

**CHALLENGES TO EFFICIENT IMPLEMENTATION OF SCIENCE
CURRICULUM IN PUBLIC PRIMARY SCHOOLS: A CASE OF
MIGORI DISTRICT, MIGORI COUNTY, KENYA**

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DECLARATION

This is my original work and has not been presented to any of the study programme elsewhere in any university.

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DEDICATION

To my parents for having been excellent role models setting pace for the children in education advancements particularly Mzee Okeyo who is a degree holder and a retired Secondary School Principal. To my family, particularly my spouse (Alilly) who encouraged and at the same time supported me spiritually and financially. To dedicated typist Jackline Ochieng who worked tirelessly on the manuscripts to its final conclusion.

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ACRONYMS/ABBREVIATIONS

FPE	-	Free Primary Education
EFA	-	Education for All
UPE	-	Universal Primary Education
UNESCO	-	United Nations Education, Scientific and Cultural Organization
NARC	-	National Rainbow Coalition
MOEST	-	Ministry of Education Science and Technology
GOK	-	Government of Kenya
ROK	-	Republic of Kenya
NGOs	-	Non Governmental Organizations
GER	-	Gross Enrolment Rate
UN	-	United Nations
SPSS	-	Statistical Package for Social Sciences
DEO	-	District Education Officer
GPA	-	General Purpose Account
SIMBA	-	Schools Instructional Material Bank Account
SBTD	-	School Based Teacher Development

TABLE OF CONTENT

DECLARATION	ii
DEDICATION	iii
ACKNOWLEDGEMENT.....	iv
ACRONYMS/ABBREVIATIONS	v
TABLE OF CONTENT.....	vi
LIST OF TABLES.....	ix
LIST OF FIGURE	x
ABSTRACT	xi
CHAPTER ONE: INTRODUCTION.....	1
1.1 Background to the Study	1
1.2 Statement of the Problem	11
1.3 Purpose of the Study	11
1.4 Objectives of the Study	11
1.5 Research Questions	12
1.6 The Significance of the Study	12
1.7 Assumptions of the Study.....	12
1.8 Scope and Delimitations.....	13
1.9 Limitations of the Study.....	13
1.10 Theoretical Framework	13
1.11 Conceptual Framework	14
1.12 Operational Definition of Terms.....	16
CHAPTER TWO: LITERATURE REVIEW	17
2.1 Introduction	17
2.2 School Indicators for Good Academic Performance	17
2.3 The Teaching of Primary Science Syllabus	20
2.4 Reasons for Teaching Primary School Science Syllabus.....	20
2.5 Methods of Teaching Primary Science	21
2.5.1 Questioning Techniques	23
2.5.2 Practical Work.....	24
2.5.3 Demonstration	24

2.5.4	Discussion	25
2.5.5	Science Walk.....	25
2.5.6	Field Trip	26
2.5.7	Project Method.....	26
2.5.8	Dramatization/Role Play.....	27
2.5.9	Lecture Method.....	27
2.6	Resources for Teaching Science	27
2.7	Role of the teachers.....	28
2.8	Management of Time	31
2.9	Evaluation and Assessment	32
2.10	Continuous Professional Development (CPD).....	34
2.11	Summary of the Literature Review	35
 CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY		36
3.1	Introduction	36
3.2	Research Design	36
3.3	Target Population.....	36
3.4	Locale of the Study	37
3.5	Sample and Sampling Procedure	37
3.6	Research Instruments	37
	3.6.1 Science Teachers Questionnaire.....	38
	3.6.2 Headteachers Questionnaire.....	38
	3.6.3 Observation Checklist.....	38
3.7	Piloting	39
	3.7.1 Validity of the Instrument.....	39
	3.7.2 Reliability of the Instrument	39
3.8	Data Collection Procedure.....	40
3.9	Data Analysis.....	40

CHAPTER FOUR: RESULTS AND DISCUSSION.....	42
4.1 Introduction	42
4.2 Demographic Information of the Respondents.....	42
4.3 Factors that Hinder Effective and Efficient Implementation of Science Curriculum.....	44
4.4 To Investigate Sources of Tools, Equipment and Materials for Teaching Primary Science in Public Primary Schools	48
4.5 To Determine the Relevance of the Methods used in Teaching Primary Science Curriculum in Public Primary Schools.....	51
CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS.....	54
5.1 Introduction	54
5.2 Summary of the Research Findings	54
5.2.1 Factors that hinder Implementation of Science Curriculum	54
5.2.2 The Sources of Tools, Equipment and Materials for Teaching of Science in Public Primary Schools.....	55
5.2.3 The Relevance of the Methods used in Teaching Primary Science Curriculum in Public Primary Schools	55
5.3 Conclusion.....	56
5.4 Recommendation	56
5.5 Suggestion for Further Studies	57
REFERENCES	58
APPENDICES	61
APPENDIX A: HEADTEACHERS QUESTIONNAIRE	61
APPENDIX B: SCIENCE TEACHERS QUESTIONNAIRE	64
APPENDIX C: OBSERVATION CHECKLIST	69

LIST OF TABLES

Table 1.1:	General National Candidates Performance as Per 2010 K.C.P.E	8
Table 2.1:	General National Candidates Performance as per 2011 K.C.P.E	9
Table 3.1:	Migori District analyzed Science mean Score between 2006 and 2012	10
Table 4.1:	Sex Information of the Teachers	42
Table 4.2:	The Teaching Duration of Teachers	43
Table 4.3:	Specific Science Branches Studied at High School	45
Table 4.4:	Preparation of Learners Science Experiences before the Lessons are Taught	46
Table 4.5:	In-Service Education and Training (INSETS) Attendance to Promote Continuous Professional Development of Science Teachers between 2006 and 2012	47
Table 4.6:	Sources of Tools, Equipment and Materials for Teaching Primary Science	49
Table 4.7:	Number of Book Publications used to enrich Contents Delivery	50
Table 4.8:	Methods used to teach Primary Science According to Gichuki et al (2008).....	51

LIST OF FIGURE

Figure 1.2: Factors Motivating or Demotivating Efficient Science Lesson Delivery	15
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ABSTRACT

For the achievement of the school goals, aims and objectives as articulated in the vision and mission of a school, the stakeholders should emphasis on high efficiency in all activities. This minimizes wastages on both human and material resources leading to high quality output that meet the desires of the society. The Kenya Government is faced with the attainment of Millennium Development Goals (MDG), Universal Primary Education (UPE), Education for All (EFA) and Vision 2030. To accomplish the desire, there is need for more science oriented human resource. The purpose of this study was to investigate the challenges to efficient implementation of science curriculum in public Primary School in Migori District, Migori County. The study involved twenty (20) Headteachers and one hundred and forty (140) Science Teachers. Simple random sampling was used to select schools while purposive sampling was applied to select Head teachers and teachers teaching science in the schools. Questionnaire and observation check list was used to collect field data. A pilot study of two schools was done with application of Test-re-test based on Pearson product moment correlation coefficient favouring the use of split half technique of the test-re-test administration to test the reliabilities of the instrument. The study adopted exploratory survey design to describe the outcome. The following were the findings: Female teachers preferred teaching science than being headteachers of their schools, teachers in the school administration had higher grades than the rest, the ASEI/PDSI paradigm (teaching through activities), science walk and field trips were hardly applied by science teachers, pupil – teacher ratio was high in most classes, management of time was wanting, most schools had no well-defined evaluation policy, improvisation among the teachers was quite minimal and a lot of evidence proved that continuous professional development among science teachers to update their knowledge, skills and attitudes was very low in terms of INSETS attendance.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The Universal declaration of human rights in 1948 at Geneva raised education above all social endeavors as an instrument for stimulating World Peace and Economic Development. Citizens of all countries had a right to reap benefits of education. The declaration stated “everyone has a right to education.” The commitment made by one hundred and fifty five member states at Jomtien, Thailand, emphasized that all countries should meet the basic learning needs of all. It was, therefore, a duty and responsibility of all nations to provide education that was free, compulsory and available to all children (EFA Global Monitoring, 2005).

The report to the UNESCO (1996), of the International Commission on education for the twenty first century, chaired by a French Jacques Delors, emphasized on certain pillars to be observed by education to enable children reach their fullest potentials in terms of cognitive, emotional and creative capabilities.

These included:

- (i) Education that provides learning focused on the practical application of what had been learned.
- (ii) Education that helped people to live together by encouraging and addressing life free from discrimination, where all have the opportunity to develop themselves, their families and communities they belong.

- (iii) Education that identified and helped people to emphasize on individual skills so that they develop their fullest potential holistically.

Okech (1992), argue that the term education matches very well with the term curriculum, such that whenever curriculum is discussed, the word education will be trickling through the conversation. He says that in spite of the frequent references to education, its purpose is to socialize the individual. Dewey (1938) talks of Education as the “process of remarking or reconstituting experience.” While on the other hand Bobbit defined a curriculum as those series of things which children and youth experience by way of developing ability to do things well, that make up the affairs of adult life.

Schools management (1999) had defined curriculum as all the subjects taught and the activities provided by the school including time devoted to teach each subject. Scholars argue that, all that which takes place outside the classroom should not be considered as a formal curriculum but as co-curricular activities because they are done outside the classroom.

Bennaars et al (1994) on the other hand asserts that the consideration of the fact that all that takes place outside a school classroom is both extra-curricular or co-curricular activities and not part of formal curriculum is misplaced. He argues that all these activities are part and parcel of the school curriculum without any discrimination. Science is a curriculum subject that requires some of its lessons to be taught outside the classrooms, this does not make it a lesser subject of the curricular. UNESCO (1985) defines science as “All that Scientists do, where many

questions like “what” and “how” are asked and answers sought for by means of experimentations and observations”. It is the same argument by Gichuki et al (2008) who added that the “what” question refers to facts while ‘how’ refers to the methods of discovery. Science is a discipline that studies the establishment of facts, principles and methods through experimentation and instills processes of investigations to learners.

A scientist explores science from different angles, perspectives, or viewpoints. Two views have been documented and these are static and dynamic views. Static views explain that science is an interconnected set of principles, laws and theories which consist of immeasurable collection of information and that the discipline is just an approach of explaining the universe. They dispute the fact that it should be learned or taught as an activity or as a process of investigation to prove facts, laws, principle or theories but is a way of internalizing formulated statements and facts. (Gichuki et al, 2008).

Dynamic view on the other hand, considered science as a discipline that should be taught and learned through activities and looks at the present state of knowledge as a basis for further investigations. According to the dynamists, investigations are key in science and end up defining science as an interconnected series of concepts and theoretical schemes that have developed as a result of investigations. This view asserts that it is a subject in the curriculum that is activity oriented and emphasizes the use of experiments in its teaching and learning.

Gichuki et al (2008) gives the following as major process skills in science: observing, recording, classifying, controlling, communicating, counting, predicting,

manipulating, designing, inferring, questioning, hypothesizing and drawing of conclusions just to mention a few. Attitude is explained as behaviour and a way of thinking about something or somebody. Some of these include: Curiosity, self-confidence, open mindedness, genuine interest, co-operation, responsibility and practical approach to problem solving.

Science began as an outdoor nature study offered only by interested teachers in few countries in the nineteenth century (19thC). In the United States of America, for instance, around 1950s there was an average commitment of one hour per week devoted to the teaching of science at the elementary school level. In the early parts of the twentieth century (20thC) there was a dramatic societal interest in science and technology, while in Africa at this time, the knowledge of science was simple and quite rudimentary. It was taught by oral traditions with a lot of emphasis on memorization of names of plants, animals, their uses as food and for medicinal purposes. In mid 1970s science was included as part of primary school curriculum. It drastically changed in content and approach as was seen in the United States of America and United Kingdom all of which had adopted new innovations, methods and approaches of teaching science in their schools. The Africa, the Caribbean and Asian countries borrowed a lot from the developed world. Through this kind of selective borrowing, large scale programmes in science came into existence however; teaching or oral methods of presentations of scientific facts did not change anyway. Thanks to the production and publishing of UNESCO Handbook for Science Teachers, for it became instrumental in revolutionizing the teaching of science in both Primary and Secondary Schools.

It was observed that teachers should emphasize on the direct learner experiences as the basis for all science programmes. The role of teachers changed then, to a great deal because they perceived themselves as no providers of scientific facts but as facilitators of learning experiences thereby eliminating the method of chalk and talk (lecture) where in most cases learners were perceive receptors of scientific knowledge.

In the 1990s, Kenya and Japan governments had a bilateral understanding where Japan through Jica and Kenya through Ministry of Education signed an agreement of commitment to the strengthening of the teaching of Science and Mathematics in Schools Education (SMASE). This was to take place in faces in the form of in-service education and training (insets) in secondary schools. In 2006 primary schools were considered indirectly by training the lecturers of Primary Teacher Colleges at the National Levels, who were then professionally referred to as trainers of trainers (T.O.T) who from the regional level were then to cascade the training to the cluster level or group of schools. In 2010, most primary schools science teachers of classes six, seven and eight underwent in-service education and training whose objective was to sensitize the entire science teaching fraternity. This was based on the new pedagogical skills in the teaching and learning of Science and Mathematics in their schools. Teachers were to perceive themselves as managers in their classrooms where they planned in advance the learner experiences, provided and arranged for the acquisition of learning resources and practiced class group activities.

Kagunda et al (2007) reasoned that with a well-organized learner scientific activities, the teaching of science in primary schools which is somehow terminal to most pupils, would enable them acquire the ability to observe and explore their environment, develop manual and mental skills for rational decision making, be creative and possess critical thinking in addressing emerging issues, manage and conserve the locally available resources as well as developing interest in science and its related courses to make a career and a living after school.

Scientific knowledge was very necessary to those terminating at primary level, because of the low transitional rate from primary to secondary. This could be as result of either poor economic status by parents being unable to send their children to secondary schools, or high enrolments in primary schools making secondary schools fail to acquire the capacity to absorb those who have qualified well in Kenya Certificate of Primary Education (KCPE). Such knowledge would enable the dropouts to function well in the modern society.

In 2003, the Narc government declared Free Primary Education (FPE) which improved access enormously in terms of enrolments for both boys and girls. In January of the same year, the enrolment of pupils increased from 5.9 million in 2003 to 7.4 million in 2004. The Gross Enrolment Rate (GER) for girls rose giving an overall GER of 104.8% at this level, which was a remarkable improvement over GER figures in 2002 which stood at 88.2% (MOE, 2006). The most surprising part of the high enrolment due to Free Primary Education was the fact that teaching and learning resources, human resources and physical facilities either remained constant or improved less proportionally to the enrolment. In a study by Omote (2005) on

challenges faced by Headteachers in the management of Free Primary Education, found the following as very much wanting: large enrolment in classes caused overcrowding, low quality of teaching, inadequate classrooms, few instructional materials, book sharing ratio far above the recommended ratio of 1:3 in lower and 1:2 in the upper primary (UNESCO 2008). He also observed similar scenario on the pupil teacher ratio which was above the recommended 1:32 by UNESCO and 1:45 by the Ministry of Education.

Similar studies carried out by Mitaki (2005) and Githire (2008) concurred that little had been done by the government to correct the challenges. Atieno (2004) added that most of the Headteachers operated in an overcrowded atmosphere in their schools. In a baseline study by Center of Mathematics, Science and Technology in Africa (CEMASTEA) 2006 and repeated in 2009, discovered similar challenges in the teaching of science and mathematics in the public primary schools.

The following were found;

- (i) The teaching of mathematics and science was poor because of the pedagogy that was traditional and teacher centered.
- (ii) Schools lacked adequate conventional and improvised tools, equipment and materials for practical activities.
- (iii) Topics in science such as Properties of Matter and Making Work easier were taught theoretically due to poor mastery of the lesson content by science teachers.
- (iv) Teachers lacked exposure to modern instructional pedagogical skills to teach science such as ASEI-PDSI, constructivism and behavioral strategies.

- (v) There was little effort by the teachers on improvisation of simple tools, equipment and inadequate formative evaluation of learners which would reveal their classroom strengths and weaknesses.

A school is likened to a production unit which feeds the raw materials in it (pupils) who undergo processing (teaching) for production of output (superior exam grades) to be absorbed in the labour market (graduates) however, this is after having obtained appropriate certificates from Kenya National Examination Council.

In the summative evaluation conducted by the Kenya National Examination Council between 2006 and 2012, several weaknesses were revealed in the performance of science subject as explained below:

Table 1.1: General National Candidates Performance as Per 2010 K.C.P.E

Year	2007	2008	2009	2010
Mean Raw Marks	29.72	27.62	29.96	29.75
St. Deviation	9.20	7.40	8.69	9.04

From table 1.1 above, it was observed that in 2010 the performance was lower than that of 2009 but better than those of 2007 and 2008. The slight drop could have been attributed to the increase in candidature due to Free Primary Education (FPE) introduced in 2003 by the Narc government. It was also observed that the standard deviation for 2010 was higher than those of 2009 and 2008 but lower than that of 2007. The year 2010 therefore, had the largest number of candidates with an increase of 2.7% compared to 2009. Despite these findings, the year 2011 showed

some slight improvements in the performance of science nationally revealed by the National candidates' general performance as explained below.

Table 2.1: General National Candidates Performance as per 2011 K.C.P.E

Year	2007	2008	2009	2010	2011
Mean Raw Mark	29.72	27.62	29.96	29.82	33.63
Standard Deviation	9.20	7.40	8.69	8.94	9.11

From table 2.1 above, science performance was highest compared to the last years (2010, 2009, 2008 and 2007) the same was also reflected on the standard deviation. The result indicates that the paper discriminated the different abilities of the candidates whose number increased by 3.66% in 2011 compared to 2.74% in 2010, however, this did not create a substantial deviation in the performance.

Based on the above information, the following were the weaknesses cited by the Kenya National Examination Council:

- (i) Teachers to adopt innovative teaching strategies of topics that require hands and minds on activities for the learners to understand specific concepts taught clearly.
- (ii) Learner should be well prepared in advance on exams techniques, how to respond to questions through frequent formative evaluation.
- (iii) Female learners should be encouraged to learn science by the use of gender friendly approaches and strategies that motivate them towards developing of genuine interest in science at an early age. Such actions would help in narrowing the gap between male and female disparities in the performance of

science in public examinations so that the poor trends experienced are not transferred to the next cycle of education during the transition to secondary level.

The national districts performance reflected the same trend as revealed by the Kenya National Examination Council in 2010 and 2011 Kenya Certificate of Primary Education (K.C.P.E). A case in point was observed in Migori District whose science results were not quite impressive nationally. The Migori District Education Day Newsletter gave the following K.C.P.E analyzed statistics of the District mean score in science between 2006 and 2012 as shown below.

Table 3.1: Migori District analyzed Science mean Score between 2006 and 2012

Year	2007	2008	2009	2010	2011
Mean Score	50.83	51.57	50.93	50.55	51.52

Table 1.3 above, indicates an average performance in science which is not competitive compared with other districts whose mean scores were above sixty. This means that in terms of admission into National Schools, candidates from Migori District could not match others because their scores were not superior as may have been a requirement for a national school selection. Performance created a gap that should be narrowed by finding out what could have been the challenges prompting the average mean score in science in the District.

1.2 Statement of the Problem

Many studies have been carried out to investigate challenges faced by Headteachers in the management of Free Primary Education, for instance Mitaki (2005), Omote (2005), and Atieno (2004), however, few if any have investigated the teaching of science in the public primary schools. Based on the background information the study was to fill the gap by investigating challenges that impact negatively in the implementation of Science Curriculum thus resulting to an average performance in Kenya Certificate of Primary Education (KCPE) in Migori District Migori County.

1.3 Purpose of the Study

The study investigated challenges to efficient implementation of science curriculum hindering the attainment of superior grades in Kenya Certificate of Primary Education in Migori District, Migori County.

1.4 Objectives of the Study

- (i) To determine factors that hinder effective and efficient implementation of science curriculum in public primary school.
- (ii) To investigate the sources of tools, equipment and materials for teaching primary science curriculum in public primary schools.
- (iii) To determine the relevance of the methods used in teaching primary science curriculum in public primary schools.

1.5 Research Questions

- (i) What factors hinder effective and efficient implementation of science curriculum in the public primary schools?
- (ii) What are the sources of tools, equipment and materials for teaching science in the public primary schools?
- (iii) To what extent are the methods used in the teaching of primary science curriculum in the public primary schools relevant?

1.6 The Significance of the Study

- (i) The Ministry of Education will use the recommendation on the teachers continuous professional development to organize in-service courses.
- (ii) The study can enable replications by other scholars to find out if the revealed challenges apply in secondary schools in Kenya.

1.7 Assumptions of the Study

The study was conducted based on the following assumptions:

- (i) The Headteachers know that it is part of their responsibility to provide tools, equipment and materials for teaching science.
- (ii) Science teachers sampled from the schools will respond to the questionnaire.
- (iii) There was no subject specialization in primary schools, any teacher will teach science.

1.8 Scope and Delimitations

- (i) The study focused on challenges to the efficient implementation of science curriculum in public primary schools in Migori District, Migori County.
- (ii) Stakeholders involved in providing efficient implementation of science curriculum included: Pupils, teachers, Deputy Headteachers, the Headteachers and other interested education stakeholders.

1.9: Limitations of the Study

- (i) Researcher was unable to observe a class lesson delivery because this needed a lot of time to observe a reasonable number of such lessons.
- (ii) There were financial constrains for transportation, hiring research assistants, buying stationary and typing.

1.10 Theoretical Framework

The study was guided by Expectancy theory cited by Okumbe (1998) that motivation is a force or a drive within a person. The force varies according to three factors namely:

Valence is the degree of perceived attractiveness or non-attractiveness of an object. This degree leads to either an acceptance or rejection of an object by the individual.

Expectancy is a momentary belief concerning the probability that one outcome or sets of them will follow a particular action. This action would lead to another favorable or not favorable outcome.

Instrumentality is the expected usefulness of a direct outcome attained or avoided as a relationship between the direct outcome and indirect outcome. Algebraically this is expressed as $\text{motivation} = \text{valence} \times \text{Expectancy} \times \text{Instrumentality}$. The theory was relevant to the study since it explained that for an individual to be motivated to

perform a certain task the person must expect that the completion of the task will lead to the achievement of one's goal. This is explained in the following conceptual framework that portrayed the effects of motivation and demotivation of Science teachers, Head teachers in their participation in either science lesson planning or supply of science tools equipment and materials respectively for efficient implementation of the subject.

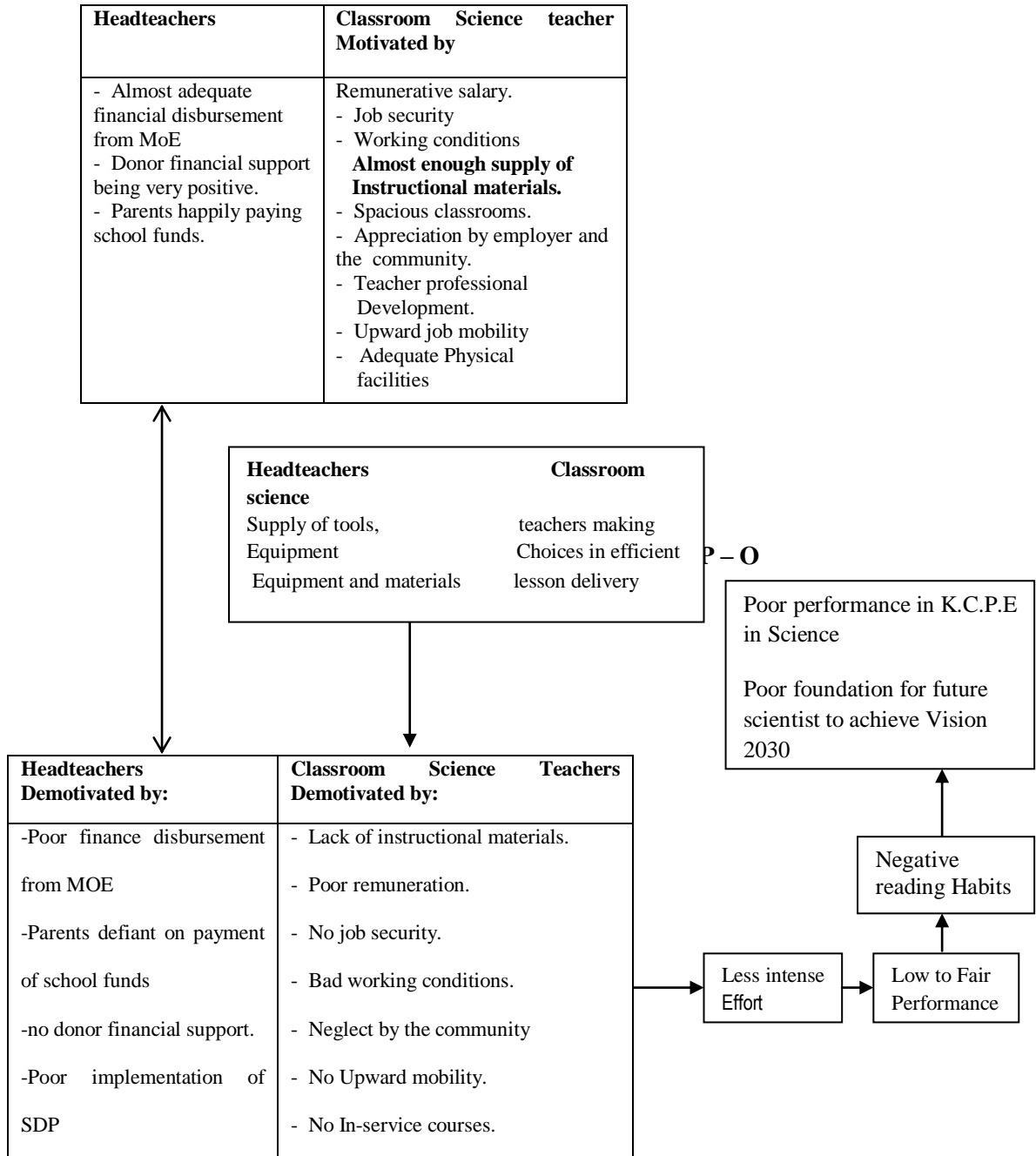
1.11 Conceptual Framework

According to Orodho (2005) conceptual framework is a presentation where a researcher explains the relationship between variables in a study graphically. Okumbe (1998) argue that a graph is conceptualized to explain a behavior. In this study it is the effort of teachers and headteachers to achieve or not to achieve educational goals.

The efficient implementation of Science Curriculum is dependent on various variables such as: attractive salary, security, work conditions, enough instructional materials, adequate physical facilities, employer and community appreciation of teachers' work, staff professional development and their upward mobility on the job. The supply of tools, equipment and materials by the headteacher is dependent on their perceived adequate financial disbursements from the MoE, donor financial support, and prompt payment of school funds by parents enabling them to buy the same. The framework explains two paths, the path of motivated Science Teachers, and Head teachers, leading to an efficient implementation of science curriculum to attain good KCPE results. The other path indicates demotivated Science Teachers, and Headteachers leading to poor K.C.P.E results hence defeating MDGs, EFA, and Kenya Vision 2030.

Figure 1.2: Factors Motivating or Demotivating Efficient Science Lesson Delivery

P-E



Source: Adapted from Orodho, J.A.2005

KEY: (E-P)-Effort-Performance Expectancy

(P-O) –Performance-Outcome Expectancy

1.12 Operational Definition of Terms

Assessment	Used to mean pupils own observation or of the other groups or teachers observation of the pupils work to make some value judgment.
Demonstration	An activity during teachers' lesson delivery involving the use of charts, audio- visuals and posters to reinforce scientific concepts clear understanding
Evaluation	Is a formal science testing, administered to learners to gauge their understanding and mastery of the lesson content either during or after a lesson has been taught.
Experiment	All the classroom learning activities involving the use of apparatus and materials that enables a learner to acquire knowledge and the development of scientific process skills.
Implementation	All the teaching learning activities that lead to achievement of educational and instructional objectives as is required by the syllabus
Laboratory	A specific room or outdoor learning areas for conducting science activities.
Teacher	A person who facilitates, directs and manages learning both Processes in a classroom or outdoors

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter covers a review of literature related to the study. First there is an overview of school indicators for good academic performance, followed by literature on reasons for teaching science in primary schools, then methods for teaching and learning of science, literature on the availability of resources, evaluation and assessments, management of time and review of literature on the continuous professional development of primary science teaching personnel for efficient implementation of the curriculum.

2.2 School Indicators for Good Academic Performance

It should be noted that one of the factors for the achievements of Education for All (EFA), Millennium Development Goals (MDGs) and Kenya vision 2030 is a strong foundation laid on the learning of sciences starting from the basic level that is primary school. The government of Kenya needs experts in technology, science, engineering and researchers to carry out research and to develop new ways of doing things for quicker economic prosperity. UNESCO (1985) adds that engineers, pharmacists, agriculturists and forensic scientist are a prerequisite in economic development and growth of a county.

The accomplishment of this demand rests in the hands of teachers who have been delegated the responsibility of imparting knowledge, skills, values and positive attitudes to the children, youths and adults of this country. Children at the primary level need this desirable attitude at an earlier stage of their development. At this

stage learners are extremely curious and interested in whatever is taking place within their environment; they are active and playful with objects, water and soil. They are seen to be pushing, weighing, filling and emptying of sand, solids and liquids in containers. It will be imagined that sometimes they go as far as tasting the play things to discover how these things taste whether sweet, sour or bitter. Teachers should therefore help them in such explorations and to re-direct their thinking for proper understanding of the relevant concepts. The school should be conducive and to provide the required environment to promote excellent acquisition of the needed scientific knowledge.

In a study by Githire on the strategic plan for schools, she argued that the gateway to school performance in academic was effort on:

- (i) Improved instructional methods
- (ii) Well established school culture
- (iii) Active parental involvements in school affairs and
- (iv) Sound continuous assessments and evaluation of the learners' progress. Saitoti

(G.O.K, 1998) a former Minister of Education once remarked that the determinants of quality education included the following:

- (i) School aims and objectives related to the National goals
- (ii) Relevant instructional materials
- (iii) Conducive learning environment
- (iv) Quality of the teaching personnel and good monitoring and evaluation of learning achievement.

It is therefore the responsibility of leaders of county governments to promote education by emphasizing on quality, equity and relevance at all levels. The Kenya education master plan and Training (1997-2010) emphasized on quality and relevance of education, the kind of education that shifts from passing of examinations to that which is geared to the discovery of learners talents, development of analytical skills, critical thinking, cognitive and creative potentialities for economic development and prosperity. Parkey and Smith (1983) noted and believed in school improvements, quality and effectiveness based on the following indicators for good performance:

- (i) Strong school leadership (management)
- (ii) Clear goals on basic skills
- (iii) Orderly school climate, that foster achievement oriented policies
- (iv) High expectations of positive outcome
- (v) Time reinforcement streaming and
- (vi) In-service training for staff continuous professional development. Lavin and Lazotte (1990) added that there should be a strong leadership that incorporated the following factors.

- (i) Emphasis on central learning skills
- (ii) Productive climate and culture
- (iii) Appropriate monitoring and evaluation
- (iv) Effective instructional arrangements and
- (v) Practical oriented staff development. They believed that with all these in place, the quality of teaching and effectiveness will improve for the betterment of educational outcomes.

2.3 The Teaching of Primary Science Syllabus

A syllabus is an official document containing all that is to be taught and examined in schools. It states the topic aims of a subject, lesson objectives, content and the desirable learning experiences as noted by Bennaars et al (1994). Primary Science Syllabus is one of the publications produced by Kenya Institute of Education now known as the Kenya Institute of Curriculum Development. It is a semi-autonomous government agency (saga) whose basic function is curriculum development.

Science as a discipline has varied definitions depending on the academic background of the authority or scholar whether one is biology, chemistry or physics biased. Kagunda et al (2007), argue that science is a subject of interconnected set of concepts and conceptual schemes which have developed as a result of experiments and observations. UNESCO (1985), on the other hand asserts that science is what scientist do to control nature until nature reveals its secrets. Scholars and teachers explain that science is a Latin word “Sciencia” meaning knowledge about ourselves and the world around us. It is this science being explained that is to be taught to the primary school children by teachers strictly following the guidelines provided in the syllabus.

2.4 Reasons for Teaching Primary School Science Syllabus

The primary science syllabus was revised between 1992 and 1994 when the government heeded the public outcry that the 8.4.4 system of education was overloaded with so many subjects whose contents were also vast. Primary school children were subjected to carrying heavy load of books on their backs to schools. This really impaired their physical development as it interfered with their normal posture. Several science subjects were therefore combined and were to be taught as

an integrated subject. These subjects included Science, Home science and Agriculture. The primary science syllabus is “Spiral” and by this is meant that all the topics to be taught are introduced to learners at all primary levels with a lot of emphasis on the scope and standard of the learners. The spiral nature of the syllabus enables learners to learn the concepts from known to unknown or from simple to complex, therefore enabling of quick mastery of the lesson content during delivery. According to primary syllabus (2005), the main objectives for teaching science at the primary cycle included the following;

- (i) For the learners to acquire the ability to observe and explore the environment
- (ii) To develop manual and mental skills for rational decision making.
- (iii) To create and possess critical thinking in addressing emerging life challenges
- (iv) Possess skills and techniques to solve problems
- (v) To develop positive attitudes to self and the environment
- (vi) To manage and conserve the resources
- (vii) Finally, to develop interest in science and science related courses.

2.5 Methods of Teaching Primary Science

There are as many methods of teaching, as there are professional teachers; however, in science as a curriculum subject, there is an order or procedure that must be followed. The terms method, approach and strategy are key words and pertinent in the teaching and learning of science. The Oxford Advanced Learners Dictionary, International Students Edition, defines method as a particular way of doing something, while approach is defined as to start dealing with something like a

problem or task in a particular way which is always considered to be the best alternative. Strategy on the other hand is a plan of action that is intended to achieve a particular purpose.

Teachers therefore need to choose the best of all methods, approaches and strategies which are learner centered for effective and efficient teaching.

Peacock (2007), noted that effective science teaching has not been easy to come-by in most primary schools in Africa because:

- (i) Teachers don't prepare adequately before going to class to teach due to lack of skill for doing so;
- (ii) Quite a number of teachers are ignorant of the kind of preparation to be made before teaching;
- (iii) Some of the teachers were ill trained professionally on how to teach science, thus developed poor attitude in the teaching of science.
- (iv) Little knowledge in science plays part in teachers' lack of confidence in class while teaching and in most cases hate challenging questions from their learners.
- (v) Finally, he adds that, there have always been inadequate instructional materials and resources for teaching science while few teachers make an effort in improvising such resources for effective teaching. Because of this, the teaching of science becomes boring and uninteresting to the learners hence the development of poor attitude towards science subject.

Okeke cited by Peacock (2007) says that for a strong foundation to be laid in any school curriculum subject, there is need for: adequacy in the curriculum itself, availability of teaching learning content in the curriculum, availability of teaching

learning resources, profound teacher mastery of the lesson content, teacher capacity to organize an effective instruction which solely depends on the teachers preparedness, resourcefulness, ability and self-confidence in the implementation of the curriculum. There are so many approaches of teaching and learning that the teachers can choose from. According to schools management guide (2008) they include: storytelling, investigation, project work, experiments, excursions, discussions, group work, memorizing, conditioning, repetitions, and practical assignments, play and dramatization just to mention a few, however, it should be noted that the method or approach chosen must be relevant to the knowledge, skill and attitude to be imparted to the learners at their level.

2.5.1 Questioning Techniques

Confusion may prevail in a class when the teacher is not very skillful in asking scientific questions. Questions should enable the intended responses to be achieved unless they are framed accordingly. Garry(2009) says that the learner should be given enough time after a question is asked so as to re-align learners' mental faculties before responding rightly to the teacher's desired answer. The teacher should consider individual differences in the classroom. Kagunda et al (2007) lists reasons for asking questions:

- (i) To arouse interest and curiosity concerning the subject matter,
- (ii) To focus pupils attention on a particular issue or concept,
- (iii) To develop an active approach to learning,
- (iv) To organize a task in such a way that learning is enhanced,
- (v) To diagnose specific difficulties hindering learning.

2.5.2 Practical Work

This method appears to be simple but is not the case. It is learner centered, trains many skills and knowledge; however the teacher must put in place a proper procedure with specific guidance on how to carry out the tasks or investigations which include:

- (i) How to collect and acquire amount and relevant materials,
- (ii) Make a try-out of the tasks or experiments before, so as to see their effectiveness within the specified time,
- (iii) Demonstrate and give instructions on how the set-up works
- (iv) Supervise through questions and answers, with a lot of reinforcements as the learners investigate,
- (v) Ensure that they record their findings on a worksheet,
- (vi) Allow them to discuss, draw relevant conclusions and communicate their findings to other groups,
- (vii) Clearing up the work area after the practical.

2.5.3 Demonstration

UNESCO (1985), comments that this is one of the most important methods of teaching science. It involves the teacher performing an investigation, while the learners observe particularly when the materials are inadequate, the apparatus are delicate and expensive, when the procedure is complicated or the experiment is dangerous and needs precautions and safety measures.

In this case the teacher will explain the main points on the purpose of the demonstration, displays charts and pictures involved, explains to learners step by step through questions and answers, provide them with worksheets to record results

of group discussions after the teachers demonstrations and to communicate their findings to the rest of the class.

2.5.4 Discussion

This is always an oral interaction between the learners which may occur in a classroom at different times. It may be pre-planned or deliberate. The teacher must know how to handle it to promote learning. Both teacher and the learners have to be involved in any of the discussions that may arise after or during an informal science activity demonstration or laboratory lesson, however the level of learners must be considered before it is used as an effective method of learning (Bennaars et al 1994).

2.5.5 Science Walk

A teacher is believed to be knowledgeable of the environment in which the teaching and learning is taking place so that they use it optimally for the benefit of the learners. As per the teacher's scheme of work, the method requires that the pupils are enabled to visit a nearby place outside the classroom where they can focus on certain issues on which they are to manipulate resources involving use of several scientific processes.

Such places may include: farms, construction sites and school fields (KIE Science guidelines). The teacher should think about what is to be done before, during and after the science walk by making proper arrangement for learning to be effective. Before the lesson, teacher should identify the site, make prior visit to familiarize with the site, prepare simple questions based on the subject matter, prepare a worksheet, plan learner activities, brief learners and sensitize them on precautions, safety measures and how to conserve the environment during the walk. During the lesson, learners

should observe, collect specimen, ask and answer simple questions based on the specimen, record the observations made and carry a few samples and specimen with them back to school. A follow-up activity should take place, may be in another scheduled lesson if time does not allow after they have compiled the report. Learners would then mount or display samples and specimen collected and preserve them for future use. They will draw items, classify, record and even discuss them through questions and answers.

2.5.6 Field Trip

A very interactive and practical method of teaching science but limitedly used by schools. Most teachers substitute this with science walk, however it has more meaning to the learners since they can see things they have discussed in class, hence learners are able to relate them with real life situations outside the classroom. Best places for such trips include research institutes, factories, game reserves and parks. The method is mostly avoided by teachers because it involves transport logistic, parents have to chip in some money, the headteachers and other teachers must be brought on board including the county education stakeholders.

2.5.7 Project Method

Project method takes a longer period of time, but has many learning advantages in terms of knowledge, skills and attitudes acquired. The teacher has to observe certain fixed conditions like weather and seasons of the year. The learners have to be brought on board during planning and implementation because learning starts from the word go. After discussion between teacher and the learners about purpose of the project, they will form groups and choose leaders; teacher will give the instructions on how to carry out the tasks, issue relevant resources, monitor the activities and

correct mistakes being made by learners and at the same time sustains their interest. They will be shown how to keep records and finally make presentations in the form of oral, written or displays in front of class to be evaluated by all.

2.5.8 Dramatization/Role Play

Dramatization or role play is a method that can be used selectively by the teacher considering a scientific theme and involving pupils to present while others observe. Teacher should decide on the objective, then write the play or a story, and rehearse it before learners present. Teacher ensures there is a summary of the concepts learned.

2.5.9 Lecture Method

The method is traced back to the Jews who used it with fairly large audience. Since those days the teachers' words were highly valued, the Jew students felt compelled to carefully listen memorize the lesson and reproduce the content as it had been taught. However, modern educators consider lecture method out-dated. New approaches have over taken lecture but teachers on their part have failed to discard it. (Bennars et al 1994).

2.6 Resources for Teaching Science

The UNESCO (1985) emphasizes the fact that Science teachers should improvise teaching learning resources by the use of locally available materials in schools and Community environment so as to enrich learners experiences because such materials have the following implications to the learners:

- (i) Arouse their interest
- (ii) Give accurate implication
- (iii) Give a lot of meaning to words

- (iv) Saves teaching time
- (v) Aids memory as learners will recall better on things they have seen, touched and interacted with.
- (vi) Stimulate their imagination
- (vii) Brings distant environment into the classroom
- (viii) Evoke emotional responses and feelings
- (ix) Promote critical thinking

Such resources include:

- (i) Real items like living plants and animals
- (ii) Non-living things like metals, wires, and nails
- (iii) Non-metals like wood, charcoal, plastics, ribbon, paper, glass fibers, soap, bulbs and candles.
- (iv) Liquids such water, ink, milk, oil and Kerosene
- (v) Others include posters, charts, pictures, photographs, condition tapes, video tapes, films and Quest speakers.

2.7 Role of the teachers

First and foremost, the Headteacher is the inspiration of the school and has duties to perform. The headteacher is the manager and at the same time the administrator of the school. He does the functions such as planning, organizing, staffing, communicating budgeting and evaluates school activities. Bennars et al (1994) provision of physical facilities and instructional materials are in his docket, all teachers look upon him to provide them with materials for effective teaching.

Planning for instruction is an essential element of curriculum implementation. The aspect of planning of what and how to teach in any school system starts early in the year. Teachers start to think ahead and design action plan for each class they are assigned to teach in the year. A lot of issues relevant to teaching are considered by the teacher in preparation for the instruction. To be successful in this, the teacher must carefully consider;

- (i) The National Goals
- (ii) School syllabus
- (iii) Schemes of work
- (iv) Format of the teacher's lesson plan
- (v) Teaching learning resources
- (vi) Modes of assessment and evaluation
- (vii) The assignments to the learners (Bennaars et al, 1994).

Science teachers need to be very skillful during class teaching in order to achieve the psychomotor, cognitive and effective domains of the educational objectives. Mastery of the general principles of Piaget's theory is almost mandatory in order to teach effectively. This will enable teachers give learners the correct dose of knowledge depending on their developmental levels. The four stages are;-

- (i) Sensory motor age in infancy (0-2years)
- (ii) Pre-operational stage – Pre-School and early elementary school Years (2 – 6 years)
- (iii) Concrete operational stage – middle and late elementary school years (7-11 years)

- (iv) Formal operational stage – adolescence and adulthood (11 years and Above), (Keil 2001).

The science teachers should know that each of these stages is marked by a distinctive way of thinking and understanding, because some learners move through the stages more rapidly than others depending on their ability and experience. Piaget holds the fact that all children go through the four stages and in exactly similar sequence without skipping any.

Cognitive growth occurs as children construct their own understanding of the world, therefore the science teachers' role is to create an environment where children can discover for themselves how the world works. A teacher should not simply try to explain how addition and subtraction are complementary but instead should provide them with materials that allow them to discover the complementariness by themselves.

The reason behind this is that children profit much, from experience with their current cognitive structures. It follows then that the best teaching experience are slightly ahead of the children's current level of thinking which the teachers should understand. A young child begins to master basic concepts in science or mathematics for instance, the teacher should not jump to subtraction before completing the mastery of the concept of addition. It is advisable that they introduce more complex addition as the child progresses.

On the other hand, cognitive growth can be particularly rapid when learners discover inconsistencies and errors in their own thinking. Teachers should therefore

encourage learners to look at the consistency of their thinking but let them take the lead in sorting out the inconsistencies. If a child is making a mistake in borrowing on a subtraction problem, the teacher should not correct the error directly but should encourage the learner to look at a larger number of these errors to discover what he/she is doing wrong. With this, science teachers would be facilitating efficient learning in a classroom situation.

2.8 Management of Time

Refers to making good use of seconds, minutes, hours and days for the completion of tasks. Wastage is realized when these elements of time are not put to good use for learning or for socio-economic gains at whatever level of education. Classroom teachers should have good time management skills by the use of school time-table which is a list showing the durations at which particular school events will be happening especially teaching time and breaks. This kind of arrangement assists teachers to avoid stresses which may be counterproductive. An overall planning is an asset to proper use of time in a school. It would schedule time for the teacher and that of the learners who will be working to some agreed deadlines at the same time being flexible to accommodate other contingencies and emergencies which may disrupt the planned lesson time. Peacock (2003) list factors that should be considered in a lesson plan which enhances good time management such as:

- (i) Designing and making time-table in good time
- (ii) Avoiding all matters that waste learners time
- (iii) Plan to talk less by avoiding long lesson introductions
- (iv) Having teaching materials set out clearly on tables
- (v) Pupils to use materials themselves economically

- (vi) Pupils to record only what is necessary
- (vii) Teachers not to over emphasize on spelling and punctuations.
- (viii) Learners to avoid too much coping or writing of long notes
- (ix) Encourage oral reporting and questioning

The Headteacher should ensure that the school is well staffed; there is availability of learning resources and discouragement of chronic absenteeism for both teaching staff and the learners. Monitoring and evaluation of science objectives achievements to be done in good time, same to reporting scientific findings from investigations. Strategies should be in place to compensate learning time spent on extra-curricular activities.

2.9 Evaluation and Assessment

In the context of classroom situation, evaluation refers to the measuring of the ability of a learner to solve a given problem scientifically rather than merely testing for factual information. Assessment is the process of making some value judgment on the performance of a task. This means that the two terms go hand in hand for justifying the value and quality of an educational outcome.

For the improvement of learning achievements, evaluation and assessment should be regular, reliable and timely for it is the bedrock of effective teaching in a learning environment. It enables the education stakeholders to diagnose, monitor and to ensure the quality of learning or education that is being provided.

Bennaars et al (1994) explains three levels of evaluation and assessment. That there is the pre-assessment which precede the actual teaching. Intelligent teachers will

carry it out to find out how much the learners already know before they begin to teach the class. Then there is formative evaluation which is quite popular in schools. Both the formal and informal aspects are used in this type of evaluation which is done when learning is in process. Some schools conduct formative assessment on weekly basis, some do it fortnightly while others at the end of the school term.

Summative evaluation is done at the end of the course, particularly at the end of the year. End year evaluations involve issuing reports or certificates. At the National Level, the Kenya National Examination Council does the evaluation.

Research evidences show that by giving feedback to learners, formative assessment can help improve their learning and performance. Black and William, (1998) cited in Efa Global Monitoring (2005) argue that where practical's are involved, learners attention should be directed to assessing their own progress and to reflect on how they can improve on their own learning.

Effective formative assessment requires adequate resources, trained teachers in assessment techniques and small class sizes. These requirements are not realities in most schools in many countries in Africa. For instance, governments seeking to improve on quality, require sound assessment policy. If the school level assessment is to be influential, it should be consistent, regular and reliable as part of an overall school development policy which reconciles both formative and summative assessments with a strong focus on providing feedback to the learners and to the teachers.

2.10 Continuous Professional Development (CPD)

The three terms above are self-explanatory. There is need for members of a profession to continuously enrich their knowledge and skills in order to perform and fit well in the changing global knowledge economy.

The teaching profession is by its very nature, a learning profession (Harlen et al, 2009). The pace of change over the last twenty (20) years has meant that keeping up with development and continuing to learn has become more of a challenge. It is not simply new technology that has changed or that of science itself has moved on space but also the frequency of appearance of new ideas about learning and teaching.

Many new terms have emerged like” Personalized Learning”, “Assessment for Learning,” “Every child matters” and a whole lot of other terms have emerged. How are teachers to engage with all these new ideas so as to make reasoned judgment, if they are to influence learning and teaching?

Harlen et al, explains the answer, that continuing Professional Development is the means by which members of a profession like teaching, can maintain, improve and broaden knowledge and skills throughout their career. It is increasingly recognized that all educators, should have access to good quality opportunities for professional development. Research has also shown that attendance at short courses off site, with little or no follow up has little impact on improving teaching. Effective teachers are continually learning on the job because their work entails engagement with succession of cases, problems or projects which they have to learn about (Eraut, 1994:16) cited in Harlen et al (2009).

In-service Education and training are planned courses and activities where serving teachers may participate for the purpose of improving their instructional or professional knowledge, skills and attitude (Harris et al 1969) quoted by Olembo et al (1992). He adds that education and training of teachers does not stop with the award of degrees, diplomas and certificates at the end of an initial training. A single course of pre-service is not enough to enable a teacher face many challenges taking place in education. Science teachers therefore must be exposed to further training to sharpen their teaching skills for effective and efficient lesson delivery. This should be done continually through INSETS either at school, District, County or National level.

2.11 Summary of the Literature Review

The literature Review reveals that for good academic performance in schools the following need serious consideration; well established school culture, improved instructional resources, conducive learning environment, quality of the teaching force and parental interest in school affairs. Methods of teaching have to be relevant to the content and the use of the available resources. Other factors include; good time management, sound education policy, well established schools regional, county or National in-service education and training basically for teacher continues professional development. These are the factors that the study questions sought to investigate to ascertain their efficient impact on implementation of Science Curriculum.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The chapter discussed research design, Target population, locale of the study, piloting, research instruments, validity and reliability of the instruments, sample and sampling procedure, sampling size, , piloting, methods of data collection and data analysis and presentation:

3.2 Research Design

The study adopted descriptive Survey design because it was relevant to the purpose, objective and significance of the study, all of which were to be described comprehensively. Orodho (2005) states that a design is a conceptual structure within which research is conducted. Lokesh (1984) argues that descriptive survey design enables pertinent and precise information concerning the status of a phenomenon to be described and general conclusion from the facts to be discovered. The study was non-experimental and dealt with non-manipulative variables in the natural setting.

3.3 Target Population

According to Borg and Gall (1996) population refer to all members of a real set of people, events and objects to which the researcher wishes to generalize the results of the research. The target population for this study was science and Headteachers of public primary schools in Migori District, Migori County. The sample size comprised one hundred and fourty (140) Science Teachers and twenty headteachers.

3.4 Locale of the Study

The study was carried out in Suba East and Suba West Divisions of Migori District, Migori County. The researcher chose the area due to familiarity with the environment. According to Singleton (1993), familiarity with the environment provides advantages of easily creating good rapport with the potential respondents for accurate information.

3.5 Sample and Sampling Procedure

According to Sommers S. and Sommer B. (1986), sample is a small group of a given population selected by a researcher for testing. Orodho (2005) on the other hand states that sampling is a technique where the investigator seeks knowledge or information about a whole population, objects or events by observing a sample and extending the findings to the entire population through generalization. Gay (1992) adds that for a survey design a sample of at least twenty percent (20%) is justifiable for a study. Science Teachers and Headteachers who formed the sample size were selected by a sample procedure of both probability and non-probability. The probability used was simple random sampling to clear any biasness, while purposive sampling being a non-probability was used to select Headteachers by virtue of their functions in the sampled schools. Folded papers (raffle) were used to select 20 schools representative of the fifty six schools in two divisions.

3.6 Research Instruments

Orodho (2005) explains that an instrument is a tool researchers uses to collect information or data in the field. A questionnaire is an example of such instruments. McMillan Schumacher (2001) explains that a researcher uses questionnaires because of their economy, an anonymity of the respondents since they don't write their

names, permit use of standardized questions, have uniform procedure, provide time for the respondent to think about what information to give and that they are easy to score.

The study used two instruments namely; Questionnaire and Observation Checklist.

The instrument was divided into four parts aimed at revealing maximum challenges to Science Curriculum implementation in the sampled schools. Part “A” dealt with Demographic Information, Part “B” Professional and Academic qualification, Part “C” the Availability of Resources for Teaching Science and Part “D” the Methods for Teaching Science and their Relevance.

3.6.1 Science Teachers Questionnaire

This questionnaire aimed at revealing maximum challenges to efficient implementation of science curriculum in the sampled schools.

3.6.2 Headteachers Questionnaire

The instrument was expected to reveal as many as possible the administrative and management challenges to efficient implementation of science curriculum in the sampled public primary schools in Migori District, Migori County.

3.6.3 Observation Checklist

The instrument was to enable the researcher see for himself what the school poses in terms of tools, equipment, materials and physical facilities that enable efficient science implementation.

3.7 Piloting

It is a process by which study instruments are tried out. According to Mulusa (1990) the trying out is to check on the reliability, validity and to assess the clarity of writing of questions so as to give the expected data, questions that don't are removed or modified. The researcher distributed the questionnaires to two schools which were not among the twenty sampled schools. Fourteen teachers responded to the questionnaires whose results were evaluated and scored. After a period of two weeks there was a repeat of the same which gave similar scores as was formed the first test. A few modifications were made in question wordings thereafter the researcher being confident of the accuracy of the instruments to be used in the field.

3.7.1 Validity of the Instrument

Validity is defined by Orodho (2005) as the degree to which an instrument measures the intended content accurately. On the other hand Nachmiars (1996) qualifies the statement by arguing that content validity is the extent to which content in an instrument in terms of question, and statements, represent the property being measured.

3.7.2 Reliability of the Instrument

Borg and Gall (1989:249) defined reliability as the level of internal consistency or stability tested overtime of a research instrument. They add that an instrument is reliable when it is capable of bringing a consistent result from the same or different population administered twice especially if the researcher used split half techniques to determine the degree of consistency. The study approved this by the results obtained after piloting the instruments in two schools which were outside the sampled twenty schools where data was to be collected.

3.8 Data Collection Procedure

The researcher sought for a permit from the National Council for Science and Technology after having been given a go-head to collect data from the field by Post Graduate School of Kenyatta University. The council responded promptly and directed that a copy of the authority letter to collect data be delivered to the District Commissioner and the District Education office.

The District Commissioner and the District Education officer gave their consent in writing. The researcher then booked an appointment with the Head teachers of the sampled schools to offer a day to administer the questionnaires to them after having introduced himself and the purpose of the visit. The researcher went to each school to deliver the instruments. The questionnaires were given out according to each Head teacher's day of convenience and data collection was done on the same day, however, Okumbe, (1998) explains that questionnaires could be collected after one week.

3.9 Data Analysis

The study used qualitative and quantitative data analysis, qualitative data tackled attitude and behaviors while quantitative worked on numerical representations. The statistical methods employed were measures of central tendency, frequency distribution and percentiles, that explained how data was classified into some purposeful and table categories.

Before the application of the above methods raw data was sorted out, cleaned and edited by checking the blank spaces on the questionnaires and correcting responses with spelling mistakes. The questionnaires were organized and classified according

to the patterned questions. The questions were coded for purpose of allocation of the magnitude of what was to be measured.

The coded data was entered into a computer for analysis using the Statistical Package for Social Sciences (SPSS), while the other analysis from Observation Check List was subjected to content analysis as per the questions. Qualitative data were quantified where possible with data comprising answers to the closed ended questions. Bell (1999) points out that data analyzed and reported using frequency distributions and percentages, were good for a variety of readers and was of considerable advantage than complex ones.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

The chapter presented the analyzed and interpreted data in the form of tables, frequencies and percentages. It was organized in four parts guided by the objectives, addressing the aim of the study which was to investigate challenges to efficient implementation of science curriculum in Suba East and Suba West Divisions of Migori District, Migori County. The collected data was coded and analyzed using the Statistical Package for the Social Sciences (SPSS).

4.2 Demographic Information of the Respondents

The researcher sought for demographic information of the respondents in order to establish if there was a fair representation in the sampling procedure that selected one hundred and forty science teachers and twenty Headteachers for accurate and balanced information in teaching of Science in Migori District, Migori County. The findings are shown on table 4.1 below.

Table 4.1: Sex Information of the Teachers

Sex	Headteachers		Science Teachers	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Males	16	80	60	43
Females	4	20	80	57
Total	20	100	140	100

Table 4.1, indicates that 16(80%) of the Headteachers were males and 4(20%) were females.

Despite the limited number of females, all sexes were represented in giving their views as was required by the study instrument questions.

The analyzed data indicate that few Headteachers taught science compared to the number of females. The teaching of science required a lot of preparations in terms of relevant apparatus, tools, equipment, materials and learner experiences planned in advance. These factors added to Headteachers responsibilities as managers of schools may have resulted to fewer opting to teach science.

In a study by Omote (2005) on challenges that Headteachers faced in the management of Free Primary Education (FPE), similar findings were registered as most Headteachers taught Art subjects. In this study, teachers were asked to tell their teaching duration by stating number of years each had served in their current schools teaching science. The findings are presented in Table 4.2 below.

Table 4.2: The Teaching Duration of Teachers

Duration	Headteachers		Science Teachers	
	F	%	F	%
Upto 3 years	5	25	53	38
3-4 years	14	70	78	56
11-15 years	1	5	9	6
15 years and above	0	0	0	0
Total	20	100	140	100
F (frequency)	% (Percentage)			

Table 4.2, shows that 14(70%) of the Headteachers had served in the school for between four to ten years, 5(25%) had served up to three years, and 1(15%) had served between eleven and fifteen years. No teacher had served for more than fifteen years in their current schools.

For the case of science teachers, 78 (56%) had taught in their current schools for a period of between four to ten years, 53(38%) had taught for three years and 9(6%) had taught for between eleven and fifteen years. Based on the statistical information above, the study considered that a duration of between three to fifteen years were adequate for the respondents to give an accurate information on challenges to efficient implementation of science curriculum in their respective schools. It was evident that the majority of Headteachers (70%) and science teachers (56%) had the required teaching duration authenticating the strength of the information they had given.

4.3 Factors that Hinder Effective and Efficient Implementation of Science Curriculum

The first question which the study sought to address was “**What factors hinder effective and efficient implementation of Science Curriculum in public primary schools?**” The questionnaire sought to determine factors that hinder effective and efficient implementation of science curriculum in public primary schools in Suba East and Suba West Divisions of Migori District, Migori County. The results of the findings are presented in table 4.3 below.

Table 4.3: Specific Science Branches Studied at High School

Science Branches	Headteacher		Science Teacher	
	F	%	F	%
Physics and Chemistry	3	15	10	7
Biology and Chemistry	3	15	40	29
Physics and biology	2	10	8	6
Biology	5	25	35	25
Chemistry	3	15	9	6
Physics	1	5	20	14
General Science	2	10	8	6
Home Science	0	0	5	4
Agriculture	1	5	12	10
Total	20	100	140	100

Table 4.3, indicates that out of the twenty sampled Headteachers, 5 (25%) did Biology alone, 3 (15%) Biology and Chemistry, another 3 (15%) did Physics alone, 2(10%) Physics and Chemistry, another 2 (10%) General Science, 1(5%) Physics alone and 1 (5%) did Agriculture. For the case of science teachers, 40 (29%) studied Biology and Chemistry, 35 (25%) Biology alone, 20(14%) Physics alone, 15(10%) Agriculture, 8 (6%) Physics and Biology, 9 (6%) General Science and 5 (4%) studied Home Science at high school. The implication of the study was to find out if all teachers studied majority of the branches to enable them teach topics of the syllabus related to the branches.

From the above statistical information it is evident that no teacher could be able to teach primary science syllabus competently due to the varied backgrounds in their study of science. Almost all had a challenge in teaching either physics, chemistry, Biology, Home science or Agriculture oriented topics of this syllabus which is

taught as an integrated subject at this level, except those who did general science whose percentage was only (6%).

According to Gyang (cited in Peacock, 2007), efficient teaching of science has not been easy to come by in most primary schools in Africa because of being poorly trained, lacked adequate preparation due to ignorance of what to prepare, little knowledge of science which eroded their classroom confidence.

The researcher sought to gather information, if the science teachers prepared learner experiences in advance before they taught the lessons programmed on the timetable in the form of learner activities and work sheets. This was to ascertain that minds and hands on activities were considered for the lessons to be taught efficiently. Such preparations enhance the acquisition of science knowledge, develop positive attitudes to science as a subject and trains science process skills to the learners. The results are indicated on table 4.4 below.

Table 4.4: Preparation of Learners Science Experiences before the Lessons are Taught

Types of Preparations	F	%
Learning Activities	40	28.57
Work Sheets	30	21.42
Both Activities and worksheets	14	10.00
No Preparations	56	40
	140	100

From table 4.5 above, 56 (40%) of the sampled science teachers said they do not prepare science learner activities and work sheets for learners to record their findings during experimentations, 40 (28.57%) prepare learning activities but not

worksheets, 30 (21.42%) prepare worksheets only and 14 (10%) prepare both worksheets and learner science activities. Peacock (2007) noted that effective and efficient science teaching has not been easy to come by in most primary schools in Africa. He argues that most teachers do not prepare adequately before going to class to teach due to lack of skills for doing so and adds that quite a number of the teachers were ignorant of the kind of preparations to be made before they teach the lessons.

The study instrument sought to establish how many times science teachers had attended In-service education and training (inset) as part of their Continuous Professional Development between 2006 and 2012. The inset courses were organized by the Ministry of Education and cascaded to primary science teachers from the chosen regional centres specifically Teacher Training Colleges. The courses are referred to as Support Mathematics and Science Education (SMASE). The semi-autonomous Government Agency charged with the responsibility of dissemination of the courses was Centre of Mathematics, Science and Technology in Eastern Africa (CEMASTE) stationed at Caren. The results of the findings are presented on table 4.5 below.

Table 4.5: In-Service Education and Training (INSETS) Attendance to Promote Continuous Professional Development of Science Teachers between 2006 and 2012

Attendance	Frequency	Percentage %
Once	9	6
Twice	31	22
Thrice	50	36
Four and above	20	14
None	30	22
Total	140	100

Table 4.5, indicates that 50(36%) of the one hundred and forty sampled science teachers had attended INSETS three times between 2006 and 2012 , 31(22%) had attended twice, 20(14%) four times and above, 9(6%) had attended once and 30(22%) did not attend any of the INSETS organized between 2006 and 2012. This promoted inefficiency in the teaching of science. Teachers were not exposed to regular INSETS hence in the long run would become obsolete especially those who trained many years back. Lavin and Lazotte (2005) argue that Continuous Professional Development among other factors must be a priority in a strong school leadership. This fact was supported by Parkey and Smith (1983) both in agreement that a strong school leadership must have clear goals on basic skills, ordered school climate, good planning, time reinforcement and in-service education and training for staff Continuous professional Development. The study therefore found that in-service education and training was irregular and poorly attended by teachers with the implication that teachers lacked new pedagogical skills which promoted efficiency in teaching.

4.4 To Investigate Sources of Tools, Equipment and Materials for Teaching Primary Science in Public Primary Schools

The second question which the study sought to address was ‘**what are the sources of tools, equipment and materials for teaching science in the public primary schools?**’

Table 4.6: Sources of Tools, Equipment and Materials for Teaching Primary Science

Major Sources Areas	F	%
Schools Equipment Production Unit	5	3.57
Tendered Procurement from SIMBA A/C	86	61.42
Donation from NGO's and Individuals	14	10.00
Parents Book/Materials Donations	35	25.00
Total	140	100

Table 4.6 above, indicates that 86(61.42%) of the sampled one hundred and forty Science teachers responded that their main sources for tools, equipment and materials was from schools Instructional Materials Bank Account (Simba). Thirty Five (25%) said the resources came from parents book/materials donations, 14(10%) cited donations by NGO's and individuals and 5(3.57%) responded that resources came from Schools Equipment Production Unit (SEPU). Peacock, again asserts that there have always been inadequate instructional materials for teaching science in most schools in Africa, while few teachers make efforts in improvising such equipment for effective teaching. He adds that because, of this, the teaching of science became boring and uninteresting to the learners hence learners overall poor attitude towards science as a subject.

Okeke cited in Peacock (2007) states that, for a strong foundation to be laid in any school's curriculum subject, there is need for adequacy in the curriculum itself, availability of teaching learning contents, teaching learning resources, teacher mastery of the contents and the capacity to organize an effective instruction which solely depends on teacher preparedness, resourcefulness, ability and self-confidence in the implementation of the curriculum.

The researcher again sought to establish the number of book publications used by science teachers as references to enable them teach science effectively. Book publication here, means science text books supplied or bought by the school administration from the publishers to enable efficient teaching of science. They form references from which scientific knowledge and contents are obtained to be taught. Table 4.7 below gives the results of the findings.

Table 4.7: Number of Book Publications used to enrich Contents Delivery

Number of publications used in schools	Book Publishers	
	KIE, JKF, Moran, Longhorns, EAEP, KLB, Longmans	
	Frequency	Percentage (%)
One and supplementary	58	41
Two and supplementary	49	35
Three and supplementary	23	15
Four and supplementary	12	9
Total	140	100

Table 4.7, indicates that out of the one hundred and forty science teachers sampled in the study, 58(41%) used one publication and supplementary in their schools to teach science, 49(35%) two and supplementary, 23(15%) used three and supplementary, 12(9%) used four publications and supplementary. Teachers are required to use at least two publications for good work. Olembo (1992) argued that there was need for teachers to make maximum use of the available resources for teaching. According to Olembo, book publications should be those that are recommended by the Ministry of Education and adds that staff should be able to make efficient use of the new resources on the market. Olembo advises that, Headteachers should work closely with the District Tender Boards, Kenya Equipment Scheme, the Inspectorate and

publishers to make copies of publications available for use in their schools and to some extent a few science teachers should be involved in the selection of materials which they feel are useful during lesson preparations.

4.5 To Determine the Relevance of the Methods used in Teaching Primary Science Curriculum in Public Primary Schools.

The third question which the study sought to address was “**To what extent are the methods used in the teaching of primary science Curriculum in the Public Primary Schools Relevant?**” The research Instrument had ministered these questions to science teachers to tell the methods and to explain extent of the relevant of the methods to the acquisition of scientific knowledge skills and attitudes by the learners. The findings re shown on table 4.8 below.

Table 4.8: Methods used to teach Primary Science According to Gichuki et al (2008)

Methods	Frequency	Percentage %
Lecture (chalk and talk)	26	19
Teacher demonstration	18	12
Question and Answers	25	18
Project Work	16	11
Field Work (Excursion)	15	11
Science walk	14	10
Discussion	14	11
Dramatization/ Role play	15	8
Total	140	100

Table 4.8, indicates that 26(19%) of the sampled science teachers used lecture as their main method of teaching, 25(18%) preferred the use of questions and answers, because it developed in the learners critical thinking, 18(12%) used teacher demonstrations especially where apparatus were inadequate, 16(11%) used Project Work since it trained a variety of scientific process skills, 15(11%) used field excursion because it provided first-hand information of scientific phenomenon to learners, 15(11%) preferred discussion because it trained scientific self-expression, 14(10%) used Science walk since it created Scientific awareness to learners environment and 12(11%) used Dramatization or Role Play because it was learner centered and trained memorization of scientific facts, imagination and creativity in science.

The use of lecture method in teaching Science has met with serious criticism and resistance among scholars that it makes learners naïve and passive listeners in a classroom situation, let alone boredom in the learning process. Bennars et al (1994) argued that the method is irrelevant in the teaching of science for it does not promote hands and minds on activities. Gary (2009) supports the use of questions and answers if a learner is given enough time after a question is asked so that learner re-aligns the mental faculties before responding or giving the right answers to the question.

UNESCO (1985) recommended the use of demonstration method of teaching science when materials are inadequate, apparatus delicate or when the procedure is complicated. It may also be used if the experiment is dangerous or precautions and safety measures are to be observed. Bennars et all (1994) defends the use of discussion in science but only if the teacher and the learner know how to handle

themselves in the process, especially in an informal scientific activity, however, the level of the learners need to be considered before it is used as an effective method of learning. In Science walk as a method KIE (KICD) guideline states that the method is only relevant and effective if the teacher knows what is to be done before, during and after the science walk.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The chapter gives a summary, conclusion and recommendations drawn from the findings in connection to challenges to efficient implementation of science curriculum in public primary schools in Migori District, Migori County.

5.2 Summary of the Research Findings

The study findings were analyzed and presented under the following themes derived from the objectives, the research questions supported by the literature review, as shown below.

5.2.1 Factors that hinder Implementation of Science Curriculum

The study found out that 80% of the teachers were professionally qualified with an experience of between 4-5 years, however, most of them studied two branches science at high school, and this reduced their effectiveness and efficiency in teaching primary science which is taught as integrated subject.

The study again revealed that 40% of the sample teachers did not prepare science learner activities and worksheets which are a pre-requisite in the teaching and learning of science.

Another revelation was that some teachers lacked favorable Continuous Professional Development since they did not attend in-service courses which could have sharpened their teaching skills.

5.2.2 The Sources of Tools, Equipment and Materials for Teaching of Science in Public Primary Schools

Finding from the study ranked SIMBA Account funds for Free Primary Education higher at (61%), parents' book/materials donation (25%), NGO's / individuals (14%) and schools equipment production unit (SEPU) (3.57%). The study revealed that most teachers used one book publication as their main reference which is a limiting factor for effective teaching.

5.2.3 The Relevance of the Methods used in Teaching Primary Science Curriculum in Public Primary Schools

Most teachers preferred the use of lecture method but it was the least relevant in teaching primary science syllabus. Teachers cited various reasons to explain their choice and relevance of each method they used: Lecture was relevant to most of them especially for syllabus coverage, demonstration was used in cases where apparatus and materials were inadequate, project was preferred because it trained many process skills, field excursion gave learners first-hand information of scientific phenomenon, discussion trained self-expression, science walk created learner awareness of the environment , drama or role play gave learners an opportunity to memorize, imagine and promoted creativity.

5.3 Conclusion

- i. Most teachers at high school studied two branches of science which made them less effective in teaching primary science.

The study also found that teachers were ill prepared in learner experiences and provision of worksheet for recording during experimentation or group work.

Few teachers attended in-service education and training for their Continuous Professional Development.

- ii. Major source of materials and equipment was SIMBA Account but it was found to be inadequate to procure enough resources for effective teaching. Teachers were found to be using one book publication as their main reference. This impaired enough content preparations.
- iii. Most teachers preferred the use of lecture method but it was least relevant in the teaching of primary science syllabus.

5.4 Recommendation

- i. Most teachers at high school studied only two branches of science, this made them less effective and efficient in the teaching of unfamiliar science topics the study recommends that teachers adopt team teaching to solve the problem.

The study found that teachers were ill prepared in learner experiences and provision of worksheets for recording during experimentation or group work.

It is recommended that school administration and science panel leaders advise teachers on good science teaching and learning practices.

Few teachers attended in-service education and training, it is recommended that school administration and teachers service commission should encourage teachers to attend the organized in-service courses frequently.

- ii. Although schools get funds for Free Primary Education from the government, this amount is inadequate for the procurement of instructional materials for effective teaching. The study recommends that the vote head for SIMBA Account should be increased reasonably with enough funds for the procurement of teaching resources.

Teachers are advised to use more than one book publication for enough contents to teach effectively and efficiently.

- iii. Since most teachers preferred the use of lecture method CEMSTAE SMASE programme should be intensified to introduce teachers to the new methods of teaching, like the ASEI PDSI paradigm both at school and County levels.

5.5 Suggestion for Further Studies

Challenges to efficient implementation of science curriculum cited above were found to have an effect on the achievement of superior grades in Kenya Certificate of Primary Education (K.C.P.E). A similar study could be carried out to investigate if these challenges have effects on Kenya Certificate of Secondary Education science performance.

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APPENDICES

APPENDIX A: HEADTEACHERS QUESTIONNAIRE

Introduction

This questionnaire seeks for information on challenges to efficient implementation of science curriculum in public primary schools. All the information given will be treated confidentially and for academic purposes only. It is divided into four parts: Part A deals with background information, Part B: academic and professional qualifications Part C: availability of teaching learning resources and Part D: methods for teaching and their relevance. Please respond to all parts by putting a tick (√) against the statement that applies to your situation.

(1) Part A: Demographic Information

1. What is your gender?

Male Female

2. How many years have you served as Headteacher or science teacher in this school?

Upto 3 years 4 to 10 years

11 to 15 years 5 years and above

2. Part B: Factors hindering Science Curriculum Implementation

(i) What Science subjects did you study at high school?

Physics and Chemistry Physics

Biology and Chemistry General Science

Physics and Biology Homescience

Biology Agriculture

Chemistry

(Specify).....

- (ii) How many times have you attended science In-service education and training (inset) courses between 2006 and 2012.

Once	[]	Twice	[]
Thrice	[]	Four times	[]
Four and above	[]	None of the above	[]

- (iii) Do you prepare experiences for each lesson before you teach? Yes/No if Yes which one do you prepare?

Work sheet	[]	Learner Activities	[]
Both	[]		

3. Part C: Sources of Science Tools, Equipment and materials for schools

- (i) Which of the following areas form your school's major source for tools, equipment and materials?

School Equipment production Unit (SEPU)	[]
Tendered Procurement from Simba Account	[]
Donation from NGO's and Individuals	[]
Parents Book/materials donation	[]

- (ii) How many book publication form part of your science reference books namely JKF, KLB, Longhorn and many others

1	[]
2	[]
3	[]
4	[]

4. Part D: Methods and extent to which they are relevant to the teaching of primary science

(i) Which method among the following do you prefer in the teaching of primary science in your school?

- Lecture Demonstration and answers
 Project work Field excursion
 Science walk Discussion
 Dramatization or role play

(ii) To what extent is each one of the methods relevant to the teaching of primary science? Choose only one option (1) Very relevant (2) Satisfactory (3) Relevant (4) Fairly relevant (5) Not relevant.

Methods	Extent of Relevance					Reasons more knowledge skills
	1	2	3	4	5	
Lecture Syllabus coverage						
Demonstration (less apparatus)						
Questions and answers (critical thinking)						
Project work (more process skills)						
Field Excursion (first hand information)						
Science walk (awareness environment)						
Discussion (self-expression)						
Dramatization or role plays (memory and creativity)						
Total	140					

APPENDIX B: SCIENCE TEACHERS QUESTIONNAIRE

Introduction

This questionnaire seeks for information on challenges to efficient implementation of science curriculum in public primary schools. All the information given will be treated confidentially and for academic purposes only. It is divided into four parts: Part A deals with background information, Part B: academic and professional qualifications Part C: availability of teaching learning resources and Part D: methods for teaching and their relevance. Please respond to all parts by putting a tick (√) against the statement that applies to your situation.

Part A: Background Information

1. What is your gender?

Male Female

2. How many years have you served as Headteacher or science teacher in this school?

Upto 3 years 4 to 10 years

11 to 15 years 5 years and above

Part B: Professional and Academic qualifications

(i) What is your professional qualification?

P2 P1

ATS B-ed (Arts) B.Ed (Science)

Others (Specify)

(ii) What is your academic qualification?

K.C.P.E [] EAACE ('A' LEVEL) []

K.C.S.E [] B-ED (Arts) []

K.J.S.E [] B-ED (Science) []

E.A.C.E ('O' Level)

(iii) What science subject did you study at high school?

Physics and Chemistry [] Physics []

Biology and Chemistry [] General Science []

Physics and Biology [] Home science []

Biology Agriculture [] Chemistry []

(iv) How many times per week do you prepare science lesson plan?

Once in a week []

Twice in a week []

Thrice in a week []

Four times in a week []

Daily []

(v) Do you agree that science panel is active at school and at zonal levels? Select only one that applies to you.

Highly Agree []

Agree []

Highly disagree []

Disagree []

None of the above []

(vi) How many times have you attended science In –service education and training (inset) courses between 2006 and 2012?

Once Four and above

Twice None of the above

Thrice Four Times

Part C: Availability of Teaching Learning Resources

(i) How many of the following science book publications do you use in your school? (K.I.E, J.K.F, Moran, Longman, EAEP, K.L.B, Longhorn etc.).

One Publication Two

Three Four

(ii) What is the pupil book sharing ratio in lower primary?

1:1

1:2

1:3

1:4 and above

(iii) What is the pupil book sharing ratio in the upper primary?

1:1

1:2

1:3

1:4 and above

(iv) What are the sources of funds for the purchase of books in your school?

- | | |
|--|-----|
| Schools instructional materials Bank Account (Simba) | [] |
| Donation from NGOs | [] |
| Parents Books Donation Day | [] |
| Harambee Fund | [] |
| Religion organization donations | [] |

(v) Which of the following resources do you have in your school?

- | | |
|-----------------------------|-----|
| Supplementary science books | [] |
| Tafakari science kit | [] |
| Science Kit | [] |
| Conventional charts | [] |
| Simple apparatus | [] |

4. Part D: Methods for teaching Science and their Relevance

(i) Which of the following science teaching methods do you commonly use for teaching?

- | | |
|---------------------------------------|-----|
| Activity oriented methods (ASEI-PDSI) | [] |
| Project and assignments | [] |
| Field and Science walk | [] |
| Lecture, Question and answers method | [] |
| Demonstration and discussions | [] |
| Dramatization or Role Play | [] |

(ii) Of what relevance to learning science is the method chosen in 4(ii) above?

Trains most of the process skills []

Efficient in syllabus coverage []

Imparts more science knowledge []

Rich in Science attitude development []

Creates more awareness of the environment []

Teachers learner activities, prepared in advance []

(iii) Which of the following is your school evaluation policy?

Weekly []

Fortnightly []

Every end of the month []

Termly []

APPENDIX C: OBSERVATION CHECKLIST

May I request the administration of the school to allow me observe the listed school items for purposes of this research only? Whatever information obtained shall be kept as confidential as possible.

	Items	Inadequate	Adequate	Satisfactory
1.	Instructional Materials/Equipment <ul style="list-style-type: none"> - Apparatus - Textbooks - Chalkboards - Chalk/Dusters/Pens/Exercise Books - Desks - Library – Mini-laboratory 			
2.	Physical Facilities <ul style="list-style-type: none"> - Compound - Fencing - Building and rooms - Boys Latrines/Toilets - Girls Latrines/Toilets - Administrative offices - Lockable doors/windows 			
3.	Staff Furniture <ul style="list-style-type: none"> - Chairs - Lockers/Cabins 			
4.	Learning Areas <ul style="list-style-type: none"> - Nature Corner - Farms model - Shop model - Wall displays 			

Source: Researchers' own collection