristics hinder achievement in biology?
- v). Which other factors contribute to students' poor achievement in biology?

The research used a sample size of twelve secondary schools drawn from Migori district. The respondents for the study included three hundred and sixty form three biology students and twelve biology teachers. The heads of the sample schools and the District Education Officer were also involved. The Theoretical framework of the study was based on the knowledge that modified human behavior leads to prediction and control over performance and learning.

The nature of this study called for the use of questionnaires, interview schedules and observation checklists. The questionnaires were used to get information from the teachers and the students about the factors that contribute to biology achievement. Interviews were held with the head teachers of the 12 sample schools and the D.E.O. to provide a comprehensive and richer picture of those factors that they considered significant in influencing achievement in biology in Migori district.

Observations were done to find out how the biology teachers and the students interacted with each other, techniques and instructional resources at their disposal. The researcher also checked and listed all the resources and facilities available for biology teaching and learning as part of observation. The data was analyzed using descriptive statistics such as frequencies and percentages which were used to describe data according to the various variables under study. The findings of this study established the following as the major contributing factors to poor achievement in biology in Migori district:

- i). Use of inappropriate teaching techniques in biology. Principles on effective teaching are rooted in logic of instructional design, for example, instructional methods (Corno & Snow, 1986, Kumar, 2005, Franyo, 2007).
- ii). Unprepared for teaching, hurried and haphazard presentation on the part of the teachers. Prepared teachers are less likely to pass on misconceptions, are more confident in imparting information and are able to present a wider range of examples and analogies which help the students to learn and understand a certain topic more easily.

iii). Lack of frequent, regular assignments, tests and examinations with feedback to the students

iv). Inadequate use of resources and facilities. Availability of instructional resources does not necessarily translate into effective teaching and learning of a subject. Adequacy of resources is much more important in achieving the latter. This is because most of the resources play an important role in understanding concepts and imparting skills to the learner

v). Students lack attention from teachers since teachers are not committed and complain of inadequate time to cater for each and every student. Comber and Keeves (1973), teaching experience does not necessarily cause higher achievement in science, but committed teachers are less likely to pass on ~~to pass on~~ misconceptions, are more confident in imparting information, use less time for preparation and are able to present a wider range of examples and analogies which help the students to learn and understand a certain topic more easily.

vi). Students waste valuable study time in group discussions that are not guided by teachers and therefore digress from study purpose to personal stories that have no connection to achievement in biology.

The following recommendations were made on the basis of the above findings:

a). Ministry of Education to;

i). Intensify seminars, workshops and other in-service courses frequently in conjunction with SMASSE project to encourage biology teachers' creativity and innovation in using resources and facilities.

ii). Regularly review the teachers training program in conjunction with the relevant training institutions with a view to improve on the trainees' interests and attitude on the use of instructional resources and facilities since the earlier they develop it the better for high achievement on the student's part.

iii). Conduct regular visits to public secondary schools through its' Quality Assurance department to assess the availability, state and utilization of resources. This can assist teachers to be consistent in resource use.

b). School administration to provide for the resources in the school budgets.

c). Remedial classes be conducted to the weak students by the schools.

d). More practical activity be carried out in the teaching of the subject in the schools.

CHAPTER ONE

INTRODUCTION

This chapter outlines the background to the study, statement of the problem, purpose, objectives, research questions, significance of the study, limitations, assumptions, conceptual framework and operational definition of terms.

1.1 Background to the study

According to Ajelayemi (1990) the knowledge of biology is the major potent source for social and economic changes in the contemporary history of mankind. It has contributed so much and still continues to contribute to make life comfortable for people, whether in urban or rural areas, both in developed and developing countries (Kumar, 2005). It has helped to promote health and control many diseases, increase in food production through genetic engineering and other modern family practices over famine, affluence over poverty, reason over superstition and education over ignorance (Tsuma, 1998). The main reason why the Kenyan government decided that science and in particular biology be taught in schools was the recognition that biology education plays an important role in economic development of the country (Waithaka, 1960). The development of human resources in science has also become a priority in many developing countries (UNDP, 1994).

Biology plays a vital role in modernization, social and economic development in the world in general (Orodho, 1996). In Kenya, the Biology syllabus has ten objectives that a learner

is expected to achieve by the end of the four year program. However, the extent of success in the achievement of these objectives is questionable in Migori district since the students constantly display low achievement below 40% (KNEC, 2001) though Migori district may not be representative of the entire Republic. The other subjects beside biology are given to contextualize the problem in biology.

Table 1.1: Percentage of Passes in KCSE for the Years 2001-2005

Year	Biology	Chemistry	Physics	Mathematics	English	Geography	C.R.E
2001	51.2	55.0	65.6	48.5	51.3	60.0	76.7
2002	40.3	47.0	49.6	39.1	60.0	55.1	75.1
2003	31.6	49.0	47.3	43.9	57.2	58.0	78.5
2004	36.3	46.1	46.1	49.0	53.4	63.0	78.8
2005	40.1	51.6	47.0	40.0	54.1	61.0	74.7
Mean	39.9	49.6	53.2	44.8	55.6	59.6	77.2

Source: D.E.O's Office, Migori, June 28th, 2006.

On average, sciences were poorly done compared to the other subjects though the interest of this study was in biology only. Among the science subjects Physics, Chemistry and Biology, the latter was the worst performed over the five years. Despite the determination shown by many classroom teachers, administrators, curriculum developers, educators, biologists and policy makers, persistent poor achievement in biology made it clear that many students may not be learning the biology that they are expected or need to learn. The knowledge gap on factors contributing to low achievement in biology is a problem to parents, teachers and the school administration since they cannot devise appropriate

intervention strategies to enhance students' achievement in the subject in the district. In fact the public outcry and concern by parents and other educationists to enhance achievement in sciences in the national examinations is clear that factors affecting the sciences need urgent investigation (Eshiwani, 1983).

Research reports by leading educators indicated that achievement in biology education is determined by such factors as the quality of teaching staff, availability and effective use of instructional resources, time spent studying the subject, students' attitudes, aspirations, school administration, teaching strategies and assessment (Anderson, Ryan and Shapiro, 1989, Dunkin, 1989, Eshiwani, 1993, Khatete, 1995 and Orodho, 1996). The teachers have fallen victim of criticisms by parents and the society at large as being the cause of this poor achievement (Shiundu, 1990). Nevertheless, it is pertinent to note that these factors may not apply to Migori district.

The Kenya National Examination Council (2001) report cites poor coverage of the syllabus, failure to understand questions, theoretical teaching and lack of mastery of concepts as the main contributors to poor achievement in biology in the Kenya Certificate of Secondary Education Examination (KCSE). Inadequate revision, a negative attitude towards the subject and failure by students to read questions carefully were other factors cited in the report. Research reports has not been produced to explain for instance why the syllabus is poorly covered or why students have poor mastery of biological concepts in Migori idistrict. It was necessary to isolate those causative factors for these observed effects.

More than 30% of the annual government budget on education is channeled towards the improvement of science education (Republic of Kenya, 1994). However, there is no evidence that this increased expenditure in education has necessarily been associated with improved achievement in biology education on the part of the learners at secondary school level (Eshiwani, 1993 and Orodho, 1996). Developing countries have increasingly given attention and emphasis to science education in primary, secondary and tertiary educational institutions in recent years (Franyo, 2007). For instance, in Kenya since 1970s, the need to relate science and technology to national goals for economic and industrial development has become central to educational planning. The current 8.4.4 educational system stresses the importance of science and vocational education (Mackay, 1981). It was observed that achievement in biology in Migori district public secondary schools was wanting.

1.2 Statement of the Problem

As table 1.1 indicates, sciences were poorly done compared to the other subjects though the interest of this study was in Biology only which affects our life on a daily basis. Health, drugs and their abuse, nutrition, agriculture and environmental issues are all vital aspects that to be well addressed and represented in the school curriculum. However, the research problem that was addressed in this study was that the significant factors contributing to the students' poor achievement in Biology in Migori district were not well documented. This limits the ability of all the stakeholders in education to improve on the teaching/ learning process of biology as a science subject.

Biology education among other subjects makes the quality of life better for everybody. It is a science-based subject needed for entry in various fields, for example, Genetic engineering, Medicine, Agriculture, Education and others. Biology education modifies the habitual attitude of imagination, creativity, feelings of the learners and humans' thoughts of the purposes of life and how to improve it to a sufficient extent (Tsuma, 1998 and Lord, 2003). Yet, available research reports and data indicate that students do not perform equally well in biology like in other school subjects. It is on this basis that this study set out to investigate the factors that contributed to students' poor achievement in Biology in Migori district of Kenya.

1.2.1 Purpose

The goal of this study was to contribute to the general improvement of teaching and learning of Biology at secondary school level. The purpose of this study was to identify factors that contribute to students' poor achievement in biology at secondary school level and to suggest possible interventions aimed at enhancing biology achievement.

1.3 Objectives of the Study

This study was guided by the following objectives:

- i) Identify teaching methods that influence achievement in biology;
- ii) Establish the extent to which availability, adequacy and use of resources/ facilities contribute to the teaching and learning of biology;
- iii) Investigate the learning environment influencing students' achievement in biology;
- iv) Find out students' characteristics that hinder their achievement in biology; and

v) Find out teachers' characteristics that negatively contribute to biology achievement.

1.4 Research Questions

i) What pedagogical practices hamper the effective teaching and learning of biology?

ii) To what extent are resources available and how are they used?

iii) What learning conditions constrain students' achievement in biology?

iv) What teaching and learning characteristics hinder achievement in biology?

v) Which other factors contribute to students' poor achievement in biology?

1.5 Significance of the study

A study of this nature drew its importance from the fact that achieving the aims of the country's industrialization can be jeopardized if a large proportion of the anticipated beneficiaries do not have adequate access to the appropriate kind of biology education and training required (Eshiwani, 1983 and Orodho, 1996) Practically, the findings were expected to contribute towards improvement of teaching and learning strategies of Biology not only for schools under study, but also the entire nation. Theoretically, the study was expected to contribute to the advancement of science knowledge for social and economic development. The results of this study would also be beneficial to:

a) Classroom teachers- to help them make desirable decisions that can enhance achievement in biology.

b) School administration- may benefit from the suggestions on how to ensure an enabling learning environment for students to enhance achievement in biology

c) Students- suggestions would help secondary school students to identify those particular characteristics that enhance achievement in biology.

d) Teacher trainers- give them useful information on how teachers' characteristics contribute to achievement in biology and how it can be enhanced.

1.6 Scope and Limitations

1.6.1 Scope

The study involved head teachers, form three biology students and biology teachers in purposively selected public secondary schools. The area District Education Officer (D.E.O) was also involved.

1.6.2 Limitations

This study identified factors that contribute to students' poor achievement in Biology at secondary school level in Migori district which is a cosmopolitan district comprising a number of ethnic communities with different socio-cultural backgrounds that provided the various expected differences in the learners. Only form three students and not a cross section of all the students in all the forms was involved in the study. The study involved secondary schools drawn from one district in Kenya, the sample may therefore not be representative of all the secondary schools in Kenya. The main findings of this study may not therefore apply to other secondary schools in Kenya. The design of the study among other factors was guided by time and financial constraints.

1.7 Assumptions

It was assumed that:

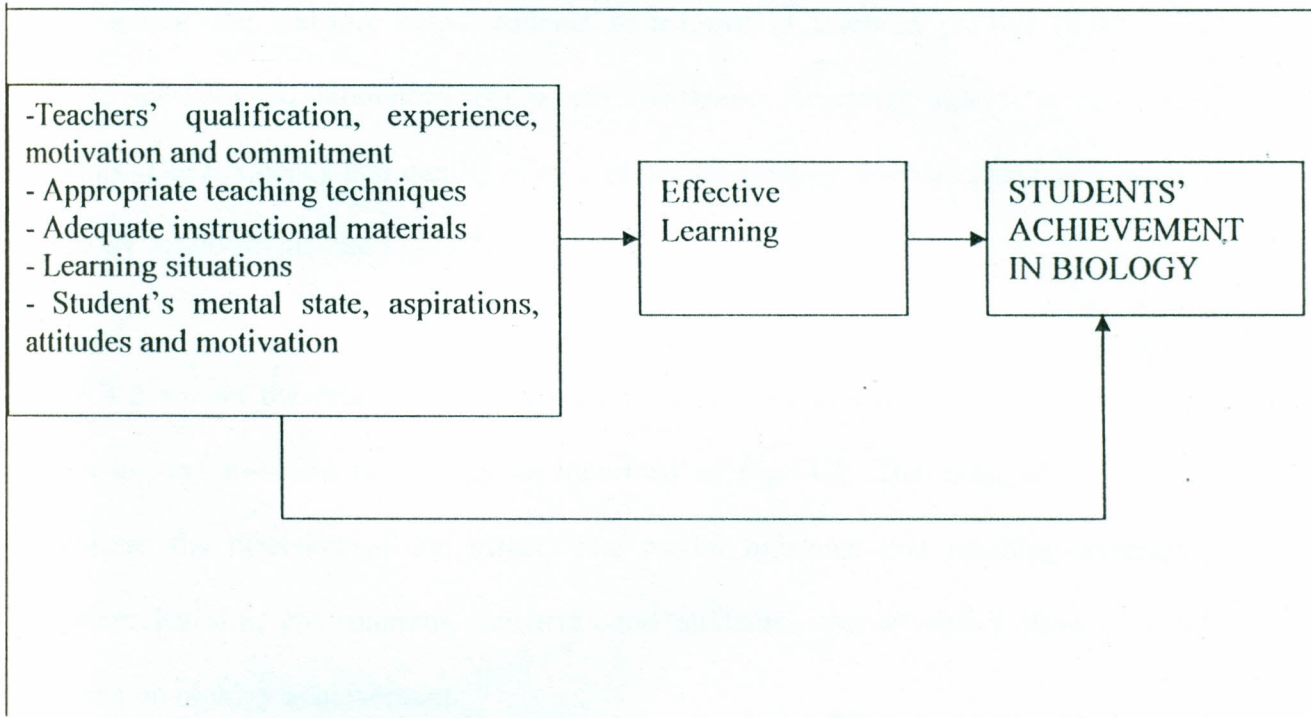
- i) The teachers had been teaching biology in these schools for the past five years.
- ii) The students learnt under similar conditions as those who had done KCSE in the past five years.
- iii) All secondary schools investigated adhered to a uniform Biology curriculum.

1.8 Theoretical Framework

The knowledge that humans have acquired regarding the ways behavior is modified, permits some measure of prediction and control over performance and learning (Di Viesta, 1989). Theories of Mental State by J. Locke (1986) provide descriptive information about the limits of effective learning. These important factors and their interaction contribute to the students' learning process. They provide a basis for realizing the learning situations, instructional resources, students' characteristics, teaching strategies and the kind of information a teacher requires when faced with a decision about which instructional strategies (amount and kind of experience to provide to the students) to use at a given time (Brenner, 2002). The mind is compared to a 'white paper' upon which the teacher leaves imprints or records which are designated by such terms as sensations or impressions and which affect a student's learning and therefore achievement in any school subject (Bode, 1940).

Figure 1.1 below shows the interaction of the elements of the Theoretical Framework.

Figure 1.1 Interactions of Elements of the Theoretical Framework



Source: Adopted and modified from Di Viesta (1989)

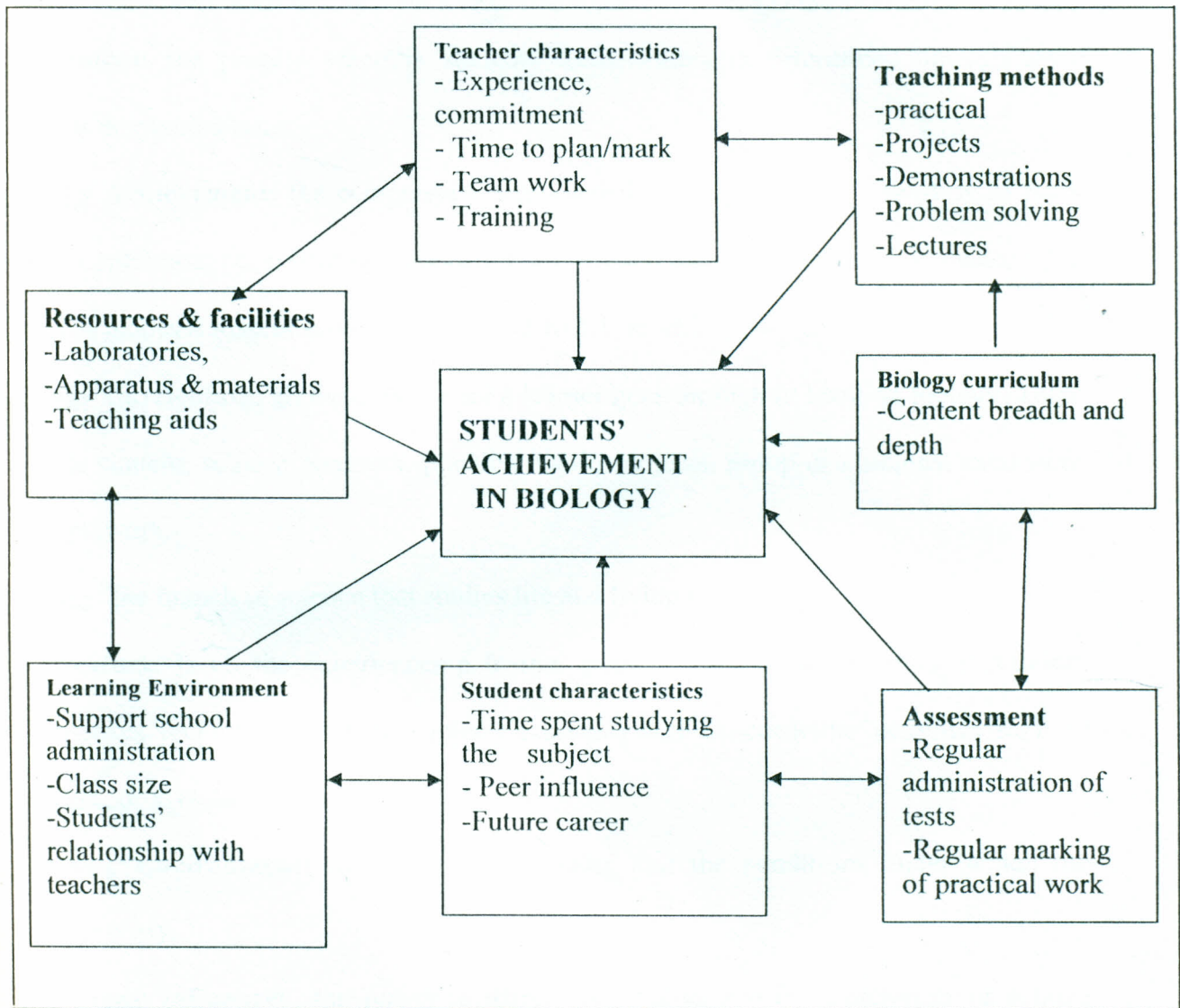
1.8.1 Conceptual framework

The conceptual model underlying this study was concerned with the major factors that had been linked to low achievement in sciences and by extension, to Biology. Achievement in Biology involves a number of independent variables such as teacher and student characteristics, teaching strategies, resources and facilities, assessment and learning environment (Kumar, 2005). It is primarily the acquisition of proficiency in a subject that leads to positive attitudes in that subject and the reverse is also true (Jacklin & Maccoby, 1974). Teachers on the other hand play an important role in teaching biology and therefore have a strong influence on the students' learning of the subject. The qualification,

motivation, commitment, experience and instructional styles of the teacher have an influence on learners' achievement in biology. Availability of facilities and resources for both teaching and learning helps students to achieve in sciences (Kelly, 1978). This includes laboratories, laboratory equipment, textbooks, teaching aids, chemicals and materials. The frequency and quality of assessment by biology teachers also has a bearing in biology achievement (see Fig. 1.2).

Figure 1.2 shows the relationships that are hypothesized to exist among the variables influencing achievement in biology as theorized in Fig. 1.1. The head of the arrows symbolizes the direction of the effect. The model indicates that teaching strategies, resources, learning environment, teachers' and students' characteristics have a direct influence on biology achievement.

Figure 1.2: Relationship between variables contributing to Biology achievement



Source: Adapted from (Kotte, 1992)

1.9 Operational Definition of Terms

Achievement: is performance of a student in the school as measured by school and national tests and examinations.

Assessment: the process whereby students' achievement is determined through tests, projects or examinations.

Biology Achievement: the competency attainment in biology including mastery of basic skills (experimenting, recording, reporting), knowledge and concepts which is measured in terms of grades a student scores in biology at KCSE level.

Biology Curriculum: all the experiences a learner goes through in learning biology. These include content, science congress, practical work, projects, group discussions, excursions and fieldwork

Biology: the branch of science that studies life and living organisms.

Curriculum: Is all the experiences a learner goes through in any learning institution. Experiences include time-tabled subjects (content) and Co-curricular activities such as games, sports, clubs and societies.

Learning Environment: this is the surrounding and the conditions under which the students study.

Peer group influence: the power to affect one another's beliefs, character or actions found in people of the same age.

Poor Achievement: low grade scores which is 40% and below obtained in biology by the students at KCSE level.

Science: is a vast body of connected knowledge of theories, concepts and facts developed by scientists through scientific methods.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter dealt with literature relevant to this study. The literature in this study is reviewed under the following: review of previous research, classroom learning environment, teacher characteristics, teaching strategies, assessment, resource availability and use, student characteristics and achievement.

2.2 Previous research

Knuth (1991) has identified three major arguments that have been used to point out the need for reform in science education. First, Kenya's economic position appears to be declining. The technical preeminence of any country is dependent on workers who are scientifically literate (Barbara & San, 2006). Consequently, the blame for this economic decline is often placed on educational institutions for inadequately preparing students, which is shown by their poor achievement in science subjects. The second argument arises out of the data that show that many students are not taking advanced science classes. In some schools the decision to choose certain science subjects is left at the sole discretion of the learners who opt for humanities at the expense of sciences and some of those who choose the sciences are scoring below average.

The third argument is tied to low scientific advancement in Kenya. Biology has had significant influences on society that have allowed improvements in the living conditions and affluence of many people. He further states that because of scientific thinking, lives

often are transformed forever. It is imperative to carefully, thoughtfully, democratically, but urgently engage in the task of biology education reform. Opportunities for thinking about new things and thinking in different, more powerful ways become possible only if the factors contributing to poor achievement in biology are well understood.

Everyday, each person is called upon to make decisions concerning personal and societal issues involving biology. Such decisions are likely to be difficult to make. They may be the wrong decisions if there is little or no understanding of biological information or scientific awareness. Apart from getting all citizens scientifically literate there is ever increasing need for scientific manpower necessary for social and economic development (Franyo, 2007). Therefore it becomes very important that each member of the society should develop an understanding of biology and an awareness of its potentials and limitations. Some of the world's worst problems have often been caused or promoted by science and technology (Tsuma, 1998). Biology has often been castigated for accelerating over-population, threatening the world's peace, polluting the environment, destroying natural resources and dehumanizing mankind for example, through cloning (Lord, 2003). But, the resolutions of these problems still require more and more biology (Baez, 1967). This is possible only if students are able to effectively learn biology.

In their summary of a series of studies conducted under the auspices of International Association for the Evaluation of Educational Achievement, Anderson et al (1989), found a relationship between teacher characteristics, classroom interaction, school characteristics, student characteristics, teacher perceptions, quantity of instruction and student participation

with students' achievement in biology. Dunkin (1989) suggests that, there are various factors that influence students' achievement either directly or indirectly. Some of these factors are external to the school while others are part of the intricate web of influences that operate within the school (Brenner, 2004). He cited leadership, school administration and the teacher as those factors that operate within the school and have a direct bearing on students' achievement. According to Eshiwani (1983), the quality elements that have been found to be consistently related to achievement are: instructional materials, especially textbooks, school library, teacher qualification, length of instructional program and school administration. However, these factors may not apply to Migori district in particular.

Other quality elements cited are the frequency of assessment, teachers' correction of students' work, class size, in-service training of teachers and academic teaching practices and learning time (Beck & Earl, 2002 and Black & Wiliam, 1998). This study sought to find out some of the educational practices that differentially affect particular groups of students' opportunity to learn biology effectively. It formed an important extension of existing literature as it addressed the basic agent of change 'the teacher' and aimed at helping teachers make desirable decisions that can enhance students' achievement in biology.

2.3 Learning environment and achievement

The types of classroom interaction determine not only the effectiveness of the learning situation, but also the attitudes, interests and in part, even the personality of the child.

According to Gammage (1971):

In the context of personality, as it is, affects learning. The child's reaction to success, failure, praise and blame (which is in interaction with the teacher) become crucial since they relate not only to the pupil's social and emotional behavior in the classroom but also to motivation. (P.56)

The teacher must be fully aware that what happens in the first few encounters with the pupils is likely to establish the particular class. The learning environment or atmosphere found inside the classroom is of extreme importance in molding the character of the pupils and determining the efficiency with which learning takes place. The motivation of the learner to achieve may be enhanced or damaged by the teacher's attitude towards the students and how he or she interacts with them (Anderson et al, 1989 and Flanders, 1970). The teacher can make the students to be eager to learn or inhibits their interests and attitudes.

Classroom teacher-student interaction is important since it either enhances or inhibits effective learning that translates into higher or lower achievement. Turiel (1969) stated that it is necessary to consider what the child responds to in the environment as well as the nature of interaction with the environment that leads to change. The effectiveness of teaching strategies largely depends on the match between the level of concepts being encountered and the developmental level of the child (Barbara & San, 2006). The goal of education in a democratic society like Kenya should be to provide the conditions to produce more abstract conceptual structure.

The classroom interaction that governs verbal communication between the teacher and the learner are learned in the course of children's learning experiences. Many signals pass between the teacher and the learner, which convey feelings about a topic and give information, which helps to organize conversation. Flanders (1970) and Franyo (2007) argue that if these signals are responded to appropriately, it is possible for effective communication to take place. Among the teachers, there are those who choose to ignore or do not notice these cues, so they influence the communication to become one-sided. Such are autocratic teachers and therefore make the students to withdraw and become uninterested in learning. In this situation, the listener(s) can show disapproval in various ways- making explicit remarks about the subject which forces them to have a negative attitude resulting in low achievement.

In the traditional classroom, wisdom and knowledge is supposed to flow from the teacher to the student. The teacher is the final authority as far as the possession of knowledge is concerned and the learner is considered an 'empty vessel' who is supposed to imbibe the presented knowledge (Tsuma, 1998). Unfortunately, this is what most of the teachers believe in. The interaction of the teacher and the student, which is one of the most important aspects of the education process, still may be one of the most neglected aspects of the teaching learning process implying the need for constant investigations (Amidon & Hough, 1967).

According to SMASSE report findings of 2000, heads of secondary schools must take a more responsible role in both administrative and academic activities in the schools they head.

Hellinger and Heck (1995) noted that in many ways, the school head is the most important and influential individual in any school. It is his/her managerial skills that set the benchmark, the direction, the tone and the learning environment. His/her management are pivotal for the moral of the teachers and set the degree of concern for what students may or may not become. One basic role of schools is to provide a suitable environment conducive for learning. Therefore, the heads should ensure that all available resources are directed towards this end. Starting projects for the sake of it without due consideration of high academic achievement including biology is a failure on the heads part. Lack of prioritization of meager resources generated by schools lead to empty laboratories, libraries and stores (SMASSE, 2000). Teachers work within hierarchical institutions that place highly visible constraints upon their professional discretion (Hawthorne, 1992). Teachers' effort to make a difference in the students' achievement is influenced by the school administration.

The heads of schools cannot escape the blame for the falling standards of biology achievement in Kenyan schools. This is because a school's performance is a reflection of the head's management style (SMASSE, 2000). Kamotho in Kombo (1998) states that the basic reasons why some schools perform better than others in examinations is that while some school heads organize the learning process for their students, others leave it to chance. Head teachers who are committed to their work are responsible and have a sound moral conduct and usually provide favorable learning environment to students.

2.4 Teacher characteristics and achievement

When the professional approach is embraced in the teaching and learning process, the use of indirect verbal behavior, for instance, acceptance of the students' feelings, praises or encouragement is enhanced and this is associated with a more positive attitude towards learning and higher achievement by the students (SMASSE, 2000). Some teachers subject learners to the traditional 'telling' or the narration marathon which leads to ineffective learning of knowledge, concepts and skills required in biology as a practical subject (SMASSE, 2000). Gachathi (1976:106) in his report says; "...that no matter how education is viewed, the role and the quality of teachers must be given the most critical consideration."

In view of Gachathi's conclusion, there is need not only in biology but also in every subject for qualified teachers. Teachers' qualification goes with their effectiveness in the classroom. They play an important role in teaching biology and influence the students' acquisition of knowledge, skills and concepts. Just how teachers deliver the content of their lessons affects the achievement of the students in biology (SMASSE, 2000). According to Comber and Keeves (1973), teaching experience does not necessarily cause higher achievement in science, but knowledgeable teachers are less likely to pass on misconceptions, are more confident in imparting information, use less time for preparation and are able to present a wider range of examples and analogies which help the students to learn and understand a certain topic more easily. Commitment and instruction styles are also other characteristics that contribute to students' achievement. Teachers who elicit strong achievement gains, accepts responsibility for doing so. They believe that their students are capable of learning and that teachers are capable and responsible for teaching them

successfully. They also team up with the other teachers in order to share ideas and opinions on the strategies to be adopted in teaching and learning of biology (SMASSE, 2000).

Nevertheless, there might be several aspects that determine the teacher's effectiveness in the classroom. According to Tsuma (1998) Science educators should make sure that learners get involved in the teaching and learning process always. This is because biology is a system of acquiring and generating knowledge and thought based on acute observation, thorough investigation, experimentation, logic, proof, explanation and validation (Barbara & San, 2006). They would certainly become better teachers and stop turning students off science by resorting to dictatorial and rote learning methods to cover their own ignorance. Eswaine (1996) described the falling number of students pursuing sciences at the university by saying that it is the short fall of science teachers in secondary schools nationwide. Teachers make decisions daily by selecting content, texts and materials, mode of presentation, learning activities and evaluation methods to construct classroom curriculum. The professional autonomy associated with these choices characterizes conception of teachers as professionals. Moreover, in-service training courses are necessary since teachers who attend them get to know the changes in the curriculum as far as the subject matter and teaching techniques are concerned (Beck & Earl, 2002).

2.5 Teaching strategies and Achievement

According to SMASSE project findings of 2000, many science teachers plunge into the activity of teaching armed with textbooks. Should teaching be done by or through textbooks? Two opposing schools of thought of whether the content or the process is more important during teaching and learning situations compound the problem of methodology.

Teachers need to understand that the learner is the most important person in the classroom and therefore should be treated with care and concern. The learner's attitude in biology has to be nurtured so that this can lead to improved achievement.

Effective teaching comes from the knowledge of the relationship between classroom processes measured through observation systems and student outcomes, most notably gains in standardized achievement tests, for instance, KCSE. However, some principles on effective teaching are rooted in logic of instructional design, for example, instructional methods (Corno & Snow, 1986). Principles of effective teaching rest on a few fundamental assumptions about optimizing curriculum and instruction. The first assumption is that school curriculum sub-sums different types of learning that call for different types of teaching. No single teaching method such as direct instruction, social construction of meaning, can be the method of choice for all occasions. Secondly, within any school subject like biology, instructional needs change as the students' expertise develops. Consequently, what constitutes an optimal mixture of instructional methods and learning activities will evolve as student-school years, instructional units and even individual lessons progress (SMASSE, 2000). Corno & Snow (1986), Gastel (1991) and Harris and Taylor (1983) also confirm this assertion.

The third assumption is that, students need to learn effectively and progress through curriculum. Effective instruction needs to focus on the zone of proximal development, which is the range of knowledge, concepts and skills that students are not yet ready to acquire on their own but can acquire with the help from their teachers. Teachers have

different styles and strategies for helping students learn particular biology concepts and skills and there is no one right way to teach. However, teaching biology well involves creating, enriching, maintaining and adapting instruction to achieve biology objectives, capture and sustain interest and engage students in building biological understanding. In addition, teachers have a wide variety of instructional strategies at their discretion, which differs in terms of the amount of teachers' preparation and the number and type of students being taught at any given time. These strategies are selected based on their purpose in teaching, their understanding of teaching-learning processes and consideration of cost effectiveness (Tsuma, 1998).

According to Khatete (1995), constructivism brings about the desired outcome of conceptual change by creating a conflict between the student's naïve ideas and the accepted biological ideas. The student should be exposed to situations where his/her ideas are matched against the biological concepts, which are backed up by evidence through experimentation, and therefore the student has to justify her/his ideas against the conflicting scientific observations. Another strategy involves the use of analogies between students' ideas/conceptions and the accepted science ideas.

The teacher should establish the student's ideas in a given concept area and then introduce analogies of the accepted biological concepts so that children compare their own conceptions with the biologically accepted concepts. This may lead to better understanding of the scientific concepts and hence greater achievement in science and particularly in biology. The teachers should take into account the fact that children do not

come to class 'empty headed', so that when planning for teaching, they are supposed to develop strategies that make the process of learning more meaningful, the kind of teaching-learning process that will make the students change their unscientific conceptions.

The author further suggests that teaching and learning process should be a spiral mode of teaching which facilitates the restructuring of students' concepts hence better understanding of biology which translates to high achievement. He argues, however, that the school teaching and learning in Kenya is examination oriented at all levels of schooling, secondary schools included. There are highly competitive national examinations at the end of secondary schooling. The good schools, as judged by the top 100 schools in performance in the KCSE results countywide, are regarded by the parents, students, Ministry of Education and the society as a whole as the best for the students.

In the event of all these, the head teachers and the entire teaching staff will resort to drilling their students through repetitive teaching of what is likely to lead to higher percentage of their students passing the national examinations so that their schools can appear in the top 100 nationally. This in turn reduces the students to passive recipients who are supposed to imbibe knowledge from the teachers, memorize it and reproduce at the examination time. Failure to reproduce means low achievement on the students' part. This has a great implication to curriculum developers and teachers who do not seem aware of these effects on students' learning of biology.

Harris and Taylor (1983) argue that effective teaching practices allow for increased opportunity to learn. This is because students tend to learn more when most of the time allocated to curriculum activities and the classroom management system emphasizes maintaining their engagement in those activities. Effective teachers allocate most of the available time to activities designed to accomplish instructional goals. Establishing a learning orientation is through beginning lessons and activities by communicating the purpose of the activity, connecting it to prior knowledge and cueing the kinds of students' responses that the activity requires and establishes learning orientation (Baez 1967, Dunkin 1989 and Kelly 1978) share this same view.

Most studies on achievement effects of co-operative learning have found that, there is significantly greater achievement in co-operative classes than in the control classes. Co-operative learning generally works equally well for all types of students (Lord, 2001). Research on co-operative learning supports such diverse outcomes as students' achievement at a variety of class levels and in many subjects including biology. It is practical and attractive to teachers (Kelly, 1978). in their summary on the effects of co-operative learning Corno and Snow (1986) observe that, 'lower ability students performed better in small group approach and higher achievers also benefited from this form of instruction.

According to Schulman and Tamir (1973), discovery learning, in spite of its limitations, generally brings about better outcomes, both cognitive and affective. Discovery learning depends on the theory that learning involves progressive development and restructuring of

learner knowledge and schemes (Driver, 1989). This process of learning whereby knowledge schemes are constructed and reconstructed is broadly termed as constructivist (Khatete, 1995). Discovery teaching has not gained easy access in most schools in Migori district. Several reasons may account for reservations and reluctance on the part of many teachers to adopt discovery learning. These include a general lack of adequate resources and facilities (Harris & Taylor, 1983).

Given the practical situation in the Kenyan biology curriculum, the subject is content based and the time allocation as stipulated by the Ministry of Education is inadequate (SMASSE, 2000, Kumar, 2005). This creates competition during teaching between content and the process. If teachers give more emphasis to content in order to finish the syllabus, they are content driven. If on the other hand, emphasis is on the process then they are process driven (SMASSE, 2000). It is worth mentioning that many teachers are content driven though a few are process driven and spend more time during planning thinking about the delivery process and the resources or teaching aids to be used and therefore student-centered (SMASSE, 2000).

The current biology curriculum is content-based and hence causes a backwash effect and narrows the attention of the teachers and that of the learners to the examinable areas of the syllabus only (SMASSE, 2000). According to Beck & Earl (2003), the right kind of curriculum is that which has the right kind of content- (not too much nor too little to make the consumers be together with the rest of the world in social, economic and scientific developments) and that teachers understand and share the underlying aims and objectives of

biology education, and that they do so autonomously. This carries a major implication for the education of teachers themselves and for teachers' accountability. Teachers are accountable for not satisfying aims, or not achieving objectives of biology education (Traverse and Westbury, 1989).

Curriculum content and learning activities need to be difficult enough as to challenge students and extend their learning but not too difficult as to leave many students confused or frustrated (Corno and Snow, 1986). What children learn in schools influences their attitudes and beliefs of future generations, the content of the biology curriculum should support the teaching strategies recommended for biology. According to Maundu et al (2005), biology curriculum should observe the following principles: breadth, balance, relevance, differentiation, equal opportunities, continuity, progress, links across the curriculum, appropriate teaching approaches and assessment.

2.6 Assessments and Achievement

Wilson (1986) states that the techniques and frequency of assessment and examinations do profoundly affect achievement, the content of the curriculum and how it is taught. Assessment includes informal classroom processes such as observing pupils tackling a task, questioning them about their work, looking at their record of work, or listening in on their discussions. More formal processes include testing and setting assignments for marking and the national system of tests and examinations. Generally, assessment can give insights into very specific aspects of the thinking and performance of pupils (Brenner, 2004). How are they thinking about a particular situation or a topic? Where and

why skilled performance on some task is breaking down? Using assessment to ask and answer such questions improves the information available to the teacher and makes it possible to identify and address learning difficulties (Beck & Earl, 2002) and (Black et al, 2002).

Black et al (2002) identified five factors seemingly crucial for successful learning and a further five that hinder it. Standards are raised by:

- i. Regular classroom testing and the use of results to adjust teaching and learning rather than for competitive grading.
- ii. Enhanced feedback between teachers and students, which may be oral, or in the form of written comments on work.
- iii. The active involvement of all the students
- iv. Careful attention to the motivation and self-esteem of students, encouraging them to believe that they can learn what is being taught.
- v. Time allowed for self- assessment by students, discussion in groups and dialogue between teachers and students.

Standards are not raised by:

- a). Tests, which encourage rote and superficial learning, even when teachers claim they wish to develop understanding.
- b). Failure by teachers to discuss and review testing methods between themselves.
- c). Over-emphasis on giving of marks and grades at the expense of useful advice to learners.

- d). Approaches that compare students in a way that persuade them that the purpose is comparison rather than personal improvement and this demotivates some students.
- e). Feedback, testing and record-keeping which serves a managerial rather than a learning function.

Research into the use of formative assessment in classroom settings has confirmed the important contribution that it can make to effective teaching and learning (Black and Wiliam, 1998). Informal classroom assessment offers immediate information to support important teaching functions. It provides timely evidence to guide teachers' interventions in support of pupils' learning and their management of the on-going lesson (Beck & Earl 2002 and Black & Wiliam, 1998). Formative assessment helps match the planning of the future lessons more effectively to the learning characteristics and needs of particular groups of students (Brenner, 2004). It also provides the basis from which teachers can give pupils constructive oral and written feedback, and help them set appropriate targets for the development of their work. Black et al (2002) in a further study on learning gains produced by formative assessment reported the following positive effects;

- a). Careful framing of teachers' questions to encourage active participation by students;
- b). Increasing 'wait time' after questions to give students time to think and contribute;
- c). Comments on written tasks that identify what has been done well and what still needs improvement;
- d). Making criteria for evaluating any learning achievement transparent to the students;
- e). Teaching students the habit and skills of collaboration in peer-assessment;

- f). Encouraging students to keep in mind the aims of their work and assess their own progress to meet these aims; and
- g). the formative use of summative tests.

In view of the above research findings, assessment has a profound effect upon the teaching and learning process. Indeed, as mentioned above, effective learning and hence teaching could hardly proceed without the feedback that assessment provides and is therefore an important factor contributing to students' poor achievement in biology.

2.7 Resource availability, use and achievement

According to Maundu et al (2005) a classroom teacher requires various kinds of teaching resources such as text books, apparatus, chemicals, charts, models, photographs, motion pictures and facilities such as laboratories, herbarium, green houses, botanical garden and others to enhance the effectiveness of his/her instruction. A resource is any source of information, expertise, supply or support. Resources play an important role in enhancing the teaching/learning process. They aid the teacher in teaching by modifying the teaching and learning situation. The use of resources involves the use of a broad range of the human senses at the same time in the learning process. This facilitates learning and helps in conveying the intended message.

Raghubir (1979) argues that availability of instructional resources does not necessarily translate into effective teaching and learning of a subject. Adequacy of resources is much more important in achieving the latter. This is because most of the resources play an

important role in understanding concepts and imparting skills to the learner (Franyo, 2007). The learner can only adequately acquire these concepts and skills through the actual use of or contact with a resource. This is particularly important in the sciences where a hands-on approach to learning has been demonstrated to play a crucial role in the understanding of concepts and retention of content taught, as well as developing the ability to think scientifically than by using the lecture approach. Determining the availability and use of resources for teaching and learning biology in selected secondary schools in Migori District formed a part of this study.

2.8 Student characteristics and achievement

The purpose and programs of the educational system must be designed to meet the needs of each individual child (Wilson, 1986). The characteristics include; entry behavior, time spent studying, peer group influence and aspiration. They vary from one individual student to the next. According to Hunt (1971), individual differences are given much lip service and even more drawer space in the form of filed test results, yet educational planners and decision makers continue to work from models for the student-in-general. Ignoring the importance of differential student characteristics leads to questions about the general effectiveness of educational procedures, for example, whether a discovery approach is more effective than a structured approach (Kumar, 2005). No account is taken of the differential effectiveness of such approaches on different kinds of students.

Peer relationships exert their influence through the attitudes, expectations and understanding of roles that they leave with the individual (Erwin, 1993). Human

relationship is the most powerful psychological behavior modifier known to man. The students misperceive how their peers evaluate their social and academic competence and do not recognize the contribution, which their own social skills have on peer reactions so that this influences their general academic achievement (Erwin, 1993). Entry behavior of a student fosters his/her language, cognitive and social development with frequent and varied verbal interactions. It also improves students' interaction with their peers, intellectual development as well as school and social adaptations. Provision of education curriculum that permits the student to initiate and pace their own learning activities also influences the entry behavior. (Wilson, 1986).

The characteristics of the student and the educational objectives must both be employed as guides in the design of maximally effective environments for learning for better achievement. According to Driver (1989) the role of education in our society is to train children to be creative and self-reliant. This is basically through achieving biology education objectives. Africa lags so much behind the rest of the world in science and technology development: an indication of the relative failure of science education in Africa (Unesco, 1986). For Kenya to develop industrially improvements are necessary in the provisions for science education and in particular biology education at all levels in the country.

The 1982 conference of African Ministers of Education in its Harare Declaration, resolved to draw up and implement during the coming two decades, educational policies designed in particular to:

Develop and renovate science and technology teaching at all levels and activities designed to popularize Science among general public, in order to promote full utilization of modern scientific and technological knowledge in development, to stimulate an interest in scientific career and to increase the number of pupils and students opting for work in scientific fields...Unesco (1982:2)

This can be better realized if Kenya learns from reassessment of the past and present conditions of teaching and learning biology in the country (Ajelayemi, 1990). When motivational factors such as interest, attitude, and aspiration are inculcated in the learners, they tend to spend more time studying the particular subject. This translates into higher achievement in sciences. Students understand better when they spend more time studying biology and will therefore achieve to the expected standard. If the major educational goal is to encourage the development of higher conceptual level with its associated adaptive capacity and flexibility, then this study would provide a specific guide for working toward this long-term goal.

2.9 Summary of the Literature Review

From the literature reviewed, it is evident that there is concerted effort by various scholars in their quest to address low achievement in sciences, but not biology in particular. These reports have specifically sought to understand and isolate various factors that may contribute to poor achievement in sciences in secondary schools at national level. Despite the fact that various factors that may contribute to achievement in sciences have been cited, it is pertinent to point out that these factors may not apply to achievement in biology at

secondary school level in Migori district. Moreover, promotion of creativity, self-reliance and national development is not basically through the teaching and learning of biology alone but that other school subjects also contribute.

Factors that contribute to poor achievement in sciences have been identified to include poor teaching strategies, inadequate resources, poor school administration styles, inadequate assessment methods, inappropriate classroom interaction styles, inadequate teacher's qualification, lack of experience and inadequate time spent studying the subject.

Nevertheless, it is important to note that each of these factors affects achievement in other school subjects though the interest of this study was in biology only. The researcher sought to find out whether these factors exist in Migori district.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

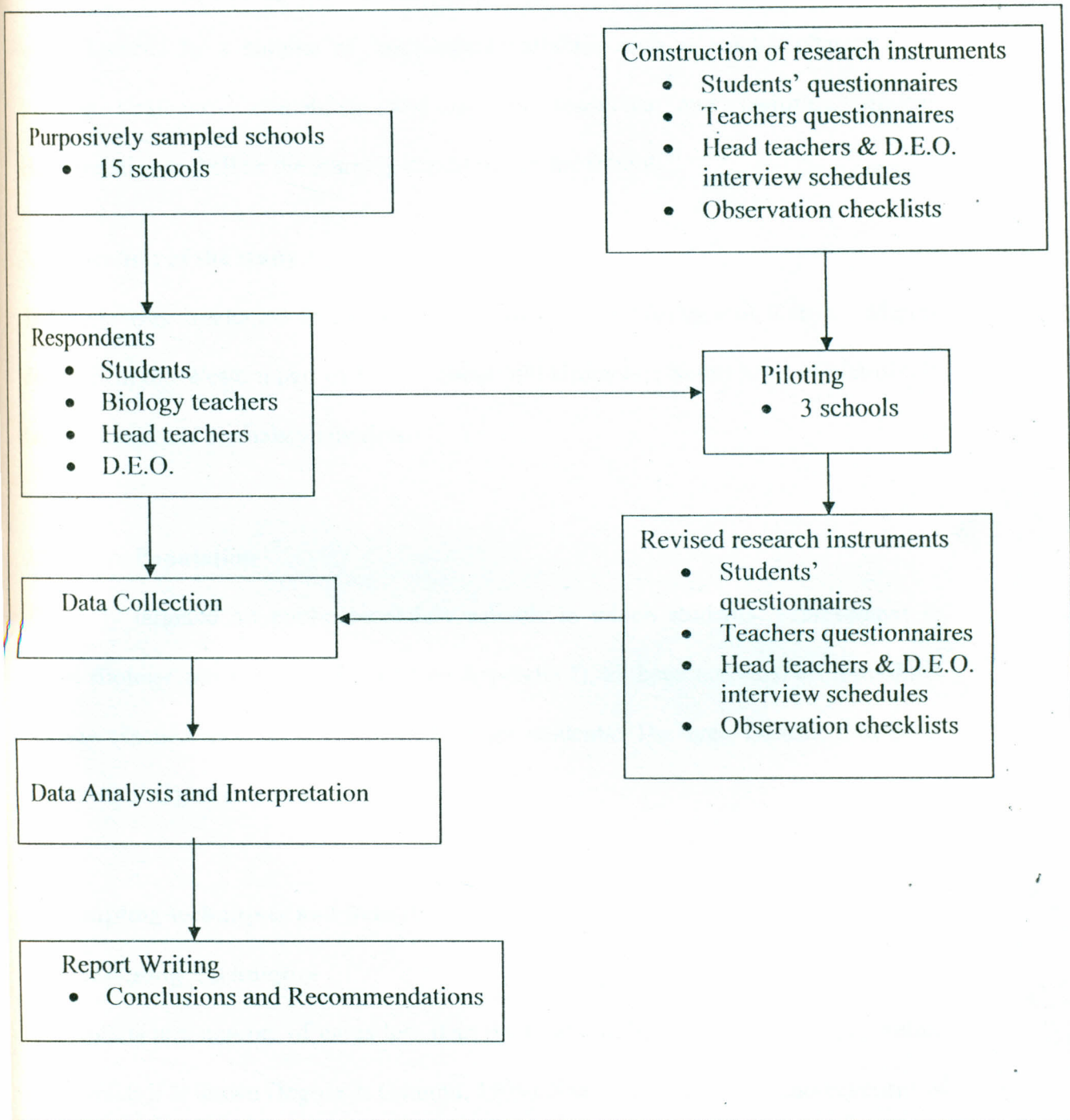
This chapter outlines the study design, study location, target population, sampling procedure, instruments which were used in data collection, pilot study, procedure used in data collection, methods of data analysis and Logistical and Ethical considerations.

3.1.1 Research Design

This was a descriptive study, which utilized survey design. Description of this type provided important leads in identifying needed emphases and changes aimed at enhancing achievement in biology (Borg & Gall, 1989). Data was descriptive and therefore the researcher used frequencies and percentages to describe the findings of the study. Descriptive Survey design also enabled the researcher to obtain information concerning the factors and to assess the opinions of head teachers, Biology teachers and students on how these factors contributed to achievement (Best & Kahn, 1992 and Gay, 1992). Descriptive technique gave a vivid descriptive account of the factors identified and how they contribute to achievement in Biology (Mugenda & Mugenda, 2003). It also showed the relationship between the factors and achievement and attempted to advance an explanation to poor Biology achievement based on the data collected.

Figure 3.1 shows the summary of the study design.

Figure 3.1 Design of the Study



Source: Adopted and modified from Cohen & Manion (1994)

3.1.2 Variables

The variables in this study included the dependent variable student's achievement which was influenced by a number of independent variables such as teacher characteristics, teaching strategies, availability and use of resources and facilities, students' characteristics as well as the learning conditions in the school.

3.2 Location of the study

The study was conducted in Migori District of Nyanza Province of Kenya. Migori district is in the Western part of Kenya, about 500 kilometers South West of Nairobi. It borders Kuria and Homabay Districts.

3.3 Target Population

The study targeted all public secondary schools in which students' achievement in KCSE Biology was considered poor (see Appendix I), all head teachers, all form three Biology teachers and all form three Biology students. The area District Education Officer (D.E.O) was also targeted by this study.

3.4 Sampling techniques and Sample size

3.4.1 Sampling Techniques

A sample is any number of cases less than the total number of cases in the population from which it is drawn (Ingule & Gatumu, 1996). Sampling saves time and expenses of studying the entire population (Borg & Gall, 1989). The study used form three students in purposively selected public secondary schools in Migori district. Form three was considered ideal for the study since the students had made decisions in form two third

term to take biology at KCSE level and it was also believed to be the base for preparations for the KCSE. Form I and II were considered not adequately exposed to the secondary school biology curriculum and some would not continue with biology beyond form two. Form four students were considered busy preparing for KCSE examinations and therefore needed least interference from researchers. Migori district was purposively selected because first it performs very poorly in KCSE biology. Secondly, it was convenient to the researcher in terms of financial and time constraint. Finally, the researcher was also familiar with the geography of the area.

3.4.2 Sample Size

The study involved the survey of fifteen (15) public secondary schools which was about 28% of the total population. Cohen & Manion (1994) state that a sample between 20-30% is accepted in survey technique. The sample size for the students was 26%, while 22% of form three biology teachers, one from each of the sampled schools were used in the survey. Where there was more than one biology teacher for form three, purposive sampling was done and the head of biology department was used because he/she was most senior and was considered more knowledgeable. The head teachers, one from each of the sampled schools (22%) were interviewed to obtain relevant information to this study. Where the head was a biology teacher, he or she was interviewed and did not respond to the questionnaires. Table 3.1 shows the poor performing schools in Migori district with Biology KCSE mean scores below 40%.

Table 3.1 Schools with KCSE Biology Mean scores below 40% from 2001-2005

Schools	2001	2002	2003	2004	2005	Mean (%)
1. Anjego Mixed	29	29	36	34	38	33
2. B.L.Okok Osogo	46	38	28	26	38	35
3. Bande Girls	31	25	31	25	30	29
4. Bware	43	31	35	43	30	36
5. Kakrao	23	26	33	31	32	31
6. Kwa Mixed	39	28	33	36	38	35
7. Lwala Mixed	39	27	37	54	38	39
8. Mukuyu Mixed	43	27	30	36	43	36
9. Nyaduong Mixed	35	32	38	31	31	34
10. Oruba Girls	24	36	30	39	38	34
11. Owiro Akoko Girls	42	36	38	36	33	37
12. Piny Owacho Mixed	39	35	34	33	33	35
13. Thim Jope Mixed	31	31	31	30	28	30
14. Kanyasrega Mixed	31	25	41	37	30	33
15. Kanga Onditi Mixed	27	24	37	56	45	38

Source: D.E.O's Office, June 28TH, 2006

Simple random sampling technique with replacement to ensure equal chances to all the students was used to select a sample of three hundred and sixty (360) students out of the total number of all the form three biology students (2700) from the fifty-four (54) public secondary schools used in this study. Random sampling yields data that can be

generalized to a larger population (Borg & Gall, 1989). Thirty (30) students were selected from each of the identified schools. In schools with more than one form three streams, students were drawn from all the streams through random sampling. The corresponding numbers to that of students in each class were written down on pieces of paper and each student picked one as the researcher replaced. In Mixed schools, approximately fifteen (15) boys and fifteen (15) girls were chosen. This was ensured by having two (2) separate containers from which the boys and the girls picked.

Table 3.2: Sampling Grid

Total Number of Schools	54
Number of poor performing schools	15
Number of pilot schools	3
Number of sample schools	12
Number of head teachers	12
Number of Biology teachers	12
Student respondents	2700
Number of sample students	360

3.5 Construction of Research Instruments

For purposes of this study, the following instruments were used: questionnaires, interviews schedules, observation checklists and past KCSE results as shown in table

3.3.

Table 3.3: Instruments for Data Collection

Instrument(s)	Target
Questionnaires	<ul style="list-style-type: none">• Students• Biology teachers
Interview Schedules	<ul style="list-style-type: none">• Head teachers• D.E.O
Observation Checklists	<ul style="list-style-type: none">• Biology practical• Theory lessons• Resources and facilities
Past KCSE results	<ul style="list-style-type: none">• Students mean scores in KCSE in the last 5 years

3.5.1 Questionnaires

The questionnaire was the main instrument for data collection. The researcher constructed questionnaires for biology students and biology teachers (see Appendix II & III respectively). Questionnaires gave the respondents greater chance of expressing their views, ideas, opinions, suggestions and specific responses. The information from Students' questionnaires was used to cross-check and to supplement the information given by teachers in regard to factors contributing to students' achievement in biology.

3.5.2 Observation Checklists

These are prepared lists containing the basic instructional resources and facilities that can be used for teaching and learning of biology at secondary school level as outlined in the SEPU guideline. Checklists were used to determine the availability and adequacy of instructional resources in schools selected for this study (see Appendix VI section I) and how they were used in the teaching and learning of biology. They were also used to observe lessons when students were being taught in the sample classes (see Appendix VI section II).

3.5.3 Interview schedules

Interviews were conducted to provide a comprehensive and richer picture of those factors that the head teachers and the District Education Officer (D.E.O) considered significant in influencing achievement in biology in Migori district. Satyanarayan (1983) says that interviewing is an appropriate instrument for any study because it helps the interviewer to cover all the dimensions of the investigation through probing of the respondents. The interviews were based on the research questions. The interviews were audio taped with permission from the interviewee and the researcher took notes in three cases (3) where the interviewees could not permit tape recording.

3.5.4 KCSE Results

The researcher examined students' Biology KCSE results to review their achievement in the past five years. The students constantly displayed low achievement in the subject as depicted by table 1.1.

3.6 Pilot Study

The researcher conducted a pilot study in three schools one boy's only, the other girls' only and one mixed. The purpose of piloting was to pre-test the research instruments and also to familiarize the researcher with the data collection procedures. The researcher herself did the administration of the instruments with the assistance of the Biology teachers in their various schools. The research instruments were administered on three (3) form three biology teachers, ninety (90) randomly selected form three Biology students and three head teachers from the pilot schools were also interviewed. The researcher also observed three (3) theory lessons and three (3) practical lessons each from the pilot schools. Following the findings from the pilot study, the researcher revised and modified the items accordingly.

3.6.1 Validity

Validity is a measure of the degree to which a research instrument measures what it is supposed to measure. The content validity of the instruments was initiated at the design stage. Opinion of the researcher's supervisors and other lecturers was sought regarding whether or not the items in the instruments represented the elements of the study. The pilot phase also helped in validation of these instruments and to confirm whether the methodology and instruments would provide the data required.

3.6.2 Reliability

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials. To maximize on reliability, instructions to the

respondents were clear and in simple language. Reliability was ascertained by split half technique whereby the instruments were designed in such a way that there were two parts (odd and even) with items sampled from the main domain of indicator measuring the variables. Respondents' scores from one part were correlated with scores from the second part. A correlation coefficient of 0.50 was obtained. Split-half technique eliminates chance error due to differing test conditions like in other techniques.

3.7 Data Collection Procedures

The researcher sought permission to conduct research from the Ministry of Education. She also informed the District Commissioner and the District Education Officer about her intention to carry out research in their area. Data for this study was collected in four (4) phases and the researcher covered two schools per day during each phase except during phase four in which the researcher met the D.E.O. for an interview. For the purposes of this study, 15 schools were selected. Three schools participated in the pilot study while the remaining 12 were used for the main study.

3.7.1 Phase one

Before the onset of the data collection, the researcher visited the schools under study as a familiarization exercise during which she verbally explained to the school authorities and the teachers about the purpose and nature of the study. In this phase, the researcher made appropriate appointments with them and requested for the respondents' cooperation and permission while assuring them that the information provided by each of them would be treated with high level of confidentiality.

3.7.2 Phase two

Involved administration of questionnaires to biology teachers and form three biology students. The biology teachers responded to questionnaires in their own free time on the appointment days. The students also responded to the questionnaires during break time and lunch hours on the appointment days to avoid interfering with the schools' teaching and learning activities. Biology lessons were observed including practical ones as they progressed on the appointment days. Resources and facilities were also examined in this phase. This enabled the researcher to fill in the checklists appropriately.

3.7.3 Phase three

Involved conducting interviews with the school heads to provide a comprehensive and richer picture of those factors that they considered significant in influencing achievement in Biology in the various schools they head on the appointment days. The interviews were based on the research questions. The interviews were audio taped with permission from the interviewee and the researcher took notes in three cases (3) where the interviewees could not permit tape recording. In addition, the researcher examined students' Biology KCSE results to review their achievement in the past five years.

3.7.4 Phase four

An interview was conducted with D.E.O. to find out the factors she considered significant in influencing achievement in Biology in Migori district and whether there were any ongoing intervention strategies organized by her office to curb the trend.

3.8 Data Analysis Procedures

Both quantitative and qualitative techniques of data analysis were used since the study generated both quantitative and qualitative data. Quantitative data provided indicators of the problem of low achievement in Biology and gave rise to the research questions whereas qualitative data sought to establish the nature of the problem and sought for options to problem solving. The type of data collected and the methods for analyzing the data are presented as follows:

3.8.1 Questionnaires

Responses from both the teachers' and students' questionnaires were organized, coded and then analyzed by the aid of Statistical Package for Social Sciences (SPSS) utilizing descriptive statistics. Frequencies and percentages were the main statistics. From the frequencies, percentages in regard to the various variables were calculated and then used to answer the research questions.

3.8.2 Interview Schedules

Analysis of responses from interviews was done through content analysis; some statements from the interviewees were quoted verbatim to emphasize a point made by the interviewee.

3.8.3 Observation Checklists

The items were quantified, organized, coded and then analyzed by the aid of Statistical Package for Social Sciences (SPSS) utilizing descriptive statistics. Frequencies and percentages were the main statistics.

3.8.4 KCSE Results

The researcher obtained secondary data which had already been analyzed by the D.E.O' office examination department which reflected each school's mean score in KCSE Biology. The researcher then used these results to compile scores for the past five years.

3.9 Logistical and Ethical Considerations

According to Mugenda & Mugenda (2003), logistics in research refers to all those processes, activities or actions that a researcher must address or carry out to ensure successful completion of a research project. In pre-field work logistics, the researcher established a work plan, obtained a research permit, constructed and pre-tested the instruments and did the sampling. In the post-field work logistics, the data collected were analyzed and the instruments kept for future reference. The ethical considerations included communicating the aims of the investigation to the respondents, being honest and establishing a rapport with them. The researcher did not use influence over students or teachers to compel them to participate in research and was also responsible for taking appropriate precaution to protect the confidentiality of both the respondents and the data (Cohen & Manion, 1994).

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

The main purpose of this study was to find out factors that contribute to students' poor achievement in KCSE Biology in public secondary schools in Migori District, Kenya.

This chapter presents an analysis of and discussion on data collected from students, Biology teachers, heads of schools and the D.E.O. The data was collected through questionnaires, interview schedules and observation checklists.

4.2 Phase 1: Findings

The findings of this study are presented below, table 4.2.1 shows students responses.

Table 4.2.1 Results from students

Statement	Response by Percentages (%)				
	SA	A	UD	D	SD
1. We have class practical lessons regularly in biology	7	10	3	28	52
2. Our biology teacher gives us assignments, marks them frequently and insists that we do corrections	13	25	-	42	20
3. Our biology teacher uses resources during lessons	18	22	-	25	35
4. I score 70% and above in every biology test I do.	8	8	-	44	40
5. We do regular biology tests in class	7	11	4	58	20
6. Our class completes the biology syllabus on time	-	16	5	40	39
7. We lag behind in syllabus coverage	39	40	5	16	-
8. Our school has adequate and up-to date biology teaching/learning resources	11	10	-	50	29
9. We are 50-70 students in our biology class	57	30	3	-	10
10. We have a separate laboratory for biology	28	30	-	12	30
11. I score just between 50 to 40% in every biology test I do	20	30	-	30	20
12. We utilize our biology laboratory adequately	12	30	-	30	28
13. We use teaching/learning aids frequently during biology lessons	11	10	-	59	20
14. Our biology teacher does not use resources during our biology lessons	10	11	-	20	59
15. We do not adequately utilize the biology laboratory	12	30	-	30	28
16. Our school administration and management is not supportive in the teaching and learning of biology.	5	8	13	40	34
17. Our school administration is very considerate and supportive in academic matters	34	40	13	8	5
18. We are less than 50 students in our biology class	-	10	3	37	50
19. I like biology since it deals with every day life	36	50	3	4	7
20. I spend time studying biology outside the school timetable	50	29	-	11	10
21. I always score 40% and below in biology tests I do	14	20	-	32	34
22. My future career will not require biology	-	11	3	36	50
23. My fellow students help me improve in biology	40	21	7	12	20
24. My fellow students are never concerned about our learning in biology	12	20	7	21	40
25. Our biology teacher is very friendly and assists us with our assignments	26	60	3	7	4
26. Our biology teacher is harsh and does not care whether we understand the concepts or not	7	4	3	26	60

4.2.2 Students' Responses per item

Objective 1: Pedagogical practices that constrain achievement in biology

Class practical lessons

Practicals play an important role in achievement of a student since it's also done as a separate paper at KCSE level. This item was intended to find out whether students had practical lessons regularly. The results show that 17% of the students indicated they did practical regularly, 80% indicated they did not while 3% were undecided.

Giving and marking of assignments, tests and exams by biology teachers

Black & Wiliam (1998) and Franyo (2007) stress that assessment in classroom setting makes important contribution to the teaching and learning process. This item was aimed at establishing whether the biology teachers gave frequent assignments and tests to the students. The findings indicated that 38% of the students agreed that their teachers gave them frequent assignments and marked them, 62% disagreed. Similarly, 18% of the students indicated that they did regular tests, 78% indicated they did not and 4% were undecided.

Completion of biology syllabus

This item was intended to find out whether the students covered the biology syllabus within the time given. The results reveal that 16% agreed they covered the syllabus on time while 79% indicated they lagged behind in syllabus coverage and 5% were undecided.

Objective 2: Availability, adequacy and use of resources/ facilities

Use of resources by the students

This item was aimed at establishing whether the students used the available resources during lessons. The results show that 42% of the students responded by indicating they adequately utilized the resources while 58% indicated they did not. Moreover, 21% of the students indicated that their teachers used resources during lessons while 79% indicated their teachers did not use resources during lessons.

Adequacy of resources in the school

As Rughbir (1979) puts it, adequacy of resources is much more important in achieving effective teaching and learning process in any subject. This item was intended to show whether the schools under investigation had adequate resources. The findings reveal 79% of the students indicated their schools had inadequate resources while 21% indicate they had adequate resources. On the same note, 58% of the students indicated they had a separate biology laboratory while 42% indicated they did not have.

Objective 3: Learning conditions

Class size

Small classes are more manageable and allow for easy detection of individual differences. This item was aimed at revealing the number of students in each school per class. The results reveal that 87% of the students indicated they were between 50-70 per class, 10% indicated they were less than 50 students in their classes and 3% were undecided.

Positive relationship between biology teachers and students

Flanders (1970) says that positive relationship between the teachers and the students encourage positive classroom interaction. This item was intended to reveal the number of students who felt that their teachers related well with them. The findings show that 86% of the students felt that their teachers related well with them, 11% did not feel the same and 3% were undecided.

Support from the school administration

This item was aimed at establishing the student's opinions concerning the support they receive from their school administration. The results indicate that 74% accepted that they received support from the school administration, 13% did not feel so and 13% of them were undecided.

Objective 4: students' characteristics

Students' ability

The results indicate that 16% of the students scored 70% and above in every test they did whereas 84% indicated they did not. Similarly, 50% of the students indicated they scored 50-40% and 34% indicated they scored 40% and below in every test they did.

Peer relations among students

Erwin (1993) asserts that peer relations exert their influence through attitudes, expectations and behavior in students. This item was intended to reveal the number of students who felt that their friends helped them in biology. The findings revealed that 61% of the students agreed that their friends assisted them while 32% disagreed and 7% were undecided.

Like for biology as a subject

A student's interest is important in any subject. This item was aimed at revealing the number of students who liked biology. The results show that 86% of them liked biology, 11% did not and 3% were undecided.

Time spent by students studying biology

This item established whether the students spent adequate time studying biology outside the school timetable. The results reveal that 79% of the students studied biology outside the school timetable while 21% did not.

Wish to be in future career requiring biology

This item was intended to reveal the number of student who intended to be in future careers requiring biology. The results show that 86% of the students would wish to be in future courses requiring biology while 11% did not and 3% were undecided.

4.2.3 Teachers' responses

Table 4.2.3 indicates teachers' responses by percentages.

Table 4.2.3 Results from teachers

Statement	Responses by Percentages (%)				
	SA	A	UD	D	SD
1. Our school has adequate resources required in Biology	12	30	-	28	30
2. I use resources to ensure mastery of biological concepts, skills and ideas frequently	25	25	-	25	25
3. Most students in my biology class are average ability students	30	28	-	22	20
4. Most students score 70 marks and above in Biology tests	15	2	-	59	24
5. Most students in my Biology class are below average	13	12	-	35	40
6. There are 50-70 students in my Biology class	50	25	-	5	20
7. My biology students are less than 50 in class	5	20	-	25	50
8. Students who spend more hours studying biology achieve better than those who do not spend more hours	53	30	-	11	6
9. I give regular assessments with feedback to students	13	20	2	40	25
10. I do not give regular tests since marking involved is tedious	19	14	4	40	23
11. We work as a team with other biology teachers to ensure our students are learning effectively	45	40	-	8	7
12. We have a separate biology laboratory in our school	22	20	-	23	35
13. The current biology syllabus has very little content to be covered in the four years	-	-	9	51	40
14. A committed teacher can still improve students' achievement in biology with limited resources and facilities	34	46	11	9	-
15. The current biology curriculum has a lot of content that is too much for the four-year course.	20	47	4	6	23
16. I mostly use lecture and demonstration methods since my biology class has more than 50 students	50	25	-	11	14
17. My biology class do practicals and projects frequently and I mark the practical record books	22	33	5	10	30
18. We do practicals very infrequently and my students have no practical record books	10	35	-	31	24
19. The current biology curriculum has just enough content to be covered within the time given at each level and so has nothing to do with the students' poor achievement in biology	13	20	7	20	40
20. Our school administration is supportive in terms of availing the necessary resources	33	50	2	10	5
21. My students like coming to me with biology problems	35	40	5	10	10
22. My students rarely come to me unless I tell them to	11	14	5	45	25
23. I have taught biology for more than five years	50	25	-	13	12
24. I have taught biology for less than five years	15	10	-	50	25
25. I have adequate time to plan for the biology lessons and mark the assignments	17	23	-	30	30
26. There is inadequate time to plan for the biology lessons and mark the assignments	27	13	2	10	48

4.2.4 Teachers' Responses per item

Objective 1: Pedagogical practices that constrain achievement in biology

Teaching techniques

The findings established that 75% of the biology teachers mostly used lecture and demonstration techniques while 57% used practical and projects during lessons.

Giving of regular tests and examinations to students

The results established that 33% of the teachers gave regular tests and examinations with feedback to student whereas 67% did not.

Teamwork

Findings from the study show that 85% of the teachers worked together with other teachers to ensure that effective learning takes place while 15% did not.

Teachers' commitment

The results revealed 80% of the teachers accepted that commitment on the part of the teacher can improve student's' achievement while 9% did not agree and another 11% were not sure.

Biology syllabus

Biology teachers look at biology syllabus with mixed feelings about its broadness, scope and the time allowed for its completion. This item was intended to find out whether some of them felt that biology syllabus content was broad, little or just enough to be covered within the time given at each level. The results reveal that 67% of the teachers indicated it was too wide while 33% indicated that the content was just enough.

Objective 2: Availability, adequacy and use of resources/ facilities

Adequacy of resources

The findings reveal that 42% of the teachers indicated that they had adequate resources in their schools while 58% of the teachers felt that they had inadequate resources. Moreover, 42% of the teachers indicated that they had a separate biology laboratory whereas 58% of them indicated that they did not have a separate biology laboratory.

Use of resources

The findings reveal that 50% of the teachers utilized the available resources while 50% did not.

Objective 3: Learning conditions

Class size

Results show that 75% of the teachers indicated they taught between 50-70 students per class while 25% indicated they had 50 students and below per class.

Support from the school administration

Results from the study found out that 83% of the teachers indicated that they received support from the school administration, 15% did not agree and another 2% were undecided.

Students approaching biology teachers

Findings from the study revealed that 75% of the teachers indicated that students approached them for assistance in problematic areas in biology while 25% indicated that the students rarely went to them.

Objective 4: students' characteristics

Time spent by student studying biology

The findings show that 83% of the teachers indicated that students who spent more hours studying biology were likely to perform better than those who did not while 17% did not feel the same.

Students' abilities in class

Teachers indicated that in the various classes they taught 58% of the students were average, 17% were above average and 25% of the students were below average.

Objective 5: Teachers characteristics

Teaching for more than 5 years

The results show that 75% of the teachers had taught biology for more than five years while 25% had taught for less than five years.

Adequate time for planning biology lessons

The findings found out that 40% of the teachers felt that they had adequate time for planning biology lessons and marking the assignments they gave to students while 60% felt the time was inadequate.

4.2.5 Results from observation checklists

Table 4.2.5 indicates percentages of resources available, adequacy and their usage.

Table 4.2.5 Findings from observation checklist

Section I

Percentages (%)						
Resources/Facility	Availability		Adequacy		Usage	
	Available	Unavailable	Adequate	Inadequate	Used	Not used
1. Slides	75	25	35	65	15	85
2. Microscopes	58	42	45	55	40	60
3. Reagents	83	17	63	37	50	50
4. Apparatus	75	25	25	75	55	45
5. Specimens	50	50	33	67	20	80
6. Magnifying lens	83	17	62	38	42	58
7. Projection equipments	33	67	46	54	25	75
8. Reference material	42	58	15	85	22	78
9. Locally available materials	91	9	90	10	51	49
10. Laboratories	59	41	40	60	31	69
11. Textbooks	67	33	45	55	50	50
12. Science encyclopedias	17	83	35	65	20	80
13. Journals	25	75	25	75	15	85
14. Charts	80	20	65	35	45	55
15. Models: eye, ear	59	41	53	47	39	61
16. Wall pictures and cuttings	33	67	45	55	40	60
17. Photographs	25	75	45	55	30	70

Section II

Statements	SA	A	UD	SD	D
18. Verbal and written instructions for experiments given to the students before the experiment	9	11	-	34	46
19. Experiment on topic being covered is in the syllabus	21	23	9	17	30
20. Students keep record of practical work and write reports	-	-	6	42	52
21. Practical reports marked by the teacher during and after the practical	-	-	-	73	27
22. Students follow scientific method in recording experiments	-	3	10	59	28
23. The teacher is present during the experiments	40	34	-	23	3
24. Teachers and students use resources during lessons	20	23	-	17	40
25. Instruction style appropriate for the topic	-	28	-	56	16
26. Students are involved in the teaching/ learning process	10	27	-	23	40
27. Large classes with about 50 to 70 students	40	36	-	22	2

4.2.6 Results from observation per item

The findings from observation checklists have been discussed as per objective 2 of the study.

Objective 2: Availability, adequacy and use of resources/ facilities

Section I

Slides

Was 75% available, 35% adequate but 15% used by both the teachers and students.

Microscopes

Available 58%, adequate 45% and used 40%.

Reagents

Availability was 83%, adequacy 63% and 50% used.

Apparatus

Was 75% available, 25% adequate and 55% used.

Specimens

Were 50% available, 33% adequate and 20% used.

Magnifying lens

Was 83% available, 62% adequate and 42% used.

Projection equipment

Was 33% available, 46% adequate and 25% utilized.

Reference materials

Was 42% available, 15% adequate and 22% utilized.

Locally available materials

Availability was 91%, adequacy 90% and 51% used.

Laboratories

Availability was 59%, 40 adequate and 31% utilized.

Textbooks

Availability was 67%, adequacy 45% and being 50% utilized.

Science encyclopedias

Were 17% available, 35% adequate and 20 used.

Journals

Availability was 25%, adequacy 25% and 15% used.

Charts

Was 80% available, 65% adequate and 45% used.

Models

Availability was 59%, adequacy 53% but 39% utilized.

Wall pictures and cuttings

Was 33% available, 45% adequate and 40 used.

Photographs

Availability was 25%, adequacy 45% and usage 30%.

Section II

The finding from this section have been discussed in regard to objective one of the study.

Objective 1: Pedagogical practices that constrain achievement in biology

Instructions for experiments

From the researcher's observation, 20% of the instructions were given to the students either written or verbal whereas in 80% of the practical lessons there was no instruction.

Experiments on topic being covered

The researcher noted that 44% of the experiments were related to the topics covered while 47% were not related and in 9% of the cases the researcher was undecided.

Students keep record of practical work

In 94% of the sample schools, the students did not keep records by the student while in 6% of the cases she was undecided.

Practical books marked by the teachers

The researcher found out that no teacher marked students' practical books since they were not there.

Following of scientific method in experiments

In 13% of the sample schools the students followed scientific method in writing the reports, 87% did not.

Teachers present during practical lessons

The biology teachers were present during the practical lessons in 74% of the sample schools but were absent in 26%.

Teachers and students use resources during lessons

The researcher observed that 43% of both the teachers and the students used resources during biology lessons while 57% did not.

Instruction style appropriate to the topic

In 28% of the sample schools the teachers used appropriate teaching style for the topic being covered while in 72% of the schools they did not.

Students involved in the teaching and learning process

The students were involved in the teaching and learning process in 37% of the sample schools but were not involved in 63% of the schools under study.

Class size

The researcher observed that 76% of the sample schools had between 50-70 students per class while 24% had 50 students and below per class.

4.3 Phase 2: Findings and Discussions

The findings of this study are presented below by research questions followed by a discussion.

4.3.1 Research Question 1: Pedagogical practices that hamper effective teaching and learning of Biology

4.3.1.1 Teaching strategies related variables

To facilitate effective biology teaching and learning, a variety of teaching methods and techniques should be used. Due to its practical nature, biology teachers find some techniques more effective than others. The most effective methods are those that ensure the participation of both the teachers and the students. In these methods individual students experience learning personally and discover personal meaning in every idea taught. This section explores the teaching methods used by the teachers, factors influencing their choices and also discusses suggestions and ways which could be used to improve the teaching and learning of biology at secondary school level.

4.3.1.1.1 Teaching techniques used by biology

Teaching techniques are essential in that they influence the degree of learning of knowledge, concepts and skills. They illustrate processes and skills and stimulate interest

along new lines of thought. This item was intended to reveal the teaching techniques that were used by biology teachers in Migori district.

Table 4. 3A Teaching techniques used by biology teachers

Teaching techniques	%
Demonstrations	75
Lecture	75
Practical	50
Projects	25
Problem solving	25

From table 4.3 A, it is important to note that most teachers used more than one teaching technique. The results show that majority of the teachers (75%) used demonstrations and lecture methods respectively. Other techniques included practical (50%) while projects and problem solving tied at 25%. Teachers do not often use these techniques since they complain of lack of adequate resources and large classes though in some schools the resources were available and adequate but the teachers never used them. The students (77%) also confirmed that they never had practical lessons regularly while (23%) agreed that they had practical lessons regularly. From observation data, the researcher found out that most teachers (75%) used lecture and demonstrations. This explains why student display low achievement in biology since these two techniques may not be appropriate for all the topics in biology. Projects and problem solving are high thinking skills which

stimulate high level of learning in students (Franyo, 2007) and given that the teachers rarely use them, then this perhaps explains low achievement in biology.

4.3.1.1.2 Factors influencing teachers' choice of teaching methods

This item was intended to depict the factors that influenced the teachers' choice of teaching methods. This is important since the teaching technique chosen in turn influences the learning process.

Table 4.3 B Factors that influenced teachers' choice of teaching methods

Factors	%
Biology syllabus-content and scope	83
Adequacy of time to plan biology lessons	75
Class size	75
Students' entry behavior	50
Resources and facilities	42

Table 4.3 B shows that there are several factors that influence a teacher's choice of any teaching technique in biology. Majority of the teachers (83%) felt that the content and scope of the biology syllabus was the major factor that influenced their choice of teaching techniques while (75%) of the teachers felt that class size and adequacy of time for planning the lesson respectively influenced their choice of the teaching techniques. Through observations, the researcher realized that many teachers (58%) taught very large classes which were impossible to manage during practical lessons with the meager resources available. As a result many teachers opted to teach through demonstrations and

lecture methods. The results also indicate that teachers in sample schools consider the students' entry behavior in their choice of teaching methods. Planning for a lesson is an important part in the teaching and learning process. The findings show that most teachers made no attempt to plan lessons and this may result in haphazard teaching which leads to jumbling up of facts that end up confusing the learners. This explains students' low achievement in Biology.

4.3.1.1.3 Biology syllabus

Biology is a life science that touches all spheres of the living world. Many teachers look at biology with mixed feelings about its broadness, scope and the time allowed for its completion. This item was intended to find out whether some of them felt that the secondary school syllabus content was too wide or too little to be covered within the time given at each level/class.

Table 4.3 C Biology syllabus breadth

Statement	%		
The current biology curriculum has a lot of content that is too much for the four-year course.	67	4	29
The current biology curriculum has just enough content to be covered within the time given at each level and so has nothing to do with the students' poor achievement in biology	33	7	60

Results from the table 4.3 C shows that (67%) of the teachers believe that the current biology syllabus is too wide for the four-year course while (33%) felt that it had just enough content to be covered at each level. None of the teachers felt that it had too little content to be covered at each level. Interview with the heads of schools revealed that

given the numerous co-curricular activities that take place every term, the time allocated for the completion of the biology syllabus is interfered with and since it is a broad subject, teachers are hardly left with enough time to complete the syllabus. Most of the students (79%) also felt that they were lagging behind in the syllabus completion while (16%) felt they covered the syllabus on time and the other (5%) were undecided. Teachers in good performing schools cover the same syllabus within the stipulated period and therefore teachers in poor performing schools should not blame their failure to cover the syllabus in time for this cut across all secondary schools which also use the same syllabus. Co-curricular activities are an integral part that helps to build an all-round student and for remain part of school activities.

4.3.1.1.4 Teachers' suggestions on adequate biology syllabus coverage

The teachers being both the translators and implementers of the curriculum would be the most ideal people to evaluate its coverage. Since majority (91%) of the teachers felt that the biology syllabus is too wide to be covered with in the time allocated at each level, this item sought to investigate the teachers' suggestions as to how the syllabus could be adequately covered.

Table 4.3 D Adequate syllabus coverage

Suggestions by teachers	%
1. Time allocated per week be added	75
2. Ministry of education through its relevant body to revise the syllabus further	67
3. Students admitted in each school should have 250 marks and above.	50
4. Materials for practicals be supplied by the schools	42
5. Fully equipped biology laboratories be constructed	42
6. Biology teachers be allocated fewer periods in other areas	42
7. Biology teachers be frequently in-serviced for effective teaching	33

It should be noted that most of the teachers gave more than one suggestion. Also it should be noted that the suggestions have been arranged in order of significance in the table above starting from the suggestion that was given by the majority of the teachers.

The majority of the teachers (75%) suggested that in order to fully cover the syllabus, more time was required, followed by the need for the Ministry of education to narrow down the syllabus further (67%) then the requirement that students admitted to schools should have 250 marks and above and that their number be in proportion to the available resources (50%). Points 4, 5 and 6 carried the same weight. Teachers (33%) suggested that biology teachers be frequently in-serviced for effective teaching outcomes. These findings tend to suggest that majority of the teachers could be undergoing a lot of difficulties and problems in teaching biology. Teachers (75%) felt that time allocated per week should be increased, this should not be so since the four lessons per week in form 1

and 2 and five lessons in form 3 and 4 are adequate. Teachers in good performing schools have proved themselves able to complete the syllabus within the stipulated time frame.

4.3.1.1.5 Teachers' suggestions of possible ways of improving Biology achievement

Teachers are directly involved in transmitting knowledge, skills, principles and practices of any given subject. Students are the receivers of knowledge, skills, principles and practices. Teachers through their teaching process come into reality with any weaknesses, strengths and problems that may not be foreseen by curriculum planners. Due to all these factors teachers are in better position to suggest possible ways of improving the teaching and learning of the subject. This item was intended to show some useful suggestions that could be possibly used to improve the teaching/learning of biology in secondary schools.

Table 4.3 E Improving biology achievement

Teachers' suggestions	%
Schools to have adequate teaching/learning resources	83
Admit students with average marks and above	67
Allow more time for biology practical lessons	58
Biology syllabus content to be narrowed accordingly	58
Biology teachers to be in-serviced frequently	50
Biology teachers be given fewer periods in other areas	42
Biology teachers to embrace improvisation intensively	42
Introduce ways of motivating both the teachers and students	25

Table 4.3 E shows the teachers' suggestions on how to improve the teaching and learning of biology. These suggestions have been arranged in order of significance showing the number of respondents and percentage for each suggestion starting from the most popular one, schools have adequate teaching and learning resources and ending with teachers and students to be motivated accordingly. From the findings, most teachers (83%) felt that the best way to improve Biology achievement is by having adequate teaching and learning resources and facilities.

4.3.1.1.6 Teachers giving and marking biology assignments and tests

This item was meant to investigate whether biology teachers gave regular assignments and tests to students and whether they marked and gave the feedback to the students.

Table 4.3 F Tests and assignments with feedback to students

Statement	%		
I give regular assessments with feedback to students	33	2	65

The results from table 4.3 F show that majority of the teachers (63%) did not give assignments and tests with feedback to students while (33%) gave the assignments with feedback regularly to their student, 4% were undecided. Similarly, (78%) of the students confirmed that their teachers did not give them assignments, tests and neither did they mark the few that they gave though (18%) agreed that their teachers gave them assignments and tests with feedback and that they insisted on the students doing the corrections while 4% were undecided. This may be due to the fact that (67%) of the

teachers indicated that they had inadequate time to give and mark these assignments and also (75%) felt that they handled large classes with more than 50 students. These findings indicate that effective learning of biology as a subject may not be taking place in the schools under study. Assignments, tests and examinations contribute a lot to achievement of a student. Black et al (2000) and Wilson (1986) confirm this when they argue that frequent testing of a students' knowledge in content areas of any taught subject exposes their areas of weakness. Nevertheless, moderation has to be applied since frequent but less constructive tests can lead to unnecessary drilling and rote learning with no practical applications to real life situations.

4.3.1.1.7 Teachers' rating of factors influencing achievement in biology

This item was intended to reveal teachers' rating of the factors they consider contributing to students' achievement in biology.

Table 4.3 G Factors influencing achievement in biology

Factors	%	Rating
Teaching techniques	83	1
Students' entry behavior, aspiration and attitude	83	1
Teachers; qualification, commitment, experience	75	3
Nature of biology curriculum	58	5
Mode and frequency of assessment	67	4
Class size and school administration	58	5
Instructional resources and facilities	50	7

The results from table 4.3 G show that teaching techniques and students' characteristics had been rated the highest respectively by 83% of the teachers, followed by the teachers' characteristics (75%), then mode and frequency of assessment (67%), class size, school administration and nature of biology curriculum carried the same weight (58%) while instructional resources and facilities was rated last. The findings indicate that majority of the teachers (83%) believe that teaching techniques and students' characteristics such as entry behavior, aspirations and attitude are the most important factors that influence achievement in Biology. Teachers could be ignoring the importance of individual differences such that the students' interests, attitudes and aspirations are not well taken care of. This is asserted by Hunt (1971) when he says that individual differences in student are taken for granted by most teachers. Interviews with the head teachers and the D.E.O revealed the following complaints as raised by the Biology teachers about teaching and learning of Biology:

Table 4.3 H Complaints raised by biology teachers

Complaints	Rating
1. Low students' entry behavior	1
2. Wide biology syllabus	1
3. Inadequate time to plan/mark biology lessons	3
4. Inadequate instructional resources and facilities	4
5. Congested /large classes	4
6. Negative peer influence	6

Table 4.3 H shows that low students' entry behavior (1), biology syllabus (1) and inadequate time to plan biology lessons (3) are the major complaints the biology teachers launched concerning the teaching and learning process of Biology. Nevertheless, complaints 2, 3 and 5 affect both good and poor performing schools and are therefore not major contributors to poor achievement in biology in the sample schools.

4.3.2 Research Question 2: Availability, adequacy and use of resources and facilities

4.3.2.1 Instructional resources and facilities related variables

Teaching and learning resources are necessary for making learning process more effective. They help the teacher to communicate with the learners more effectively and make complicated concepts realistic. Resources also increase the learners' motivation and attention span. Biology is one of those subjects whose objectives can be achieved through the use of appropriate teaching and learning resources. The analysis hereafter deals with the availability and use of teaching and learning resources in public secondary schools in Migori district.

4.3.2.1.1 Availability and adequacy of instructional resources

This item was intended to show the availability and quantities of the existing resources and facilities in the sample schools.

Table 4.3 I Adequacy of resources and facilities

Statement	%		
Our school has adequate resources required in Biology	42	-	58

From table 4.3 I (58%) of the teachers felt that their schools do not have adequate teaching and learning resources while (42%) felt that there were adequate resources and

facilities in their schools. On the same note, (79%) of the students confirmed that their schools had inadequate teaching and learning resources, biology textbooks though (21%) felt that they had enough resources in their schools. Observation data also confirmed that most of the schools (75%) had inadequate teaching and learning resources while 25% had adequate resources. This could explain the reason as to why most students perform poorly in biology though it should be noted that even in good performing schools the resources are not adequate. Raghubir (1979) asserts that resources play an important role in understanding concepts and imparting skills to the learners. For the learner can only adequately acquire the concepts and skills through the actual use of or contact with a resource. Nevertheless, it should be noted that even in the high achieving schools, the resources are not adequate in most cases and therefore teachers should not blame low achievement in biology to inadequacy of resources.

4.3.2.1.2 Use of the available resources

This item was meant to reveal whether both the teachers and the students utilized the meager resources and facilities available in their respective schools efficiently. The number of teachers who utilized teaching and learning resources is 50% which equals those who do not use resources (50%). These findings indicate that though resources are available, some teachers do not use them. When asked whether they adequately utilized teaching/learning resources and facilities during biology lessons, (58%) of the students reported that they did not and neither their teachers use resources like charts, live specimens and others during lessons, while 42% agreed that they used resources.

Observation data indicated (57%) of the teachers never used the available teaching and learning resources. The head teachers also reported this during the interviews.

4.3.2.1.3 Biology laboratories

Biology is a practical subject and therefore requires a space for the students to develop and practice the skills in the subject. This calls for a laboratory for biology practical lessons. The researcher set out to establish the number of schools with functional biology laboratories. 58% of the students indicated they had a separate Biology laboratory while 42% did not have. From the observation data, the researcher found out that 59% of the schools had Biology laboratories. The schools with functional laboratories complained of lack of adequate necessary equipment such as microscopes, magnifying lenses and materials. The remaining 41% of the schools had no biology laboratories but plans for their construction were underway. The teachers (58%) also confirmed that they did not have functioning biology laboratories while (42%) indicated they had separate functional biology laboratories.

4.3.2.1.4 Teaching aids

Teaching aids play an important role in assisting the teacher to teach more effectively. The following teaching aids were used by teachers during lessons;

Table 4.3 J teaching aids used by biology teachers

Type of teaching aids	%
1. Charts	75
2. Locally available materials	50
3. Microscopes	42
4. Models	33
5. Projector and film slides	25

From table 4.3.J it can be observed that biology teachers use a variety of teaching aids. The results show that (75%) of the teachers used charts, (50%) of the teachers used locally available materials, (42%) used microscopes, (33%) of the teachers used wall models. Through observation, the researcher found out that one teacher used herbarium materials and three had used projector films slides. These findings clearly show that most teachers do use various types of teaching aids. Majority of the students (79%) confirmed that they did not use teaching aids regularly during lessons though (21%) agreed they used teaching aids regularly. This probably is explained by the fact that most teachers (67%) had indicated that they never had enough time to plan their lessons. Interview with the head teachers also revealed that teachers improvised though not in all cases for some resources can not be improvised. Commercial teaching aids are quite expensive and schools (42%) can not afford. Teachers in low performing schools should not blame inadequacy of resources in their schools for the low achievement since their counterparts in good performing schools also are also affected by the same.

4.3.3 Research Question 3: Learning conditions that constrain students' achievement in Biology

4.3.3.1 Learning Environment related Variables

According to Gagne (1985), factors that influence learning are determined chiefly by environmental events. Members of the school society are responsible for the care of developing a person and have a tremendous degree of control over events that affect learning. The events that the developing child lives through at home, in the geographical environment, in school and in various other social events will determine what is learned and therefore to a large extent the achievement of a learner. The enormous dependence of learning on environmental circumstances implies a great responsibility for all members of school society. The conditions, in which learners are placed, whether deliberately or otherwise, have effects on them.

4.3.3.1.1 Positive relationship between the teachers and the students in biology

This item was intended to reveal the number of the students who felt that their biology teachers related well with them. Researchers have argued that effective biology teachers must be human, responsive, rational, caring and have feelings for the individuals (Flander, 1970). Such teachers therefore must show positive relationship and support interaction between them and their students to ensure positive classroom interaction.

Table 4.3.K Relationship between students and teachers

Statement	%		
Our biology teacher is very friendly and assists us with our assignments	86	3	11
Our biology teacher is harsh and does not care whether we understand the concepts or not	11	3	86

Table 4.3 K shows that majority of the students (86 %) indicated that their biology teachers related well with them by assisting them in problematic areas in biology even outside classroom, (11%) of the students felt that their teachers were harsh and the remaining (03%) of the students were undecided. The biology teachers (75%) agreed that students went to them with problems though students went to the remaining (25%) of the teachers only when they asked them to. This is an indication that biology teachers in Migori district were effective in teaching biology for they are friendly with their students and assist them in problematic areas in biology. Perhaps this is because of the SMASSE project in-service program which may have had a positive impact on the teachers themselves.

4.3.3.1.2 Congestion/class size

There is a common belief that teachers teach more effectively when they handle smaller classes since they give individual attention to the students and that students learn more effectively when they are fewer in class. Small classes are more manageable and allow for easy detection of individual differences. A teacher who teaches a small class is able to reach and assist each student individually. This item was intended to reveal the size of each class each teacher taught. Most teachers (75%) agreed that there are more than 50

students per class while (25%) had less than 50 students in their classes. Teaching a class with more than 50 students is considered to be large especially during practical lessons.

Congestion could be due to the fact that since these are mostly district schools, every parent whose child can not make it to National or Provincial schools due to financial limitations and those who scored below the pass mark in KCPE would want to secure a chance in these nearby schools. This may explain the inability of the policy makers, school administration and teachers to cater for the growing number of poor performing schools. Similarly, (87%) of the student confirmed that they were more than 50 students in class, 10% indicated they were less than 50 while 3% were undecided. Observation data also confirmed that 76% of the classes had more than fifty students. In fact, three schools had 59, and 62 each. Eight schools had between 50-58 students per class and another school had 29 students in form three classes. Although this was the case, this factor also affects the good performing schools in the district, so it should not be a major contributing factor to poor achievement in biology.

4.3.3.1.3 Support from the School administration

This item investigated the teachers' opinions concerning the support they receive from the heads of various schools they teach in as far as availing of the required instructional resources and facilities is concerned. This is because teachers' effort to make a difference in students' achievement may be influenced by the school administrative style.

Table 4.3.L Supportive school administration

Statement	%		
Our school administration is supportive in terms of availing the necessary resources	83	2	15

From table 4.3 L majority of the teachers (83%) believe that their school administration was supportive while (15%) of the teachers felt that this was not the case and 2% were undecided. Perhaps the 17% negative response explains the fact that these schools still have inadequate instructional resources and facilities. On the same note, majority of the students (74%) felt that their school administrators were concerned about their learning, (13%) of them did not feel the same and another remaining (13%) were undecided. Good relationship between the head teachers, teachers and the students encourage teamwork among the parties concerned and this boosts achievement in school subjects biology included.

4.3.4 Research Question 4: teaching and learning processes that hinder achievement in Biology

4.3.4.1 Students related variables

Students are the receivers of all the knowledge, skills, principles and practices that are passed to them by the teachers and have an important role to play in the process of their learning. As they go through the process of learning, there are many factors such as lack of adequate time, negative peer influence and low entry behavior which may affect their learning. Students are essential since without them, the teaching profession would be meaningless. Thus the students and the teachers make the teaching/learning process complete. The following section analyses student-related factors that affect their achievement in biology.

4.3.4.1.1 Time spent by students studying biology

This item was aimed at establishing whether students spent adequate time outside the school timetable studying biology. When motivational factors such as interest, attitude and aspiration are inculcated in the learners, they tend to spend more time studying that particular subject. Thus this translates in higher achievement in the subject. Majority of the students (79%) indicated that they spent time outside the school timetable studying biology. Some however, (21%) indicated that they did not spend time studying biology outside the normal school timetable. Majority of the teachers (83%) confirmed that students who spent enough time studying biology were likely to be high achievers in the subject while (17%) did not agree with that view. These findings reveal that learning of biology was taking place as was expected though the students may be lacking proper guidance from their biology teachers. The teachers rarely give tests and examinations therefore the students may be just studying for the sake of it.

4.3.4.1.2 Students' wish to be in future careers that require biology

This item was intended to show the number of students who were intending to be in future careers that required biology as a subject. This is important because it indicates the interest and attitude of the students towards the subject. Most of the students (86%) intended to be in careers that require biology while (11%) did not intend to be in future careers that require biology and 3% were undecided. This means that most students are interested in biology a fact which was confirmed by 86% of the students when they declared their like for biology as a subject though 11% did not like biology and 3% were

undecided. Although students may be interested in biology, the teachers need to reinforce this through extensive assignments, tests and examinations with feedback on their progress.

4.3.4.1.3 Entry behavior of the students

Entry behavior of a student fosters language, cognitive and social development of a student with frequent and varied verbal interaction as well as provision of education curriculum that permits a student to initiate and pace their own learning activities. It also improves students' interaction with their peers, intellectual development as well as school and social adaptations, Erwin (1993). This item aimed at gauging the entry behavior of the students.

Table 4.3 M Students' entry behavior

Statement	%		
I score 70% and above in every biology test I do.	16	-	84
I score just between 50 to 40% in every biology test I do	50	-	50
I always score 40% and below whenever I do any test	34	-	66

Results from table 4.3 M indicate that (50%) of the students are just average students while (34%) are below average and (16%) are above average. The teachers (58%) also confirmed that they had just average students though (25%) had below average and (17%) had above average students. Content analysis of the past KCSE result revealed that (62%) of the students were just average, (25%) were below average and (13%) were above average students. Teaching and learning process is made effective when there is

improvement in a student's interaction with his/her peers, intellectual development as well as school and social adaptations. Perhaps this explains why the students display low achievement.

4.3.4.1.4 Peer influence

Peer relations exert influence through attitudes, expectations and understanding of the learning activities. This item was supposed to portray the number of students who felt that their peers helped them perform well in biology. Majority of the students (61%) felt that their friends have a positive influence on them while (32%) felt that their friends had a negative influence on them and (7%) were undecided. Through interviews with the heads of schools, the researcher realized that in mixed schools boy-girl relationships are not encouraged since the teachers consider them not healthy. Most of them spend a lot of time on their relationships at the expense of their studies. Erwin (1993) supports this when he says that peer relationships exert their influence through attitudes, expectations and behavior. The students misperceive how their peers evaluate their academic and social competence. They therefore do not recognize the contribution which their own social skills have on peer reactions so that this influences their general academic achievement but mostly negatively.

4.3.4.2 Teacher related variables

A teacher is considered very important in a students' academic life. The major teacher variables considered in this study include-attendance of SMASSE training course, experience, commitment, adequacy of time for planning biology lessons and reflection of teamwork.

4.3.4.2.1 Teachers' experience and commitment

Teachers with long teaching experience are believed to be more skillful and effective in their approaches to the selection of teaching methods and instructional resources for various topics in biology. This item was intended to reveal teaching experience that respondents had in teaching biology.

Table 4. 3 N Teaching experience

Statement	%		
I have taught biology for more than five years	75	-	25
I have taught biology for less than five years	25	-	75

Table 4.3 N shows that (75%) of biology teachers have taught for more than five years though 25% had taught for less than five years. These findings indicate that most of the respondents in this study are quite experienced in teaching biology and so they should be able to handle the subject quite comfortably. However, interviews with some head teachers revealed that the schools (42%) hired form four leavers to handle biology classes due to shortage of qualified teachers. SMASSE project (2000) found out that most teachers use inappropriate strategies during the actual classroom teaching.

Another problem arises from teaching practice at universities level, which is never given adequate time or close supervision and the trainees just, go through the session as a requirement (SMASSE, 2000). Perhaps this could be one of the factors that lead to students' poor achievement in biology in the district. But according to Comber and Keeves (1973), teaching experience does not necessarily lead higher achievement in science, but knowledgeable teachers are less likely to pass on misconceptions, are more confident in imparting information, use less time for preparation and are able to present a wider range of examples and analogies which help the students to learn and understand a given topic more easily. The teachers further indicated that committed teachers made a difference in a student's achievement level. Majority of the teachers (80%) agreed that a teacher's commitment to the instructional process has a lot to do with a student's achievement though some teachers (9%) felt that the teacher's commitment has nothing to do with the students' achievement and 11% were undecided. These findings reveal that a committed teacher may make a positive impact on the general achievement in biology as a school subject. However, the teachers may just be defending themselves that they are committed to their work otherwise most of them would not be complaining of inadequacy of time as a factor that hinders their effective teaching process.

4.3.5 Research Question 5: Other factors contribute to students' poor achievement

in Biology

4.3.5.1 Attendance of SMASSE training course in Biology

This item was meant to reveal the number of teachers who have received in-service training since they started teaching. In-service courses are necessary for re-training old teachers and for informing new teachers of any changes within the curriculum as far as the subject matter and teaching methods are concerned. Since the 8.4.4 system of education was launched in 1986, there is need for in-service course for all the biology teachers concerned.

Table 4.3 O Teachers' attendance of SMASSE workshops

Attendance	%
More than thrice	50
Less than thrice	33
Those who had not attended	17

Table 4.3.O shows that (50%) of the teachers had attended the training course organized by SMASSE more than thrice whereas (33%) had attended less thrice. Through interview with the head teachers the researcher discovered that the schools are sometimes not able to pay for the teachers the fee that is always required by the organizers for the up-keep of the teachers during these seminars. Some teachers (17%) also do not see a need to attend these training sessions and therefore were not bothered. This could explain why some teachers have not attended the training at all. However, attendance of SMASSE seminars

or workshops does not mean that teachers apply what they learn and so it brings no change to such teachers. SMASSE in itself is a good project that can eventually transform the teaching and learning of biology.

4.3.5.2 Adequacy of time to plan biology lessons

This item was intended to find out if teachers had adequate time to plan and prepare for biology lessons. It is essential that teachers have some time to plan for lessons prior to the class. This is necessary so that materials are arranged and prepared before lessons during practicals. Planning a lesson, just a few minutes to time, results in poor teaching and hence poor learning. Planning is a mark of efficiency, successful teaching and learning.

Table 4. 3 P Teachers who had adequate time for planning Biology lessons

Statement	%		
I have adequate time to plan for the biology lessons and mark the assignments	33	7	60
There is inadequate time to plan for the biology lessons and mark the assignments	67	3	30

As table 4.3 P indicates, the number of teachers who felt that they had adequate time for planning was about 33%. The rest of the teachers (60%) felt that they did not have adequate time for planning for the lessons in biology and 7% were undecided. On the same note, 62% of the students confirmed that their teachers did not mark their assignments, while 38% agreed that their teachers marked their assignments. Interviews revealed that apart from the extra-curricular activities that interfere with the lessons, the form one students report to school in late February or early March meaning that form one topics overlaps to form two and this overlap is carried forward to other forms. These findings indicate that the effective teaching process may not be taking place and hence

learning may not be taking place effectively due to inadequacy of time. However, this factor applies to good performing schools as well and therefore should not be a major contributor to low achievement.

4.3.5.3 Reflection of Team work in teaching Biology

One of the objectives of Biology as a subject is to create awareness of the value of cooperation in problem solving. The teachers are therefore expected to reflect this aspect in their day to day relationships with their fellow colleagues and the students they teach. A large number of the teachers (85%) in secondary schools in Migori district worked as a team while a small group of teachers (15%) did not support this idea. These findings reflect that biology teachers in Migori district are moving towards the right direction in achieving the specific objectives of the 8.4.4 system of biology education guidelines. This may be due to the fact that SMASSE project has combined effort with the heads of schools and the teachers themselves to ensure that team work is maintained to achieve the many objectives in secondary school biology subject. Nevertheless, the teachers may not be united 100% since 33% of them had attended the SMASSE seminars and workshops less than thrice and 17% had not attended completely. Perhaps some of them think that they can work on their own.

4.3.6 Interview schedule for head teachers

The interview was conducted with a total of twelve (12) head teachers one from each of the selected secondary schools that were under study. This was about (25%) of the total number of head teachers in Migori district. The interview schedule was administered as a

way of counter-checking the information given in the teachers' and students' questionnaires and to get a richer view on all the factors they considered as major contributors to the students' poor achievement in KCSE Biology in their school. They were tape recorded with their permission and for the three (3) who did not feel comfortable being tape recorded, the researcher took notes.

On the question about students' achievement in biology, majority (58%) of the head teachers said that it was poor while (42%) said that the students' achievement was average. Most of the school heads (75%) said that most students had low entry behavior given that these schools admit students with 250 and below marks in KCPE. "It is quite pathetic that we admit some students with as low as 100 out of 500 marks in KCPE," one of the head teachers commented. Apart from the fact these schools are poor and therefore can not attract high achieving students, the head teachers are also forced to fill in all the spaces available in their schools as directed by the Ministry of Education. Since the National and Provincial schools take most of the high achieving students, they are left with no option but to take poor performing students. This eventually has an effect on the students' achievement.

The head teachers (67%) reported that peers have a negative influence on a students' academic life more especially where boy-girl relationships are concerned. This cut across in all the schools whether boys' or girls' only schools or mixed. They argued that the students concerned spend a lot of time on these relations at the expense of their studies. Moreover, they lead to unwanted pregnancies and early school dropout on the side of the

girls. However, formations of groups of friends who come together for the purposes of study were encouraged among students. When the head teachers were asked to comment on the conditions under which students learn in their schools, majority of them (75%) reported that the conditions were poor though (25%) said that the students were learning under average conditions. As the heads they would have wished to improve the conditions but they can not due to limited funds. Most schools (75%) have large numbers of students compared to the meager facilities they could offer.

Nonetheless, when the head teachers were asked to describe their relationships with both the teachers and students, almost all of them (91%) said they were trying their level best to maintain favorable environments for both the teachers and students. The following were their responses when they were asked about what they were doing to ensure that learning of Biology was taking place under favorable conditions:

- a). Construction of Biology laboratories through Constituency Development Funds (CDF)
- b). Buying of textbooks, apparatus and chemicals.
- c). Ensuring good relationship with the teachers and the students.
- d). Ensuring that the school compound is well kept and tidy.
- e). Improvising, that is, converting some classes to be used as Biology laboratories in the meantime. For instance, in some schools the biology teachers and students transport whatever is needed for a particular practical to the classrooms from the administration office then back after the practical lessons.

f). Encouraging Biology teachers to attend the SMASSE seminars and workshops. However, attendance of SMASSE seminars or workshops does not mean that teachers apply what they learn and so it brings no change to such teachers. SMASSE in itself is a good project that can eventually transform the teaching and learning of biology.

On the competencies of the Biology teachers, 58% of the heads responded that they had qualified, experienced and committed teachers who were doing their best to ensure that learning takes place as was expected while (42%) said they were forced to hire form four leavers or college student who are not yet through with their studies due the acute shortage of qualified teachers. The researcher confirmed this when she talked to some of these form leaver. They were either waiting for college admission though some had been admitted and were out for their long holidays. The D.E.O reported that some schools for sure had hired form four leavers to handle biology classes but declined to comment on why TSC had not posted qualified biology teachers to these schools.

When the head teachers were asked whether the Biology teachers had attended any in-service training course (91%) responded that the SMASSE project hold seminars and workshops every school holidays and all science teachers were supposed to attend. However, some of the teachers (33%) could not attend due to the fact that some schools could not afford to pay for all the science teachers the fees required for their up-keep during the seminars. Some teacher (17%) also complained about the lack of time to rest during holidays and therefore refused to attend. The heads appreciated the role SMASSE

project played and the emphasis it had placed on science achievement in general in the district.

On the availability of Biology instructional resources and facilities, (91%) of the head teachers said that they had inadequate resources, but they supported the biology teachers in availing the required resources. Nonetheless, they experience difficulties in purchasing the resources since the schools had inadequate funds to do so. Observation data confirmed that most of the schools (88%) had inadequate teaching and learning resources while 12% had adequate resources. Teachers in the 12% of the schools with adequate resources rarely used these resources and perhaps this explains why there was low achievement in biology as a subject. The D.E.O reported that “it is hard to avail all these materials given the limited funds in these schools.

On the question of how the problem of low achievement in Biology can be addressed, the head teachers and the D.E.O gave the following suggestions:

- a). Remedial classes for the very weak students.
- b). invite guest speakers to demystify the low achievement in the subject.
- c). encourage biology teachers to embrace hands-on approach and improvisation though teachers can not improvise all the resources such as thermometers.
- d). biology teachers should ensure that more practical activities are done by the students.
- e). fully equipped biology laboratories should be given priorities over other school projects. However, it is not guaranteed that teachers will use the laboratories since (50%) of the teachers did not use even the available resources in their schools.

- f). SMASSE to continue with the zeal, concern and support in sciences. However, attendance of SMASSE seminars or workshops does not mean that teachers apply what they learn and so it brings no change to such teachers. SMASSE in itself is a good project that can eventually transform the teaching and learning of biology.
- g). biology teachers should give frequent assignments and tests to students which they should mark and give feedback. Nevertheless, moderation has to be applied since frequent but less constructive tests can lead to unnecessary drilling and rote learning with no practical applications to real life situations.
- h). involve parents in school activities and encourage them to pay fees promptly. It should be noted that a student can still not perform well even if she/ he has no fee arrears.
- i). encourage healthy competition among boys and girls in biology. Nevertheless, competitions can also lead to bad relationship and rivalry among students which can still affect their achievement in a negative way.
- j). encourage team work among the teachers through seminars, meetings and workshops. Nonetheless, these should not take priorities so much so that teaching and learning hours are interfered with.
- k). primary science teachers should be incorporated by the SMASSE project in the fight to curb low achievement in biology. SMASSE is a project involving secondary schools only and therefore can not cater for primary schools though the suggestion is also not too belated.

4.3.7 Interview schedule for the D.E.O.

An interview was carried out with the D.E.O. as she was considered a government representative. The interview was tape recorded with her permission. The D.E.O commented that there were those schools whose results were poor, some average and a few with outstanding achievement in the district and that this had been reflected even in the previous KCSE results. She further said that most of the poor performers are district schools which admitted students from within the district including those who had not performed well in KCPE but who are to be chosen in order to fill up the capacities of these schools as directed by the Ministry of Education.

On the same note, the D.E.O gave the following as the on-going intervention strategies in the district:

i. SMASSE seminars and workshops are a must for all the science teachers in the district.

This should not be stressed so much that focus is lost on the purpose of the SMASSE project since teachers may feel that it is just imposed on them rather they should be able to appreciate its role and attend without being forced.

ii. The district Quality Assurance department organizes regular visits to the schools to ensure the teachers follow the schemes of work and lesson plans as recommended. Teachers could be acting to please the Quality Assurance Officers but all the same they will use the resources and plan their lessons if these visits are intensified.

iii. Organizing inter-schools science competitions between teachers and students on various topics and activities including science symposiums and congresses. Nevertheless, competitions can also lead to bad relationship and rivalry among

students which can still affect their achievement in a negative way. Healthy competitions for the sake of exposing students' areas of weaknesses and guiding them through these areas should be encouraged.

iv. Ensuring that through CDF money, the schools give priority to construction of science laboratories and to equip them with the required resources.

v. Plans to talk to primary science teachers were underway so that they could be incorporated in to science workshops and seminars within the district since poor science achievement starts from primary level. However, SMASSE is a project involving secondary schools only and therefore can not cater for primary schools though the suggestion is also not too belated.

The summary of the finding and data analysis is presented in chapter five.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

In this chapter an attempt is made to give a summary of the findings, implications of the findings, conclusions, recommendations and suggestions for further research. The purpose of this study was to find out factors that contribute to students' poor achievement in biology in Migori district

5.2 Summary

From data analysis and discussions in chapter four, the study established that several factors contributed to students' poor achievement in KCSE biology in Migori district, Kenya. Among the factors were students' characteristics, teachers' characteristics, resources, biology curriculum, learning conditions, teaching strategies and general problems associated with the teaching and learning of biology in secondary schools in Migori district.

5.2.1 Teaching techniques

Teaching techniques are important since they determine how well a lesson is learnt. The following were the findings in this area:

a. Teachers used a variety of teaching techniques which they found more applicable depending on the prevailing conditions. The most common technique was demonstrations with (75%) of the teachers and lecture method (75%). The other popular methods included

practical which had 50% of the teachers. This could be due to the fact that teachers themselves lack the confidence in handling resources efficiently given the nature of their training that does not monitor closely use of resources so they tend to avoid techniques that require use of resources.

b. Teachers (67%) felt that the current biology curriculum is too wide while 33% said it had just enough content to be covered within the four year period.

c. Teachers (60%) suggested that inadequate time to plan biology lessons; large class size, low students' entry behavior, wide biology syllabus and inadequate instructional resources were the major factors contributing to students' low achievement in biology.

d. Teachers (83%) rated teaching techniques and students' characteristics as the number one factors contributing to students' achievement in biology while instructional resources was rated last.

e. Teachers suggestions on how biology achievement can be improved included the following

i). Schools to have adequate teaching and learning resources. Nevertheless, it should be noted that even in the high achieving schools, the resources are not adequate in most cases and therefore teachers should not blame low achievement in biology to inadequacy of resources. Teachers should make use of the available resources first.

ii). Remedial classes for the very weak students who were admitted with low marks at Kenya Certificate of Secondary Education

iii). Allow more time for biology practical lessons. Teachers have not proved that they use the stipulated time frame wisely and therefore they can not ask for more time

iv). Introduce ways of motivating both the teachers and students. For instance, giving rewards to high performing classes during end of terms. The danger is that both students and teachers will tend to value the rewards more than the valuable concepts, knowledge and skills and can lead to unnecessary drilling and rote learning with no practical applications to real life situations.

v). Biology teachers to embrace improvisation and scaling down of reagents in terms of quantities. Improvisation can not apply to all cases for some resources can not be improvised such as thermometers. Teachers in low performing schools should not blame inadequacy of resources in their schools for the low achievement since their counterparts in good performing schools also are also affected by the same.

vi). Biology teachers be given fewer periods in other areas. Nonetheless, this would prove very expensive to the TSC since they will have to employ teachers with one teaching subject only to secondary schools.

vii). Biology syllabus be narrowed accordingly though this had been done and reviewers thought what is in the syllabus is enough content.

5.2.2 Resources and facilities

Teaching and learning resources are necessary for making teaching and learning more effective. They help the teacher to communicate with the learners more effectively and make more complicated concepts realistic. The study revealed the following factors related to resources and facilities:

- i. It was noted that (59%) of the schools had functional biology laboratories while in 41% of the schools the biology laboratories were still under construction or plans were underway for their construction.
- ii. Teachers (58%) reported that their schools had inadequate instructional resources. About 79% of the students confirmed they had adequate instructional resources. Teachers in low performing schools should not blame inadequacy of resources in their schools for the low achievement since their counterparts in good performing schools also are also affected by the same. Moreover, they have not proved to be making good use of the available resources in their schools.
- iii. Teachers (50%) indicated that they used teaching and learning resources during lessons. The other 50% did not use even the available resources. This could be due to the fact that teachers themselves lack the confidence in handling resources efficiently given the nature of their training that does not monitor closely use of resources.
- iv. Teachers (75%) used a variety of teaching aids. Could be teachers just used them to please the researcher since use of varied teaching aids has not been reflected in achievement in biology in the district.

5.2.3 Learning conditions

The conditions, in which learners are placed, whether deliberately or otherwise, have a great effect on them. The factors that influence learning are determined chiefly by environmental events. The following are the findings as regard the learning conditions.

a). the head teachers, teachers and the students all confirmed that their interrelationship was good. About 86% of the students indicated further that their biology teachers were friendly to them and therefore approachable. It should be not that the heads of schools should be firm in their decisions and not to favor teachers and students in the name of good relationship.

b). the students, head teachers and biology teachers all reported that there were large classes of more than 50 students per class. However, the problem of large classes applies to good performing schools also and therefore should not be a reason to cling to by teachers in low performing schools.

c). teachers (83% and students (74%) said that they received support from their school administration in the teaching and learning process. The reason this is not reflected in achievement in biology could that both teachers and students take the heads of schools commitment for granted and therefore do less to improve the performance.

5.2.4 Students

Students are important in that while the teachers play the part of transmitting knowledge, concepts and inculcate skills, they are the receivers. The following were the findings as regards the students.

a). Most of the students (79%) declared that they spent time studying biology outside the school timetable. However, they lack of guidance from teachers and this could lead to students just learning for the sake of it.

b). Students (86%) indicated that they wished to pursue careers that require biology though this is not reflected in their performance. Could be they lack the attention they need in guiding their study to fruition since teachers complain of being overburdened.

c). the findings indicated that (50%) were just average students, (34%) were below average and (16%) were above average students in class. Even the very weak students can benefit if only they are guided and given attention by teachers (Schulman and Tamir, 1973).

d). on the question of peer relations, (61%) of the students declared that their friends helped them improve in biology. It should be noted that students may indulge in other activities that do not support their class work especially during group discussions (Erwin, 1993).

5.2.5 Teachers

Teachers are the tools through which knowledge, skills, principles, practices and attitudes are transmitted to the students. They make learning possible by translating the syllabus of any subject to the students. Their qualification, experience and commitment affect their quality of teaching. This study revealed the following factors related to the teachers.

a). It was noted that 50% of the teachers had attended the SMASSE project seminars more than thrice. Attendance of these workshops and seminars is not enough if the teachers do not put into practice what they learn while at the workshops and seminars.

b). Most of the teachers (75%) had taught biology for more than five years. Moreover, teachers (80%) agreed committed teachers do their best to impact positively on the students' achievement. However, interview with the head teachers revealed (42%) of schools hired form four leavers who may not have the professionalism required to handle biology classes.

c). teachers (85%) declared that they worked as a team with others in sharing ideas and concepts though 15% of the teachers did not support this idea. This could just be by word of mouth but not in practice since it is not reflected in the students' achievement in biology.

d). teachers (60%) felt that they do not have adequate time to plan biology lessons. However, the teachers may just be defending themselves that they are committed to their work otherwise most of them would not be complaining of inadequacy of time as a factor that hinders their effective teaching process.

e). teachers (63%) did not give assignments and tests to students regularly. Students (78%) responded that their teachers did not give them assignments and tests. Nevertheless, moderation has to be applied since frequent but less constructive tests can lead to unnecessary drilling and rote learning with no practical applications to real life situations.

5.2.6 Head teachers

Twelve (12) head teachers of schools participated in the interview during which they gave information on poor achievement in Biology as follows:

a). teachers (58%) were not able to teach effectively due to inadequate instructional resources and facilities especially well equipped biology laboratories. The heads need to realize that availing all the resources is an ideal situation and that they should ensure teachers use wisely the little that is available.

b). heads of schools (75%) said that the schools had very large classes of more than 50 students per class. However, the problem of large classes applies to good performing schools also and therefore should not be a reason to cling to by teachers in low performing schools.

c). They reported that a good number of students were admitted with very low marks as low as 100 marks in form one and this contributed directly to ineffective learning. However, with dedicated teachers remedial classes for the weak students can help them improve achievement in biology.

d). that the current biology syllabus is too wide to be covered within the given time at each level. This is confirmed by SMASSE project 2000. Nonetheless, this had been done and reviewers thought what is in the syllabus is enough content. It is a call to the curriculum developers to take in teachers concern.

e). they suggested that the Ministry of Education in conjunction with SMASSE project to intensify training programs for the teachers in use and resource handling.

5.3 Implications of the findings

The findings of the study would have the following implications on factors contributing to students' poor achievement in KCSE biology.

i). The fact that most schools (75%) admit students with as low as 100 marks implies that the students may not be able to initiate and pace their own learning activities, but rather be drilled by the teachers who are already complaining of being overburdened. Perhaps this partially explains why students have not been able to attain high level of achievement in Biology.

ii. Inadequate instructional resources (58%) and facilities and inadequate utilization (50%) imply that the teachers have to rely on lecture and demonstration methods which may not be effective in the teaching and learning process of Biology (Raghubir, 1979 and Franyo, 2007). Teachers in low performing schools should not blame inadequacy of resources in

their schools for the low achievement since their counterparts in good performing schools are also affected by the same. Moreover, they have not proved to be making good use of the available resources in their schools.

iii. The large classes (75%) involved imply that teachers may be forced to opt for limited teaching techniques such as lectures and teacher demonstrations which may not be appropriate for all the topics. Nevertheless, these two are recommended for large classes though the problem of large classes applies to good performing schools also and therefore should not be a reason to cling to by teachers in low performing schools.

iv. Teachers' (60%) claim of inadequate time implies that they teach without proper preparations which could lead to ineffective learning on the students' part. Teachers may just be protecting themselves since they have not proved that the little time they have is utilized wisely.

v) Some schools (42%) hire form four leavers to handle Biology classes, this could have the implication that these teachers may not have the professionalism required to handle lessons and hence ineffective learning. If they have to teach, let the heads of schools organize on how they can be guided and made to understand their obligations as teachers.

vi). Some teachers (33%) had attended training programs organized by SMASSE less than three times this could imply that these teachers may not be well informed of any changes in the biology curriculum as far as teaching methods and subject matter are concerned. Teachers may attend other programs organized at the district level, though SMASSE is given more attention.

vii). Teachers (67%) felt that the current biology curriculum is too wide for the four year course. However, this might not be the case given that there are schools in the same district

which perform well in Biology despite the breadth of the Biology curriculum. The good performance could be due to dedication of the teachers who love their job and understand their duties.

5.4 Conclusion

The findings from the study allow the following conclusions to be made:

a). Teachers (50%) appreciated the role instructional resources play in the teaching and learning process, but they hardly used most of the resources available in their schools due to lack of confidence and emphasis in resource handling given the nature of their training.

b). though most teachers (75%) had taught for a long time, they had very little in-service training sensitization on the use of instructional resources and facilities to change their attitude and skills in resource use.

c). Most of the students (86%) who wished to be in future careers that required biology spent time studying biology outside the school timetable. However, they were not able to perform well due to lack of frequent assignments, tests, examination and proper guidance from their teachers.

d). the major problems cited by the teachers and head teachers as impeding high achievement in biology were;

i). admission of students with low marks at Kenya Certificate of Primary Education.

ii). inadequate instructional resources and facilities. Raghbir (1979) argues that availability of instructional resources does not necessarily translate into effective teaching and learning of a subject. Adequacy of resources is much more important in achieving the latter. This is because most of the resources play an important role in understanding

concepts and imparting skills to the learner. The learner can only adequately acquire these concepts and skills through the actual use of or contact with a resource (Franyo, 2007).

iii). content-loaded nature of the current biology syllabus.

iv). lack of experience and commitment among some teachers. According to Comber and Keeves (1973), teaching experience does not necessarily cause higher achievement in science, but knowledgeable teachers are less likely to pass on misconceptions, are more confident in imparting information, use less time for preparation and are able to present a wider range of examples and analogies which help the students to learn and understand a certain topic more easily.

v). inappropriate teaching strategies adopted by the teachers as dictated by the prevailing conditions. Some principles on effective teaching are rooted in logic of instructional design, for example, instructional methods (Corno & Snow, 1986, Kumar, 2005, Franyo, 2007)

e) The findings of this study established the following as the major contributing factors to poor achievement in biology in Migori district:

i). Use of inappropriate teaching techniques in biology. Principles on effective teaching are rooted in logic of instructional design, for example, instructional methods (Corno & Snow, 1986, Kumar, 2005, Franyo, 2007).

ii). Unprepared for teaching, hurried and haphazard presentation on the part of the teachers. Prepared teachers are less likely to pass on misconceptions, are more confident in imparting information and are able to present a wider range of examples and analogies which help the students to learn and understand a certain topic more easily.

iii). Lack of frequent, regular assignments, tests and examinations with feedback to the students

iv). Inadequate use of resources and facilities. Availability of instructional resources does not necessarily translate into effective teaching and learning of a subject. Adequacy of resources is much more important in achieving the latter. This is because most of the resources play an important role in understanding concepts and imparting skills to the learner

v) Students lack attention from teachers since teachers are not committed and complain of inadequate time to cater for each and every student. Comber and Keeves (1973), teaching experience does not necessarily cause higher achievement in science, but committed teachers are less likely to pass on misconceptions, are more confident in imparting information, use less time for preparation and are able to present a wider range of examples and analogies which help the students to learn and understand a certain topic more easily.

vi). Students waste valuable study time in group discussions that are not guided by teachers and therefore digress from study purpose to personal stories that have no connection to achievement in biology.

f). teachers and the head teachers gave the following suggestions in order to improve achievement in biology:

i). Equipping of biology laboratories should be given priority.

ii). Encourage teamwork among teachers and students by ensuring teachers attend workshops, seminars and meetings to share concepts and ideas.

- iii). Purchase the necessary instructional resources and facilities.
- iv). Teachers should ensure that more practical activities are done by the students.
- v). Need for remedial work for the weak students.

5.5 Recommendations

Based on the findings of this study, the following recommendations can be made;

- a). Ministry of Education to;
 - i). Intensify seminars, workshops and other in-service courses frequently in conjunction with SMASSE project to encourage biology teachers' creativity and innovation in using resources and facilities.
 - ii). Regularly review the teachers training program in conjunction with the relevant training institutions with a view to improve on the trainees' interests and attitude on the use of instructional resources and facilities since the earlier they develop it the better for high achievement on the student's part.
 - iii). Conduct regular visits to public secondary schools through its' Quality Assurance department to assess the availability, state and utilization of resources. This can assist teachers to be consistent in resource use.
- b). School administration to provide for the resources in the school budgets.
- c). Remedial classes be conducted to the weak students by the schools.
- d). More practical activity be carried out in the teaching of the subject in the schools.

5.6 Further Research

The researcher proposes further research on the following areas:

- a.** The research was carried out only in one district; further research could be carried out in more districts in order to increase the generalizability of the findings to the nation as a whole.
- b.** To seek for possible origins of poor achievement in biology at secondary school level in Kenya, it is recommended that a longitudinal study design be adopted using a larger sample size that includes even high achieving schools.
- c.** Most students', teachers' responses and observation checklists indicated that many resources and facilities were available in schools but the teachers rarely utilized them. A study needs to be conducted further on the reasons as to why the teachers shy away from using the available resources.
- d.** The study focused on poor performing schools only. The researcher suggests that further research be conducted in high performing schools to investigate factors that contribute to high achievement in KCSE biology.

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List of Appendices

Appendix I: Migori District Public Secondary Schools

1. Rapogi Boys	28. Rabondo
2. Ulanda Girls	29. Kanga Onditi
3. Uriri Boys	30. Moi nyatike
4. Kanga Boys	31. Nyarach
5. Lwanda	32. Gamba
6. Kodero bara	33. Raha
7. Nyandema	34. Rameji
8. Kadika	35. Minyenya
9. Kanyawanga	36. Bware
10. Migori	37. Kanyasrega
11. Nyabisawa	38. Kakrao
12. Sigiria	39. Angenga
13. Osingo	40. Dede
14. Sori	41. Wasio
15. Pe-Hill	42. Mukuyu
16. Abwao	43. Oyugi Ongango
17. Manyatta	44. Moi suba
18. Arambe	45. Kokuro
19. Lwala	46. Rabwao
20. Sagegi	47. Owiro Akoko
21. Kangeso	48. Nyaduong'
22. Piny owacho	49. Bande
23. Osogo	50. Nyangere
24. Oruba	51. Chunge
25. Anjengo	52. Sangero
26. Kogelo	53. Chunge
27. Kwa	54. Thim Joje

Source: D.E.O. Office, Migori, June 28th, 2006.

Appendix II: Questionnaires for Students

Instructions:

The following questions aim at obtaining information on factors contributing to students' achievement in Biology in your school. Against each statement are the abbreviations **SA- Strongly Agree, A- Agree, UD-Undecided, D- Disagree and SD- Strongly Disagree**. Please respond to all the statements by ticking in the correct box.

Statement	SA	A	UD	D	SD
1. We have biology class practical lessons regularly					
2. Our biology teacher gives us assignments, marks them frequently and insists that we do corrections					
3. Our biology teacher uses resources during lessons					
4. I score 70% and above in every biology test I do.					
5. We do regular biology tests in class					
6. Our class completes the biology syllabus on time					
7. We lag behind in syllabus coverage					
8. Our school has adequate and up-to date biology teaching/learning resources					
9. We are 50-70 students in our class					
10. We have a separate laboratory for biology					
11. I score just between 50 to 40% in every test I do					
12. We utilize our biology laboratory adequately					
13. We use teaching/learning aids during biology lessons					
14. Our biology teacher does not use resources during our biology lessons					
15. We do not adequately utilize the biology laboratory					
16. Our school administration is not supportive in the teaching and learning of biology.					
17. Our school administration is very considerate and supportive in academic matters					
18. We are less than 50 students in our class					
19. I like biology since it deals with every day life					
20. I spend time studying biology outside the school timetable					
21. I always score 40% and below whenever I do any test					
22. My future career will not require biology					
23. My friends help me improve in biology					
24. My friends are not concerned about our learning					
25. Our biology teacher is very friendly					
26. Our biology teacher is harsh and unapproachable					

.....THANK YOU.....

.....END.....

Appendix III: Questionnaires for Biology Teachers

Instructions:

The following questions aim at obtaining information on factors contributing to students' achievement in Biology in your school. Against each statement are the abbreviations AS-Strongly Agree, A-Agree, UD-Undecided, D-Disagree and SD-Strongly Disagree for section I. Please respond to all the statements by ticking in the correct box. Section II contains open-ended questions. All the information given will be strictly confidential and will be used for the purposes of this study only. Your cooperation is highly appreciated.

Section I

Statement	SA	A	UD	D	SD
1. Our school has adequate resources required in Biology					
2. I use resources to ensure mastery of biological concepts, skills and ideas					
3. Most students in my biology class are average ability students					
4. Most students in my biology class are below average					
5. There are 50-70 students in my biology class					
6. My biology students are less than 50 in class					
7. Students who spend more hours studying biology achieve better					
8. I give regular assessments with feedback to students					
9. I do not give regular tests since the marking involved is tedious					
10. I work as a team with other biology teachers					
11. We have a separate biology laboratory in our school					
12. The current biology syllabus little content to be covered in the four years					
13. A committed teacher improve students' achievement in biology					
14. The current biology curriculum has a lot of content that is too much for the four-year course.					
15. I mostly use lecture and demonstration methods since my biology class has more than 50 students					
16. My biology class do practicals and projects frequently and I mark the practical record books					
17. We do practicals very infrequently					
18. The current biology curriculum has just enough content to be covered within the time given at each level.					
19. Our school administration is supportive.					
20. My students like coming to me with biology problems to help them					
21. My students rarely come to me unless I tell them to					
22. I have taught biology for more than five years					
23. I have taught biology for less than five years					
24. I have adequate time to plan for the biology lessons					

Section II

27. How can you cover the biology syllabus adequately?

28. How can Biology achievement be improved?

29. What are the factors that influence your choice of any teaching technique during biology lessons?

30. i). Have you ever attended any SMASSE training course?

YES

NO

ii). If yes in (30) above, how many times have you attended the course?

- a) Less than thrice
- b) More than three times

31. Please rate the following according to their importance in influencing students' achievement in biology in your school such that the most important is rated (1) and the least important rated (6)

Factors	Rating
Teaching techniques	
Students' entry behavior, aspiration and attitude	
Teachers; qualification, commitment, experience	
Instructional resources and facilities	
Nature of biology curriculum	
Class size and school administration	
Mode and frequency of assessment	

32. Among the following teaching techniques, which one do you prefer? Please tick where appropriate

Teaching method	The one I prefer
Precticals	
Projects	
Demonstration	
Lecture	
Problem solving	

...THANK YOU...

.....End.....

Appendix IV: Interviews for Head Teachers

This interview aims at obtaining information on factors contributing to students' achievement in biology in your school. All the information given will be strictly confidential and will be used for the purposes of this study only. Your cooperation is highly appreciated.

1. What is your opinion about achievement in sciences in your school? (Probe: Biology)
2. How can you comment on the nature of students in your school?
Probe: Peer influence?
- 3 i). How can you comment on the conditions under which students learn in your school? (Probe- your relationship with both the teachers and students)
ii) What is your school doing to ensure that learning takes place under favorable conditions?
4. a). How does the teachers' training and qualification influence students' achievement? (Probe: Competency of biology teachers in your school)

b) Have the teachers in your school attended any SMASSE training course?
(Probe: how many times if yes and what prevents some from attending?)
5. How do availability and use of resources/ facilities contribute to learners' achievement in biology in your school? (Probe: biology teaching and learning resources/facilities in your school)
6. What are some of the concerns raised by science teachers and how does the administration handle these issues? (Probe: biology syllabus?)
7. In your opinion, what can be done to improve students' achievement in biology?

...THANK YOU.....

.....End.....

Appendix V: Interview for the D.E.O.

This interview aims at obtaining information on factors contributing to students' achievement in biology in your District. All the information given will be strictly confidential and will be used for the purposes of this study only. Your cooperation is highly appreciated.

1. What is your opinion about achievement in sciences in your district? (Probe: Biology)
2. Briefly comment on the previous biology results in your district?
3. Are there any on-going intervention measures that has been organized by your district team
4. How does the teachers' training and qualification influence students' achievement? (Probe: Competency of science teachers and pedagogical practices in your district)
- 5.i). How can you comment on the nature of students in your district?
 - ii) Why is it that students particularly in Migori district have not been performing well in sciences? (Probe: biology)
6. What are some of the concerns that teachers in your district have in regard to the teaching of sciences? (Probe: in biology)
7. In your opinion, what can be done to improve students' achievement in biology?

.....THANK YOU.....

.....End.....

Appendix VI: Observation Checklist

Generally, learning environment, availability, adequacy and effective use of resources and facilities influence achievement in science subjects. Against each item are the words Availability (Available, Unavailable) Adequacy (Adequate, Inadequate) and Usage (Used, Not used) for Section I and SA-Strongly Agree, A-Agree, UD-Undecided, SD-Strongly Disagree and D-Disagree for Section II. The researcher will tick the most appropriate column.

Section I

Resources/Facility	Availability		Adequacy		Usage	
	Available	Unavailable	Adequate	Inadequate	Used	Not used
1. Slides						
2. Microscopes						
3. Reagents						
4. Apparatus						
5. Specimens						
6. Magnifying lens						
7. Projection equipments						
8. Reference material						
9. Locally available materials						
10. Laboratories						
11. Textbooks						
12. Science encyclopedias						
13. Journals						
14. Charts						
15. Models: eye, ear						
16. Wall pictures and cuttings						
17. Photographs						

Section II

Statements	SA	A	UD	SD	D
18. Verbal and written instructions for experiments given to the students before the experiment					
19. Experiment on topic being covered is in the syllabus					
20. Students keep record of practical work and write					
21. Practical reports marked by the teacher during and after the practical					
22. Students follow scientific method in recording experiments					
23. The teacher is present during the experiments					
24. Teachers and students use resources during lessons					
25. Instruction style appropriate for the topic					
26. Students are involved in the teaching/ learning process					
27. Large classes with about 50 to 70 students					

The teachers preferred the following teaching techniques:

Teaching technique	Preferred technique
Practicals	
Projects	
Demonstration	
Lecture	
Problem solving	

The following teaching aids were commonly used by the teachers during lessons:

Type of teaching aids
1. Charts
2. Wall pictures and cuttings
3. Microscopes
4. Projector and film slides
5. Locally available materials

THIS IS TO CERTIFY THAT:

Prof./Dr./Mr./Mrs./Miss EUNICE
ATIENO OWITI

of (Address) KENYATTA UNIVERSITY
P.O. BOX 43844 NAIROBI

has been permitted to conduct research in.....

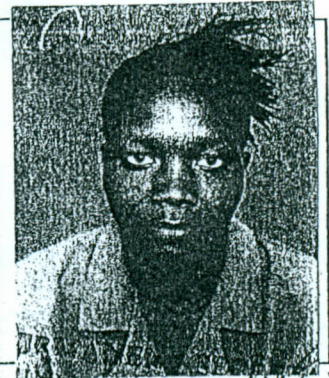
..... Location,
MIGORI District,

..... Province NYANZA

on the topic FACTORS THAT CONTRIBUTE TO STUDENTS POOR ACHIEVEMENT IN KCSE BIOLOGY IN SELECTED SECONDARY SCHOOLS OF MIGORI DISTRICT, KENYA

for a period ending 30TH SEPTEMBER 2007

Research Permit No. MOST 13/001/37C 33
Date of issue 25.1.2007
Fee received SHS. 500.00



PERMANENT SECRETARY
MINISTRY OF EDUCATION
SCIENCE AND TECHNOLOGY
M.O. ONE

[Signature]
Applicant's FOR: Permanent Secretary
Signature Ministry of
Science and Technology

CONDITIONS

1. You must report to the District Commissioner and the District Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit.
2. Government Officers will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2)/four(4) bound copies of your final report for Kenyans and non-Kenyans respectively.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice



REPUBLIC OF KENYA

RESEARCH CLEARANCE PERMIT