IMPLEMENTATION OF SECONDARY SCHOOL CHEMISTRY CURRICULUM IN KENYA: A STUDY OF CONSTRAINTS IN RACHUONYO DISTRICT

BY

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DECLARATION

This thesis is my original work and it has not been presented before to any panel for the award of any other degree.

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ABSTRACT

The purpose of this study was to establish the constraints which were facing implementation of secondary school chemistry curriculum. Quality of in- service for chemistry teachers, learning activities, availability of teaching/ learning materials and equipment and evaluation were investigated. The study was based on The Innovation Decision, Process Theory (Rogers, 1995). The research design was descriptive survey. The instruments used for collecting data were questionnaires and interview schedules. The research was conducted in secondary schools of Rachuonyo District. Stratified random sampling was used to select schools from three categories. These were girls' schools, boys' schools and co- educational schools. At the time of the study, there were 83 secondary schools in the study area. A sample of 25 schools was selected for study. The study sample consisted of 40 chemistry teachers and 170 students giving a total of 210 respondents. Data analysis involved descriptive and inferential statistics. Descriptive statistics included use of frequency tables, means and percentages while inferential statistics included correlation and regression analysis. From the findings of the study, it was established that implementation of chemistry curriculum was faced with a number of constraints. The most serious constraints were inadequate in-service provision for teachers of chemistry and availability of learning materials and equipment. Inadequacy of evaluation of the curriculum was less serious. The researcher sought to suggest ways of addressing issues in curriculum implementation and hence contribute to improvement in educational achievement in future. A number of recommendations were made taking into consideration the findings of the study. One of them was that KIE should plan for provision of adequate in-service training for all teachers of secondary schools for them to be equipped for the current curriculum. It is the researchers hope that the findings of the study will fill gaps left in curriculum implementation and hence improve teaching of chemistry. Hopefully, the findings will be useful to the curriculum developer and other stakeholders in future curricula implementations.

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DEDICATION

This thesis is dedicated to all those who are dear to me; My Mother Alice, my father Benson, my brother Fred, My sister Juliet and to my family; My daughters Pauline and Priscilla, My son Brian and my wife Carolyne.

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LIST OF ABBREVIATIONS AND ACRONYMS

K.I.E: Kenya Institute of Education.

SMASSE: Strengthening Mathematics and Sciences in Secondary Education.

INSET: In-Service Training.

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

HIV/AIDS: Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome.

SPSS: Statistical Packages for Social Sciences.

TIQET: Totally Integrated Quality Education and Training.

MOEST: Ministry of Education Science and Technology.

EFA: Education for All.

UPE: Universal Primary Education.

QASO: Quality Assurance and Standards Office.

NRC: National Research Council.

DEO: District Education Office.

RASEC: Rachuonyo South Examinations Council.

MOE : Ministry of Education

CHAPTER ONE

1.0 INTRODUCTION

In this study, the researcher sought to investigate constraints which were facing chemistry curriculum implementation. The extent of the constraints and their influence on learning of students were established and possible solutions to the problem were suggested.

1.1 Background of the Study

Since achievement of independence, the Kenya Government has conducted Education Commissions with a view to establishing and implementing a curriculum which is responsive to social, political, cultural and economic needs of the country. Ministry of education, Science & Technology (2005) stated that Ominde Commission (1964), Gachathi Report (1976), Mackay Report (1981), Kamunge Report (1988) and Koech Report (1999) were submitted to implement curricula, which were intended to meet the important needs.

Curriculum implementation all over the world require that materials, equipment, personnel, training, programme and moral support be put into place for objectives of the change to be realized (Ondiek, 2000). The National Conference on Education and Training held in November 2003 in Kenya brought together over 800 key players in the sector. The conference mandated the Ministry of Education Science and Technology (MOEST) to develop a new policy framework for the education sector. A change in curriculum came with the new policy (MOEST, 2005).

One of the objectives of curriculum development and implementation is to realize a population of citizens who are scientifically literate and technologically advanced. Technology is a critical form of wealth to any nation. A break through in industrialization can only be achieved through technology. For this reason, innovation, research, development and science which chemistry is part of will form one of the key pillars of education and training. In order to meet the demands of the 21st century, The Kenyan education and training programmes must be empowered to conserve, sustain and exploit our environment for sustainable development (MOEST, 2005).

Efficient curriculum implementation is one with minimal constraints. Curriculum development project progresses through the following stages: Relevant information about the social, economic and political philosophies of the society are gathered by teachers and education officials to reveal the need for curriculum improvement. The curriculum is planned to cater for three dimensions of learning formal, informal and non- formal by examining and re-stating objectives and determining necessary learning experiences and assessment methods. Feasible learning experiences are organized with regard to nature of the learners and principles of learning. Materials and equipment from existing stock are selected, scrutinized, collected and prepared for the new curriculum. Prototype materials are designed, produced, tested, tried out and used in mass production of new teaching/learning materials. Curriculum plan, materials and equipment are tried out in selected schools using teachers and students. Mass dissemination of the innovation by courses, conferences, workshops and mass media inform the general public about the new curriculum and its implications.

Teachers and students implement the innovation and then project evaluation by curriculum developers start. Data that is collected in the course of evaluation is used to decide whether the new curriculum is worth adopting (Oluoch, 1984). In 1968, the Ministry of Education launched the Secondary Technical Education Project (Oluoch, 1984). It was specifically aimed at updating Vocational Schools' Curriculum to enable production of students needed to man and develop Kenya's industrial enterprises. Eight three-year secondary Vocational Schools were increased to twelve and converted into four-year technical schools. All the curriculum development essentials were observed. The project was successful due to tight control of expansion within its means.

Secondary education is characterized by poor performance in national examinations especially in core subjects such as mathematics and science (MOEST, 2005). The Kenya National Examinations Council (2003) reported that, in Chemistry, performance in both the theory and practical has been quite poor. In the year 2002, the mean scores were 22.25 in the theory paper and 12.25 in the practical, (p 91). The poor performance was a sure sign of learning problems. An added dimension relates to secondary school teacher training which combines teaching methodology and subject mastery (MOEST,2005). KNEC (2004) observed that students should be encouraged to carry out as many experiments as possible. It is wrong and unfair for students to be denied the use of apparatus during tuition. Further it was noted that some candidates see apparatus for the first time at the time of examinations. Once experiments are carried out, the results should be discussed thoroughly, sources of error should be mentioned and measures to avoid errors stated clearly (KNEC, 2004).

In view of these issues which arose from teaching and learning of chemistry it was very necessary to carry out this study and find out more about the subject. At secondary schools level, syllabuses have been reviewed and rationalized to reduce curriculum overload (Ministry of Education, 2006). The topic, organic chemistry I was moved from part of forn four syllabus to form three (MOEST, 2006). According to KIE (2006), one of the challenges which was facing education provision was that KIE depended on District Education Officers to distribute revised syllabuses to schools but some of the officers did not do so. This suggested that implementation of the curriculum could be facing problems. In spite of all that, the Ministry of Education continues to conduct SMASSE in-service training in order to improve teaching of chemistry curriculum in schools.This study endeavored to assess constraints that were facing implementation of the chemistry curriculum in Rachuonyo District.

1.2 Statement of the Problem

This study sought to investigate constraints that were facing implementation of chemistry curriculum. KNEC results for the years 2004, 2005, and 2006 registered mean scores of 4.5847, 4.8628 and 3.9849 respectively in chemistry for Rachuonyo District (QASO, 2007). Performance was lowest in 2006. MOEST (2005) observed that provision of education is fundamental to the success of the governments' overall development strategy. It is central to the attainment of social, economic and industrial development (MOEST 2005). The low performance suggested that this success would not be easy to attain. It was evident that financial constraints were facing evaluation of chemistry curriculum in Rachuonyo District. QASO (2011) warned that the defaulting schools in MOCK fee payments risk their results being withheld.

It is headache to Heads Association to keep talking about defaulters year in year out. KNEC (2004) reported that overall performance in Chemistry (233) had been quite low. Lowest performance was registered in the year 2001 with a mean mark of 30.27 (p 91). This was the year when physical science was abolished and the candidates had to take pure chemistry. This low performance was an indication that there were problems in the teaching and learning of chemistry. Baseline findings of SMASSE IN-SET which suggested that lack of text books and facilities were some of the challenges that were facing teachers in Rachuonyo District (SMASSE, 1999), were in concurrence. A problem was evident: there was shortage of learning materials and equipment.

The Kenya National Examinations Council (2003) noted that many candidates did not seem to have clear understanding of the difference between covalent bounds and Van der Waals forces of attraction. The majority of the candidates including those from the best centres were not able to identify a given polymer. The examinations councils argued that these were manifestations of poor tuition and non coverage of some topics. It was suggested that teaching of organic chemistry be done early enough for the candidates to internalize the concepts involved (KNEC , 2003). Problems of learning persisted and The Kenya National Examinations Council (2007) reported that some candidates did not know the products of some chemical reactions and had difficulty in balancing chemical equations where products were known. Some candidates were not able to give precise explanations for certain phenomena while some others gave irrelevant responses. Such responses suggested that the related topics had been taught poorly. In the year 2002, some candidates gave wrong observations to almost all parts of a practical question.

Some of them did not give correct inferences for correct observations that they had made. This showed that they did the tests without the knowledge of the reactions taking place; a suggestion that such candidates had not been exposed to experiment sufficiently (KNEC, 2003). From these observations, it emerged that there were problems in learning activities, availability of learning materials and equipment and evaluation of curriculum. This study was therefore conducted in Rachuonyo District in order to investigate further and establish the extent of the problems.

1.3 The Purpose of the Study

The purpose of this study was to establish constraints facing implementation of chemistry curriculum in secondary schools of Rachuonyo District. The constraints arising from in-service of teachers, frequency of learning activities, availability of learning materials and equipment and curriculum evaluation were randomly selected for study.

1.4 Objectives of the Study

The specific objectives of the study were:

1. To determine adequacy of in-service attendance by teachers of chemistry.
2. To find out the frequency at which stated students' learning activities for the chemistry curriculum were being carried out.
3. To establish availability of teaching/learning materials and equipment for the chemistry curriculum.

4 To determine the extent to which evaluation of chemistry curriculum was being done.

1.5 Hypothesis of the study

The following were the hypotheses of the study:-

Null hypothesis:

HO: - There is no relationship between constraints and curriculum evaluation; tested at level of significance alpha = 0.05. The hypothesis was broken down into two;

HO_1:- There is no relationship between, in-service, learning activities, materials and equipment and teachers' evaluation (student assessment); tested at level of significance alpha = 0.05 .

HO_2:-There is no relationship between in-service, learning activities, materials and equipment and KIE evaluation; tested at level significance alpha = 0.05.

1.6 Significance of the study

In Kenya, education is instrumental in the attainment of industrialization by the year 2030(Republic of Kenya, 2007). Education will boost social, political and economic development. Unless we understand the effects of constraints to curriculum implementation, we can not ensure that quality education is provided to students in schools. The anticipation was that in the attempt to attain the objectives that were set down for the study, more understanding of the effects of constraints on new curriculum implementation would emerge resulting in quality implementation of curricula and hence attainment of quality education.

The study would contribute to this achievement by providing information on the following;

Teachers would gain in ways that would make them more creative and innovative towards instructional strategies and hence improve on the learning activities.

School administrations would be provided with information on the need to equip schools with teaching /learning materials and to support the chemistry curriculum.

Evaluation of the curriculum would be enhanced for the improvement of education provision.

1.7 Assumptions of the Study

The following were the assumptions of the study:-

1. The students who were involved in the research had the same entry level.
2. Students and teachers captured constraints that were facing the implementation of secondary school chemistry curriculum through responses that were given.
3. Environment of students and teachers did not affect their motivation and hence their responses.
4. The constraints which were selected had an influence on the students' learning.

1.8 Scope and limitations of the Study

This study was focused on some aspects of curriculum development and implementation. Chemistry curriculum of secondary schools was studied using descriptive survey design of

research. Information about the curriculum was provided by data which were collected from secondary school students and their Chemistry teachers.

The study focused on some selected aspects of curriculum implementation. In-service for chemistry teachers, learning activities for students and learning materials and equipment and their influence on curriculum evaluation were studied. The limit of the study was one district. Forty chemistry teachers (40) and one hundred and seventy (170) form four secondary school students of Rachuonyo District in the year 2008 provided data. The researcher acknowledged that the study of only one district could limit the degree to which the findings would be generalized. For a more conclusive result, all districts should have been studied. However, this was not possible due to limitations of time and finances. Field officers and heads of schools were not interviewed to give information about the chemistry curriculum, although they could give useful information. Students in lower classes i.e form 1, form 2 and form 3 were not involved because they had not been exposed to the chemistry syllabus for long and hence would not give sufficient information.

1.9 Theoretical Framework

The theory which formed the basis of this study was The Innovation, Decision, Process Theory (Rogers, 1995); an Adoption – Diffusion theory. In this theory, adoption of an innovation progresses in a given time through the stages knowledge, persuasion, decision, implementation and confirmation. At the stage of knowledge, education officials, teachers, students and the school administrators have know that a new curriculum is being introduced. The goal of intended process has to be known. In the study, the researcher had

prior knowledge of appropriate research design to be applied. This enabled the researcher to conduct the study adequately. Respondents in the study were made to know their roles. At persuasion stage, an innovation is introduced to users who have to be persuaded to accept and adopt it. The teachers, education officials, school administrators, students and the community have to be convinced that a new curriculum is important. Henderson (1985) observed that the innovation process is the planned application of end or means new to the adopting educational system, and intended to improve the effectiveness and/or efficiency of the system. In this study, the researcher introduced respondents to the study of constraints facing implementation of secondary school chemistry curriculum and persuaded them to participate in it. The stage of decision applies when the users of an innovation agree to use it. The teachers, school administrators and education officials decide that the new curriculum is going to be adopted. Chemistry teachers and form 4 students of Rachuonyo District decided and agreed to participate in the study. Implementation involves actual use of an innovation .Teachers, students, education officials and the school administrators start using the new curriculum. The researcher and the respondents participated in the study having known the necessary procedures. The researcher provided instruments for collecting data and the respondents gave relevant information for the study. Confirmation stage justifies the Adoption -Diffusion process. Propositions of predictions and generalizations about the future are often said to be confirmed by observational evidence (Maher, 2005).The teaching of the new curriculum is justified or rejected depending on its benefits or drawbacks. The study had significance and was deemed capable of contributing to acquisition of useful knowledge in education. Nentwig and Waddington (2005) stated that, implementation of an innovation is a social activity which aims at changes in social

practices, the beliefs and understandings of social and organized structures. It is characterized through materialized plan which describes the intended practices and the aspired ways of changing them using material, time and specific social structures like regular appraisal to make people act in another way. Its real test lies in being put into practice (Nentwig and Waddington, 2005).

1.1.0 Definition of Terms `

Achievement: - The gain in knowledge, skills and attitude that students attain during teaching and learning process.

Adoption: - The decision to start using a new idea: Decision to start a teaching/ learning process with new plan and content may be reached to enhance achievement among students

Attitude: - The way one thinks or feels about something; this influences students behaviour and determines their desire to learn a given skill or concept.

Curriculum: - A complete course consisting of all the subjects to be studied by students as they follow the plan of instruction in schools to learn specific skills.

Diffusion of innovation: - This is the disseminating of complete information about a new idea. New curriculum is disseminated so that all people can start using it.

Formal Education: - Agreed official way of getting education: it is a planned and organized way of giving instruction meant to enable students to learn.

Informal Education: - Learning which takes place without officially established procedures. Usually students learn values in society, which are non-academic.

Infrastructure:-The basic structures, which makes an organization to run by enabling delivery of services to the organization. Schools are able to run when infrastructure consisting of good roads or electricity supply provides necessary services.

Innovation: - The incorporation of new ideas into existing processes: new content and procedures are added to existing ones in teaching to improve educational achievements.

In-service:- Training given to a person on a job such as teaching in order to teach him/her new skills for implementation of an innovation.

Integrated topics: - Topics which have been arranged in the syllabuses to be done at the same time to make learners realize the unity of knowledge and to enable their experiences to supplement and complement each other.

Pedagogy: - Different strategies and techniques applied in teaching to make students learn certain skills and concepts.

Implementation of curriculum: - To start using developed curriculum plan in schools in order to teach certain knowledge and skills.

Vocational Schools:- Schools in which skills necessary for particular jobs are taught. Skills such as electrical wiring which is necessary for electrical installations are taught in such schools.

KIE Implementation:- the introduction of developed curriculum plan and teaching/learning materials into schools so that they can be used by students and teachers.

KIE Evaluation: -the process of determining quality of developed curriculum plan and its teaching/learning materials in order to determine their efficiency.

1.1.1 Summary

This chapter introduced the study by giving indicators of the problem under investigation. The purpose of the study was explained as an attempt to establish constraints to implementation of chemistry curriculum. The hypothesis, which guided the study, was stated as:Ho: There is no relationship between constraints and Chemistry curriculum implementation. The study was backed by the theory of innovation development. Key terms that appeared in the study were defined to clarify the document.

CHAPTER TWO

2.0 Literature Review

2.1 Introduction

The main aim of carrying out literature review in this study was to show the relationship between previous studies that have been done on curriculum development and the one that was carried out by researcher. A lot of research work had been done on curriculum development and while some issues still posed challenges, the researcher reviewed the issues and suggested ways of tackling the unresolved challenges.

2.2 General Review of Literature

2.2.1 Curriculum Development and Implementation

Oluoch (1984) stated that before a given curriculum is developed, relevant information about desired improvement is collected. He noted that political philosophies of the society should be known since they dictate objectives for schools, school leaver's employment opportunities and society's receptiveness to change. He further states that feasibility of identified improvement and cost of learning materials that are currently in use are established at this stage. Bishop (1985) added,` When planning the curriculum, objectives for an educational phase are formulated, translated into curriculum area objectives and stated in behavioural and constructivist terms .Oluoch (1984) further states that feasible learning activities are stated indicating action to be carried out by learner and content on which action will operate.

Student assessment methods meant to check whether they are carrying out planned learning activities and acquiring desired knowledge, skills and attitude are planned for and stated. Materials and equipment from existing stock are selected and new ones are produced considering quality variety and relevance in teams, which include teachers. Ministry of Education, Science and Technology (2002) stated that most of the apparatus, chemicals and equipment required for carrying out experiments are basic and affordable by most schools. Improvisation and use of local materials is encouraged where necessary to cut the costs. KIE (2006) expressed the view that under the new dispensation of liberalized publishing, commercial publishers and KIE have been assigned a role to develop relevant curriculum support materials. However, KIE noted that there were still subject areas where curriculum existed but the materials were yet to be developed. Try out of curriculum plan, materials and equipment is done in selected schools to identify and correct major defects before implementing the curriculum (Oluoch,1984). Storage and distribution problems are corrected and follow-up by curriculum authorities is worked out. The innovation is then disseminated to the general public and implemented. Curriculum developers select and develop necessary observations and measurement techniques for evaluation of learning activities and objectives. Data is collected, analyzed and used to make decisions (Oluoch, 1984).

Urevbu (1985) points out that, 'Despite the new syllabuses, the new books, the curriculum centers and international programmes, relatively little impact is actually being made on the school curriculums.' This is because, he believes, the scope of curriculum planning is still not wide enough in Nigeria.

He stresses that curriculum change depends on changing the people, convincing teachers to be committed and re-training them constantly through out their working lives.

Qidi (2006) explained that construction and development of curriculum theory as a discipline has nature, function and value orientation, which require us to concern ourselves with two aspects of needs: we should analyze the problem of curriculum reform scientifically and we should solve the difficult problems in the curriculum practice effectively (Qidi, 2006). As a form of rational recognition in curriculum research and teaching research and as a form of knowledge in curriculum theory and teaching theory, it is possible to integrate both of them. Two outlooks of the curriculum design were put forward, he went on : that is curriculum design, which embodies the profound properties of curriculum and the school-based curriculum. Qidi (Ibid) further noted that curriculum is influenced by such hidden elements as curriculum system and the standard of meeting students' demands and its helpfulness for students' development.As to the situation at that time and problems of curriculum assessment, the researcher and practitioners could make further theoretical research, reinforce the curriculum assessment of locality and schools, define effective curriculum assessment standards, set up fair curriculum assessment system and reinforce the dialogue and negotiation. As for teachers' professional development, we could face rationally the problems of teachers' professional development and deepen the recognition of teachers' professional development and explore its way scientifically (Qidi, 2006). Roehrig, Kruse and Kern (2007) observed that reform- based curriculum materials have been suggested as a mechanism to make inquiry based instruction more prevalent in secondary science classrooms, specifically when accompanied by comprehensive professional development (Roehrig,Kruse and Kern, 2007).

The research that examined the implementation of reform-based high school chemistry curriculum in 2007 in the US explicitly considered the role of teachers' knowledge and beliefs in their implementation of the reform-based chemistry curriculum. Analysis of the curriculum revealed that its implementation was strongly influenced by teachers' beliefs about teaching and learning (Roehrig et al; Ibid).

Tyler (1949) as quoted in Omulando and Shiundu (1992) suggests that curriculum is built on studies of the learner, studies on contemporary life outside the school and suggestions from subject specialists. He identified the following four fundamental questions that curriculum developers should answer;

> *What educational purposes should the school seek to attain?*
>
> *How can these educational experiences be organized?*
>
> *How can we determine whether these purposes are being attained?*
>
> *What educational experiences can be provided that are likely to attain these purposes?*

Omulando and Shiundu (1992) gave detailed stages of the curriculum development and implementation process. The researcher agrees that curriculum planning should come up with detailed statements which guide each stage of curriculum development and implementation.

Zhihou and Rumi (2004) contributed, saying the curriculum outlook which supports sustainable development has curriculum design with aesthetic features, content that focuses on values and aspirations, question leading organizations and curriculum evaluation that emphasize gains and generation.

However, Eshiwani (1993) noted that the new curricula seem to have failed to respond to the problems of low-quality curriculum materials, and inappropriate instructional approaches. He stressed that these are some of the key issues that must be considered in discussing the future quality of education in Kenya.

2.2.1.1 Chemistry for Modern Society and for Future Specialists

The aim of any school chemistry curriculum is not only to educate in chemistry but also to educate through chemistry. It is important to generate a population that is positively disposed to chemistry and its impact on society. From such an educated population, there will be those who choose to pursue the chemical sciences beyond school and who will become the leaders in the field for the future (Sealey, Robson and Hutchins, 1997). The syllabi ought to be planned around these themes. Such an approach will meet the needs of the whole population and also provide the essential critical basis for those who will pursue the study of the chemical sciences beyond school.

Waititu (2008) realized that in curriculum implementation, demystifying science is imperative: Making concepts clearer and easier to understand enable many students to learn and eventually contribute in making Kenya competitive and prosperous with high quality of life (Waititu, 2008). Science is demystified by giving learners tasks which enable them to develop ability and confidence to perform desired operations and manipulations, mental calculations and estimation. These are achieved when the learners can select instruments for investigation and are logical, critical thinkers, accurate, precise and have spatial

awareness (Waititu, 2008). Chemistry practical promote the achievements by enhancing ability to identify, concretize, use and interpret scientific notations and relationships in everyday life. Learners can hence apply the knowledge gained to familiar and unfamiliar situations including preparation for further education and training. This was supported by QASO (2011) urging schools to purchase the apparatus for practical as per the specifications on the confidential instructions to avoid their candidates being penalized unfairly during marking of examinations.

A study was conducted by Faisal (2008) to analyze the science curriculum at secondary school level in order to know the present state of science curriculum in Pakistan. The major objective of the study was to analyze chemistry curriculum process with special reference to content, methodology and evaluation. He critically reviewed the subject matter of chemistry and pointed out its strengths and weaknesses at secondary level in Pakistan. The target population consisted of workers of national science curriculum in the Ministry of Education and chemistry teachers at secondary school level. Shelved data was obtained from Education policy documents and science education reports. Data was collected on five point questionnaires and analyzed using chi-square test. The major conclusion was that modern teaching techniques of teacher training according to global needs were required. Faisal (2008) had found out that evaluation system supported cramming and rote learning rather than comprehension, analysis and evaluation. He recommended that sufficient audiovisuals should be provided to teachers in order to enhance teaching/learning process. He stated that content which promote creative thinking should be introduced, projects

should be assigned to students according to their abilities, latest software regarding science education and internet facilities should be initiated in schools and single author books should be replaced with multi author books. The recommendations which were made by Faisal (Ibid) could suitably improve the curriculum implementation but in addition, other curriculum areas such as try out and in-service for teachers could have been recommended for study. The research methodology which was applied by Faisal is similar to the one in this study.

2.3 Literature Related to the Study

This section presents studies on curriculum which were related to this study. Professional development and curriculum reforms are presented.

2.3.1 Professional Development

Research studies on Investigating Science Institutions (ISI) which support science education, particularly in teacher professional development reported a tendency for (ISI) to be under-subscribed and said funding was the biggest barrier to their ability to provide these programmes (Philips, Finkelstein and Weaver, 2007). The studies investigated the extent to which (ISI) -based teacher professional development incorporated features shown to produce measurable effects on teachers' instructional practice. The findings indicated that ISI-based teacher professional development incorporated features which produce measurable effects on teachers' practices. The results suggested that while some opportunities could be missed to leverage the strengths of the ISIs learning environment in science education, ISIs continued to support science education in the United States in important and varied ways.

Bogonko (1992) noted that the impact of curriculum reform was watered down by some shortcomings in science education which were still inherent in the education system in Kenya. Further, he stated that the weak base of mathematics and science teaching in secondary schools affected the recruitment of local grandaunts into the civil service. The growth in the quality of education service should entail continuous skills upgrading for teachers. In Kenya, however, limited opportunity for in-service training has denied most teachers the chance to enhance their skills beyond those acquired during their basic training (Ministry of Education, Science and Technology, 2005). This presents new problems and challenges to the teachers, education officials and other stakeholders in education.

Research exploring the ways in which Information Communication and Technology (ICT) could improve access to teacher education and its quality in the Global South showed that when teachers were given sustained training, support and access to laptop and hand held computers, the tools were useful for professional development and for supporting classroom practices (Tom and Rhodri, 2007). Many studies have investigated the use of handheld computers in classroom settings but most of them have focused on pupil learning. Handheld computers provide an opportunity for making major changes in educational settings. The study found out that handheld digital tools offer a number of pedagogic and pragmatic advantages over laptop or desktop computers for teachers.

New standards in science and mathematics education in general and in chemistry standards in particular were being advocated; standards which reflected the then current vision of the content, classroom environment, teaching methods and support necessary to provide a high quality education in the sciences for all students (National Research Council,1996). To foster change in teachers' classroom practice and meet the challenges of reform in science education, teachers could be treated as equal partners in decision making (Hofstein, 2005). Teachers play a greater role in providing key leadership at all levels of the educational system.

Pratt (2001) suggested that there are four basic skills relevant to effective leadership in science education, namely; Technical skills, conceptual skills, interpersonal skills and self-learning skills. A model for the professional development of chemistry teachers was used to provide short courses for chemistry teachers to introduce them to the new approach and its related scientific background (Hofstein, 2005). The courses were aimed at enhancing the professional development of chemistry teachers. Hofstein noted that the teachers gained in knowledge of subject content and pedagogical skills. The teachers were introduced to the use of diagnostic tests for identification of students' problems. A programme was conducted to enable development and growth of participants in conceptions, beliefs and changes in behaviour. Abilities and skills in the area of leadership were developed. Information regarding the teacher's classroom environment was obtained by probing into chemistry students' perceptions by using paper and pencil measures developed in the context of science curriculum development and implementation. The study revealed that the rate of instruction was significantly reduced, the friction among students was reduced

and the students' satisfaction regarding their experience in the chemistry classroom had significantly increased (Hofstein,2005).

Okinda (2008) stated that the importance of ICT in Education can not be overemphasized. Use of ICT in Education results in improved quality, effectiveness and efficiency by enhancing delivery of curriculum without time and distance limits. He elaborated that ICT promotes remote learning, motivation, learner centeredness, active learning and collaborative learning. It act as model of real world interactions and make learners capable of working with people from different cultural backgrounds. This enhances learners' teaming and communication skills and global awareness. Integrative learning in which artificial separation between different disciplines and between theory and practice are eliminated is promoted by ICT.

Kiarie (2002) studied the relationship between school inspectors and teachers of primary schools. He had felt that for efficient implementation of curriculum, mutual relationship between inspectors and teachers must be enhanced. Pratt (Ibid) suggested that a basic skill relevant to effective leadership in science education is interpersonal skill. Kiarie also sought to find out whether inspectors underwent in-service inspectoral training after appointment and whether teachers would accompany them during in-service. He found out that inspectors were never in-serviced adequately and teachers never accompanied them during in-service.

Levine (2006) talks about teaching for students' strengths. He says that 'demystifying the content helps kids get ability. Weaknesses too must be learnt and corrected. He is opposed to punishing children with poor grades while emphatic on counseling. A trained teacher who attends workshops corrects students' weaknesses. Big ideas and concepts of curriculum should be focused for all children but access to them is individualized. Assignments and tests should be flexible for different minds. Levine (Ibid) observed that demystifying science for students make them to learn scientific concepts easily. In the researcher's view, workshops and in-service training equip teachers with counseling and instructional skills and hence enable them to demystify subject content.

This study focused on establishing the availability of teaching/learning materials for chemistry, frequency of learning activities, curriculum evaluation, adequacy of try out and adequacy of in-service for secondary school teachers of Rachuonyo District. This arose from the realization that performance of students in chemistry in the district was dropping (QASO, 2007).

2.3.2 Curriculum Reforms in Kenya

The Kenya Education Commissions sought to introduce curricula that would develop education and training. Gachathi commission (1976) introduced a curriculum which improved access to education(MOEST, 2005). Learning materials in a number of schools remained poor resulting in poor outcomes. Koech report (1999) geared the country for industrial and technological development by introducing Totally Integrated Quality Education and Training (TIQET) (MOEST, 2005). It is hoped that Kenya will achieve

high level of industrial and technological development by the year 2030 (Vision-2030) (Republic of Kenya,2007). Quality implementation of the chemistry curriculum would make remarkable contribution towards the attainment of this noble objective.

Changes in the curriculum, which took place in the year 2002 followed. Revised Secondary Education syllabi were re-organized and rationalized. Conscious effort to respond to pertinent contemporary issues in society was being made (Ministry of Education Science and Technology, 2006). Some of the issues were positive attitude towards environmental conservation, gender responsiveness and instilling of appropriate socio-cultural values. Appropriate teaching methods and guidelines on time management were given (MOEST, 2006). In the view of the researcher, teaching students environmental conservation techniques require field trips in which they would visit industries, which emit pollutants. To be gender responsive, students could be exposed to role models invited to deliver speeches, which support the subjects that they study.

Appropriate socio-cultural values were however being instilled adequately through music, drama and sports (Ondiek, 2000). The new syllabi recommended the use of cost-effective teaching/learning materials with creativity and innovativeness in sourcing and using them. Eshiwani (1993) stated that, 'An analysis of curriculum development in Kenya shows that there exists a growing gap between the theoretical pronouncements as outlined in curriculum development stages and the actual implementation. Curriculum development has not always followed the laid down development stages'. Further, he argues that Kenya,

like many other developing countries, is in a hurry and cannot afford to wait for long highly accurate studies before KIE starts educational innovation. Some changes have been made through ministerial orders leading to by-passing various stages in curriculum development. He concludes, 'perhaps a major constraint in designing, implementing and evaluating curriculum projects in Kenya has been the limited resources.

2.4 Related research studies

This section dealt with specific studies that had been done and are related to this research. Curriculum implementation, design, basic training and in-service, approach to a new curriculum and evaluation have been presented.

2.4.1 Curriculum Implementation

A study examining the process of curriculum implementation in Ohio State in order to increase understanding of the process and its relationship to what was currently known about curriculum implementation followed the process from national level to actual use instructional materials (Diane, 1987). The study focused on three major phases: Program adoption and planning, In-service workshops and Classroom use of materials. This study was based on a statewide survey of the project WILD in Ohio. The workshop was consistently cited as the most important strategy for implementation. Diane (1987) reported that the quality of the workshop was maintained through its different levels. Its features included the overall quality, peer teaching, the people and team approach. The teacher workshop provided the educators with materials and helped them to develop the confidence, skills, enthusiasm and motivation to use the materials with students. The

project emphasized the most through the selection of activities, awareness, appreciation and scientific principles. Planning and adoption of the science curriculum were well done. The in-service made the teachers to develop teamwork skills. The instructional materials that were provided improved the teachers' instructional skills, motivation and confidence to use them with students (Diane, 1987). According to the researcher in this study, many scholars have emphasized that for curriculum implementation to be efficient, planning, provision of learning materials and in-servicing of teachers must be properly carried out.

The views of Gregory and Chapman (2007) differed slightly from Diane's experiences. They observed that students learn differently. Teachers can no longer teach the lesson and hope that everyone gets the content. They must strive to differentiate the content, the assessment tools, the performance tasks and instructional strategies for mixed ability students. They further argue that this would enable teachers to plan strategically in order to meet the needs of the diverse learners in the classrooms.

2.4.2 Curriculum Design

Okech and Asiachi (1986) carried out a research in curriculum development for primary schools. They stated that information necessary for development of curriculum should be based on external factors such as expectation and requirements of parents and employers, and internal factors such as pupils' attitudes, aptitudes and defined educational needs. They noted that the media had been on the forefront in pointing out the weaknesses that exist in the curriculum. They identified forces, which have slowed down or inhibited the

development and implementation of curriculum. They say, “Our schools appear to stress the teaching of subjects’ knowledge while ignoring the Childs needs. No solution has been got”. Okech and Asiachi (Ibid) suggest that the changes should not be brought to the child; instead, the child should go seeking for knowledge. The classroom instruction does not provide sufficient freedom for the child. Further, they say, “Flexible classroom is needed where children go discovering the world around them.” In this study the researcher made an attempt to find out if students were carrying out projects and whether they were getting the freedom to make discoveries. According to Okech and Asiachi, erratic burst of new knowledge affects curriculum change. The teacher is unable to cover books while elements of knowledge are not being understood. They say,

> *“The needs of pupils, teachers and administrators have a part to play in education, yet most parents feel that the school is an independent institution away from the society in which they live”*

2.4.3 Basic Training and In-service

In response to concerns that had been raised about the quality of teacher- education programmes and effectiveness of their preparation for the increasing complexity of the teaching role in schools, Australian government recommended much closer collaboration between schools and teacher-education institutions (Sealey, Robson and Hutchins, 1997). In a programme, teacher-education staff collaborated with school staff in teaching the trainees to enable them develop appropriate skills and understandings.

The Kenya National Examinations Council (2007) stated that one of the demands in the21st century is the acquisition of scientific skills. 'Kenya cannot afford to be left behind', the council added. Teaching of sciences, chemistry included should therefore be enhanced in most schools. Laboratories must be constructed and properly equipped for teaching and examinations. The scientific approach involving experimentation and deduction is the method recommended worldwide for the teaching/learning of sciences. This not only provide the students with the necessary skills but also make the subject very interesting (KNEC, 2007).

Often, teachers have not been able to keep up with scholarly developments, Ornstein and Hunkins (2009) denote. 'Turning a school around requires that teachers increase their knowledge base of the new curricula content, develop new expertise in pedagogical approaches, improve their knowledge of instructional design and hence increase their capacities to deliver the new programmes', they added.

2.4.4 Approach to a new Curriculum

It is inevitable that challenges of developing new instructional materials, revised teaching strategies and revised evaluation techniques will always face the implementation of new curricula. A study which was conducted to investigate the effects of new science curricula on students' performance revealed that students who were exposed to new science curricula performed better than those students who were in the previous courses (Shymansky, Kyle and Alport, 1983). The students who had been exposed to the new curricula improved in achievement, analytical skills, and process skills and in communication. They also

developed more positive attitude towards science. The improvement in the students' performance was attributed to improved pedagogic skills of teachers and improved teaching materials of the new curricula.

QASO (2010) realized that the KCSE mock examination papers of the year 2010 tested the syllabus adequately. Involvement of the senior KNEC examiners in the setting and moderation of exams and the use of the modern conveyor belt marking system were done to enhance validity of the examination. Here, a candidate's paper is marked in turn by several teachers. However, performance of most students was below average. They could not answer questions from form four syllabuses well and this resulted in district chemistry mean of 2.2 points; D- grade (p27). Further, QASO (2010) noted that in the practical paper, performance was below average. Most students had difficulty in filling tables. This was indicated by inconsistence in presenting decimal places. The students also had difficulty in performing calculations.

2.4.5 Materials and In-service

In Wisconsin, some curricula materials were prepared for the new curriculum by secondary science Improvement study groups (O'Hearn and George, 2008). Teachers' guides, students' textbooks, programmed instructional materials, laboratory manuals, supplementary readings, tests, special equipment and kits, films and other audiovisuals were produced. In addition to producing the materials, the study groups discussed changes in the activities and responsibilities of teachers and students, course content and

organization, students' equal ability discussion grouping and implications for teacher preparation.

Ogula (1990) stated KIE gave guidelines for subject panels on the design, development, implementation and evaluation of the 8-4-4 curriculum. Curriculum development teams consisting of practicing teachers, university lecturers, QASOs, lecturers from teachers' colleges, examination secretaries and representatives of teachers union were set up. However, he added, it was later argued that the views of the teachers who participated in the development of the curriculum and curriculum materials were not representative of the views of other teachers. Further, Ogula argued that although there were extensive consultation between KIE and teachers during the development and implementation of the curriculum, no needs assessment surveys among students and the general public were carried out before the development of new materials.

2.4.6 Evaluation of Curriculum

A school chemistry curriculum was designed by The Weizmann Institute of Science in Israel in the year 1983. It was designed with the future stages of learning in mind. It was re-thought in terms of citizens as well as those who would become chemists. The new approach in curriculum design sought to define the kind of chemistry, which the wider population needed. Main ideas involving the structure and nature of matter and its transformations were illustrated with much less content. Applications' led curriculum where students were introduced to the chemistry that was needed to make sense of the

world around them was developed. This gave insights into the perspectives and methods of chemical inquiry as well as its outcomes (Kempa, 1983).

The chemistry syllabus ran for several years with quite remarkable results. It had been planned for 13-year old pupils. The idea of 'elements' was presented as building blocks. The periodic table was seen as a device to display these elements. The pupils started to look at their world with a simple agenda and many fundamental chemical ideas arose naturally. Knowledge of properties of matter, energy and states of matter arose to pupils. The course was descriptive, based on the surroundings, application oriented, and it avoided quantitative aspects(Kempa, 1983). The Kenya National Examinations Council (2004) reported that chemistry tests candidates' understanding in factual chemistry, concepts and principles in chemistry. It also tests the ability to select apparatus and put them to their correct use.

Wilcox (1992) on the other hand, noted that the problem with evaluation has always been twofold: to find the time for it and to command the skills necessary for a process that will have external validity. He stressed that there is an urgent need to locate the purposes, method and organization of evaluation more soundly within the context of concerns of institutions.

Curriculum evaluation reveals how appropriate the curriculum is. The evaluation stage of curriculum development also appraises the content, pedagogy and materials that are being used in the implementation. Currently where testing was emphasized, it was in relation to

how its diagnostic features could be enhanced: features such as the alternatives yielding more information on students' prior knowledge and conceptual understanding (Kempa, 1983). The more recent techniques advocated were concept mapping assessment techniques, use of structural communication grids, structured interviews, observation and image-based tests.

Kempa (Ibid) stated that the Weizmann curriculum in Israel was applications led and had improved methods of chemical inquiry which made pupils to develop interest in chemistry. Ondiek (2000) noted that teaching in Kenya was examination oriented. Eshiwani (1993) had elaborated that examinations have tended to exercise undue influence on the Kenyan education system. He stated that they have been used to serve the highly selective objectives, structure and content of the formal education system. Further, he added that examinations fail to test hidden potentialities in the barely two to three hours that a test takes to determine the fate of a candidate. In the view of the researcher in this study, applications led curriculum in which familiar objects are used in inquiry is preferred. Continuous search for better recent evaluation techniques is also recommended by researcher.

2.5 The Classroom Experience

This section reviewed literature pertaining to teaching and learning in the classroom and the Kenyan school in general. Examinations, learning materials and inspection of schools are presented.

One of the practices was the use of examinations for rigorous selection of students from one cycle to another. The issue of examinations has remained unresolved and teaching for most primary schools was actually examination oriented. Examinations were still used for selection; no better method had been found (Ondiek, 2000).

Whereas examination oriented teaching happened in primary schools, projects were included in some secondary school subjects. This was done to reduce examination-orientation of classroom instruction (Ministry of Education, Science and Technology, 2002). Implementation of curriculum was assessed during inspection of schools. Ondiek stated that "According to Section 18 of the Education Act, QASOs had authority to audit the accounts of a school, inspect all the facilities, assess enrolment, staffing and school programme". Inspection of schools in Kenya used to take place occasionally and aspects of curriculum implementation which were being assessed were availability and quality of physical facilities and follow-up of teachers' achievement from in-service. QASO were informing on necessary improvements in curriculum implementation (MOEST, 2005). Some of the objectives of the revised curriculum were to reduce the workload on teachers and students, coordinate and integrate some topics and incorporate emerging issues such as HIV/AIDS awareness. Health promoting practices were recommended (Ministry of Education, Science and Technology, 2002).

Inspection of facilities, school programmes and learning materials were done to establish their availability and quality. Advice that was given to school managers by QASO served

the purposes of curriculum improvement. However, mechanism for the independent evaluation of curriculum support materials has been developed. Improvement in the quality of books and the book production process have been witnessed and schools easily access books(Kenya Institute of Education, 2006). At present, most subjects have maximum six titles approved. Each school is required to select only one title per subject per class from the list of the approved titles (Ministry of Education, 2008). The list is however updated on an annual basis to include other titles found suitable.

Ondiek (2000) noted that try out of 8-4-4 curriculum is an important prerequisite of curriculum implementation. It is during this stage that errors in the curriculum plan, learning materials and equipment are detected and corrected. Ministry of Education (2006) stated that publishers submit curriculum support materials to KIE for evaluation and approval for use in schools. Secondary education curriculum was rationalized and revised in the year 2002. Ministry of Education(2008) stated that secondary level objectives were restated to make them clearer and aligned to the revised goals of education.. Content that were unnecessary or too advanced were removed (MOEST, 2002). Related content from different subject areas were arranged to be done at the same time for unity of knowledge.

Management of curriculum require communication skills, delegation and problem solving techniques from the head teacher who should also be conversant with the biannual KNEC regulations and syllabi, information in the career booklet, university entrance requirements and other further training/job requirements and guidance and counseling (MOEST, 2002). Such information enable head teachers to give students focus for meeting their aspirations.

The researcher feels that career guidance for students also contribute in motivating them to pursue the chemistry course with more enthusiasm and vigour. It makes them aware of what the course leads to and hence gives them aspirations which make them more prepared to participate in the stated learning activities.

2.6: Summary

The literature review was done citing studies that were related to the research that was being carried out. Brief descriptions of the related studies were given stating their findings and some theories that applied to them. The aim of carrying out literature review was to suggest ways in which the unresolved issues could be sorted out. Some classroom experiences that were related to the research were mentioned.

CHAPTER THREE

3.0 Research Methodology

3.1 Introduction

This chapter highlights the methodology of the study. Descriptions of the area of study, target population and the respondents, sample and sampling procedures, research design, data collection instruments and data analysis for the study are given.

3.2 Area of study

This study was undertaken in Rachuonyo District. There were 83 secondary schools and 130 chemistry teachers in the district at the time the study was being undertaken. This district was studied because hardly any research on constraints facing implementation of secondary school chemistry curriculum had been done. The researcher was familiar with the district and could move to various schools administering and then collecting the research instruments. The district provides ample number of schools which the researcher used in the study. There was noticeable drop in performance in National Examinations by students. The mean points for the years 2004, 2005, and 2006 were 4.5847, 4.8628, and 3.9849 respectively (QASO, 2007).(Refer to P.4). Rachuonyo District borders Nyando District in the Northeast and Central Kisii District in the Southeast while Homabay District is in the Southwest. It covers an area of 900km^2 and is situated in Nyanza Province, Kenya.(Refer to Appendix iv (b); Map of Rachuonyo District (p103).

3.3 Research Design

The research design that was used in the study was descriptive survey. Descriptive survey design is a method of collecting information by interviewing or by administering a questionnaire to a sample of individuals (Orodho, 2003). The purpose of using this design was to describe the state of affairs and report the findings. Descriptive studies are not restricted to fact finding but may result in giving information of important principles of knowledge and solutions to significant problems (Mugenda and Mugenda ,1999).

In this study, information about the following were collected; in-service of teachers, students' learning experiences, availability of learning materials and equipment and chemistry curriculum evaluation. A adequacy of in -service and evaluation of curriculum were rated by chemistry teachers while both students and teachers rated learning experiences and availability of materials and equipment.

3.4 The Target Population

Population is a complete set of individuals, cases or objects with some common observable characteristics (Mugenda and Mugenda, 1999). A target population is that population to which a researcher wants to generalize the results of study (Mugenda and Mugenda, 1999). The target population consisted of Form four secondary school students of Rachuonyo District and their chemistry teachers. There were 3000 students in Form four and 130 chemistry teachers in the year 2008. The form four students were targeted because they had been exposed to the new curriculum for a longer period than the rest of the students. Teachers of form four were targeted because they play a key role in curriculum implementation. Various curriculum writers have underscored the role of teachers in this

crucial stage of curriculum since they have a leading and significant role to play in the teaching/ learning process (Omulando and Shiundu, 1992). Hence teachers were in a position to give relevant information in the study.

3.5 Sample and Sampling Procedure

A sample is a finite part of a statistical population whose properties are studied to gain information about the whole (Webster, 1985). Sampling is the procedure a researcher uses to gather people, places or things to study. It is a process of selecting a number of individuals or objects from a population such that the selected group contains elements representative of the characteristics found in the entire group (Orodho and Kombo, 2002). In this section, the population of students and teachers were described. The techniques of determining the sample size were stated. From 83 secondary schools in Rachuonyo District, stratified random sampling was used to select schools from the categories Boys' schools, Girls' schools and Co educational schools for study. This ensured that each individual school had an equal and independent chance of being included in the sample. Kothari (2004) stated that large samples can be made use of and thus the results can be made more dependable and reliable. 30% of the schools were selected for study and this provided 25 schools. Out of 8 Girls schools', 5 Boys' schools and 70 Co educational schools that were in the district, proportionate sampling of 30% gave 3 Girls' schools, 2 Boys' schools and 20 Co- educational schools for study. This sampling technique was chosen to achieve the desired representation from the various sub-groups of the population. From the population of 3000 form four students who were enrolled in Rachuonyo District

schools, a sample of 170 respondents was obtained. The sample size denoted n was worked out from population of size N using the relation

$$n = \frac{Z^2.p.q.N}{e^2 (N-1) + z^2.p.q}$$

Where n= Sample size
Z= Standard variate
p= Proportion of defectives in the universe
q= 1- p
N= Target population
e= acceptable error (Kothari, 2004)

Large samples that resulted in reduced sampling error were taken. Proportionate sampling was done to enable sampling from schools with different populations of students. Each of the sampled schools provided a maximum of 2 chemistry teachers who participated in the research. Purposive sampling was used to select teachers due to expertise and experience that they possess. This kind of sampling selects typical and useful cases only and is used to collect focused information (Oso & Onen, 2005).

Table 3.1 Summary of Samples

School Type	**Number of Schools**	**Sample Schools**	**Teachers Sample**	**Students enrolled in form 4**	**Students Sample**
Girls' Schools	8	3	6	282	16
Boys' Schools	5	2	4	388	22
Co educational Schools	70	20	30	2330	132
Total	**83**	**25**	**40**	**3000**	**170**

3.5.1 Respondents of the Study

Gender composition of students and teachers who participated in the research and approximate composition of males and females in the schools have been given.

The composition of teachers who participated in the research was shown in table 3.2

Table 3.2: Teachers who participated in the Research

Gender	Registered teachers	Teachers sample	Percent (%)
Male	110	34	85.0
Female	20	6	15.0
Total	130	40	100.0

From Table 3.2 , thirty four male teachers (34) (85.0%) and six female teachers (6) (15.0%) participated in the research.

The composition of students who participated in the research was as shown in table 3.3.

Table 3.3: Students who participated in the Research

Gender	Students enrolled in form 4	Students sample	Percent (%)
Male	1670	95	55.9
Female	1330	75	44.1
Total	3000	170	100.0

From Table 3.3, ninety five (95) male students who constituted 55.9% participated in the research while seventy five (75) female students who constituted 44.1% participated in the research.

3.6 Instruments of Data Collection

The instruments that were used to collect data in the study were questionnaires and interview schedules (Refer to appendix i, ii and iii) (p91-97). Likert scale was mainly used in questionnaires to rate answers that were given by respondents. The scale ranged from very negative to very positive on 5-points.(Cozby,1981).

In the interview schedule, open-ended format of items were also used. This provided the respondents with opportunity for self-expression. Here the respondents gave qualitative data by evaluating the teaching/learning process giving explanations.

3.7 Pilot Study

The pilot study was carried out in three schools outside the area of study deemed to have similar characteristics. The schools were selected randomly to ensure that internal validity of the research instruments was improved and skewed results avoided. The aim of pilot study was to analyze data that would be obtained to see if the methods of analysis were appropriate for the study ahead. The responses to the open ended items were analyzed and used to check ambiguity in them and hence improve their reliability. This was worthwhile because results of the pilot study would provide suggestions on how suitable the proposed methods of analysis would be. Piloting helped in enhancing reliability of the research instruments. Piloting was meant to standardize the procedures of the research.

3.8 Reliability of the Research Instruments

Reliability is a measure of the degree to which research instruments yield consistent results after repeated trials. Person correlation coefficient γ obtained in test-retest procedure give reliability index. High value of γ gives acceptable level of reliability (Cozby, 1981).

In this study, reliability of the questionnaires and interview schedules were assessed using correlation. Pearson product moment correlation γ was used. The correlation shows how strongly two variables are related to one another.

Two sets of scores from a given participant were used to calculate the coefficient of correlation. This applied to all participants who were involved in the test-retest procedure. That was done in two weeks interval. For teachers, the coefficient of correlation γ was 0.7 while for students the coefficient of correlation γ was 0.8 . The high values of γ gave acceptable level of reliability since they were greater than 0.5. the instruments were thus declared reliable.

3.9 Validity of the Research Instruments

Validity is a measure of the relevance and correctness of data collection technique (Oso and Onen, 2005). Validity is the accuracy and meaningfulness of inferences which are based on research results (Mugenda and Mugenda, 1999). Attempts made to enhance validity of this research were controlling extraneous variables, carrying out random sampling, taking large samples and writing precise questions for respondents to answer: hence ensured construct validity. Lecturers of Moi University who are experts in research work, were consulted to guide on ways of achieving validity of the research instruments. High degree of construct validity was desired to minimize systematic error, which could make scores to deviate from the correct ones in one direction for all subjects. Extraneous variables are controlled by minimizing all forms of interference when respondents are giving information (Mugenda and Mugenda, 1999). The researcher ensured that attention of respondents to the questions was not distracted.

Movement into their rooms by other people was avoided while they were concentrating on questionnaires and interview. The rooms were made free from noise and conducive. Random sampling, which was applied in the study, was meant to improve internal validity by avoiding skewed scores. Large samples were taken and intended for maintaining high external validity and hence to generalize results to target population. This test could be used to make useful predictions.

3.9.1 Ethical Considerations

This section dealt with ethics that governed the study. Permission was sought from the Ministry of Education, Science and Technology where a research permit was obtained to enable the undertaking of the study in Rachuonyo District. A letter of introduction was delivered to the head of each institution where research was conducted. Professional standards of conducting the study were maintained.

3.9.1.1 Data collection Procedures

The researcher obtained research permit from the Ministry of Science and Technology to conduct research in the selected schools. Letters were sent to the D.E.O and heads of selected schools requesting them to permit the research in schools. Instruments of data collection were administered by researcher. Interview was used to get in-depth information from the respondents and some of the respondents were requested to fill questionnaires. The researcher collected completed questionnaires.

Problems encountered in the field were delays while teachers and students had to finish their lessons in order to give data during breaks. Whenever heads and deputies of the

schools were absent, researcher had to reschedule visit to the schools, resulting in extra costs.

3.9.2 Data Analysis

Data analysis of this study was done to make conclusions based on the findings of the study. Once data was collected, they were converted to numerical codes, and fed into computer for analysis. Both descriptive and inferential statistics were used in the analysis. Statistical package for social science (SPSS) computer programme is used to work out mean scores and percentages (Cronk, 1997). Correlation coefficients between criterion variables and predictor variables were worked out to establish the relationship between the two sets of variables. Regression equation was used to make predictions on the basis of predictor variable. Inferential statistics enabled the researcher to generalize results from sample to target population.

3.9.3 Summary

Methodology of this study included procedures and description of what was studied. A number of areas have been described in this chapter. The area of study has been stated indicating the coverage. The reasons for selecting the study area have been given.

The target population, which consisted of secondary school students and their chemistry teachers, has been defined. The research design has been stated and the purpose of selecting the design explained. Also described were instruments of data collection, pilot study, reliability and validity of the research instruments, ethical considerations and data analysis of the study.

CHAPTER FOUR

4.0: Data Presentation, Analysis and Discussion

4.1: Introduction

In this chapter, data presentation, analysis, interpretation and discussion have been done. The prime purpose of this study was to assess the constraints facing implementation of secondary school chemistry curriculum in Rachuonyo District. The chapter contains descriptive and inferential analyses of the findings of the study. The investigations were undertaken with respect to the objectives and hypothesis of the study.

The hypothesis Ho_1, stated that there is no relationship between in-service, learning activities, materials and equipment and teachers' implementation (Students' assessment).

The hypothesis Ho_2 stated that there is no relationship between in-service, learning activities, materials and equipment and KIE implementation (KIE evaluation).

In the survey, a number of areas were studied. These were, adequacy of in-service for chemistry teachers, frequency of learning activities in chemistry, availability of materials and equipment and evaluation of the chemistry curriculum. The objectives and hypothesis of the study have been addressed by focusing on the areas in -service, learning activities, materials and equipment and evaluation.

4.1.1 In-Service Attendance

In-service training for teachers is vital in equipping them with new skills which can help them to meet the demands of revised curriculum. The research established the proportion of chemistry teachers who attended in-service from the year 2003.This gave an estimate of the extent to which chemistry teachers gained in new skills. The findings from interview were as shown in table 4.1.3.

Table 4.1.3: In-service Attendance

Attendance	**Frequency**	**Percent (%)**
Yes	7	28.0
No	18	72.0
Total	**25**	**100.0**

From Table 4.1.3, seven teachers (7) (28.0%) said yes indicating that they attended in-service.

Eighteen teachers (18) (72.0%) said no indicating that they did not attend in-service.

Majority of teachers did not attend in-service. The implication of this was that implementation of chemistry curriculum would not be adequately done since in-service is an important pre-requisite for the process. The years 2001 and 2002 had KCSE mean scores of 30.27 and 34.27 respectively in chemistry (The Kenya National Examinations Council, 2004). In-service provision for chemistry teachers was started in the year 2003 in which the mean was 37.42(p91). The improvement could be attributed to in-service.

The researcher feels that in-service provision should be continued to cater for the insufficient attendance.

4.2.1 Adequacy of In-service provision

Teachers' rating of in-service provision by KIE was reported and presented as shown in table 4.2.1.

Table 4.2.1: Rating of Adequacy of In-service Provision

Adequacy	**In-service adequacy**	
	Frequency	Percent
Very Inadequate	2	29.0%
Inadequate	3	42.0%
Adequate	2	29.0%
Very Adequate	0	0.0%
Total	**7**	**100.0%**

From table 4.2.1, 5(71.0%) teachers indicated that in-service provision was inadequate. Two teachers (2) (29.0%) indicated that in-service provision was adequate. Majority of teachers indicated that in-service provision was inadequate.

4.2.2 Learning Activities

Properly planned learning activities contribute greatly to knowledge acquisition by students. In this study, the frequencies of learning activities for chemistry were established. The findings from teachers' responses were reported as shown in Table 4.2.2.

Table 4.2.2: Frequency of Learning Activities as Rated by Teachers

	V.R	R	U	F	V.F	TOTAL
Chemistry Projects	5(20.0%)	12(48.0%)	5(20.0%)	2(8.0%)	1(4.0%)	25
Chemistry assignments	2(8.0%)	6 (24.0%)	0(0.0%)	14(56.0%)	3(12.0%)	25
Field trips	14(56.0%)	8 (32.0%)	2(8.0%)	0(0.0%)	1(4.0%)	25
Club activities	0(0.0%)	4(16.0%)	4(16.0%)	10(40.0%)	7(28.0%)	25
Class discussions	0(0.0%)	0(0.0%)	0(0.0%)	15(60.0%)	10(40.0%)	25
Teacher demonstrations	0(0.0%)	3(12.0%)	2(8.0%)	15(60.0%)	5(20.0%)	25
Group experiments	3(12.0%)	16(64.0%)	1(4.0%)	4(16.0%)	1(4.0%)	25

KEY
V.R:-Very Rare
R : - Rare
U : - Undecided
F : - Frequent
V.F :- Very Frequent

From Table 4.2.2, seventeen teachers (17) (68.0%) indicated that chemistry projects were rare. Five teachers (5) (20.0%) were undecided while three teachers (3) (12.0%) indicated that chemistry projects were frequent. Most teachers indicated that the projects were rare.

This implies that independent learning of the students through discovery could have been rare. Since learning by making discoveries is one of the recommended and fruitful ways of getting knowledge, the low frequency of projects was one of the hindrances to possible rapid learning.

Eight teachers (8) (32.0%) indicated that assignments were rare. Seventeen teachers (17) (68.0%) indicated that assignments were frequent. Majority of teachers indicated that assignments were frequent. Assignments serve the purpose of revision and evaluation. Since assignments were frequent, this aspect of curriculum implementation was well carried out.

Fourteen teachers (14) (56.0%) indicated that field trips were very rare. Eight teachers (8) (32.0%) indicated that field trips were rare. Two teachers (2) (8.0%) were undecided while one teacher (1) (4.0%) indicated that field trips were very frequent. A vast majority of teachers indicated that field trips were rare. This implies that students could have been missing the opportunity to learn using concrete objects and scenes; consequently, learning could be less exciting with less gain.

Four teachers (4) (16.0%) indicated that club activities were rare. Four teachers (4) (16.0%) were undecided while seventeen teachers (17) (68.0%) indicated that club activities were frequent. Majority of teachers indicated that club activities were frequent.

The frequent occurrence of chemistry club activities encourages collaborative learning, teaming and enhanced communication skills (Okinda, 2008). Fifteen teachers (15) (60.0%) indicated that class discussions were frequent while ten teachers (10) (40.0%) indicated that class discussions were very frequent. From the findings of this study it was noted that class discussions was a learning activity in which students participated mostly. Manzo, Manzo and Estes (2001) argue that, 'it is clear, leading a common class discussion a worthy goal but an uncommonly difficult one to achieve'.

Further, they add that, ‘ when you anticipate that students will not need a great deal of review after reading, use teacher directed recitation. Take these opportunities to practice pacing, questioning techniques and tactful handling of incorrect responses’. The Kenya National Examinations Council (2007) supports this view noting that a weakness of candidates was lack of exposure to experimental work yet students understand concepts in chemistry better when they are involved in carrying out experiments and results of the experiments discussed thoroughly between the students and the teacher. This is important because this kind of learning activity contribute greatly to knowledge acquisition.

Three teachers (3) (12.0%) indicated that teacher demonstrations were rare. Two teachers (2) (8.0%) were undecided. Fifteen teachers (15) (60.0%) indicated that they were frequent and five teachers (5) (20.0%) indicated that teacher demonstrations were very frequent. Majority of teachers indicated that teacher demonstrations were frequent. This implied that there could have been low students’ participation in practical lessons.

Three teachers (3) (12.0%) indicated that group experiments were very rare. Sixteen teachers (16) (64.0%) indicated that group experiments were rare. One teacher (1) (4.0%) was undecided while four teachers (4) (16.0%) indicated that group experiments were frequent. One teacher (1) (4.0%) indicated that group experiments were very frequent. Majority of teachers indicated that group experiments were rare. Group experiments give students the opportunity to develop ability and confidence to perform operations, manipulations, mental calculations and estimation which enable them to interpret scientific relationships in everyday life and to prepare them for further education and training (Waititu, 2008).

Rare occurrence of group experiments implied that students could end up without enough of the vital skills.

4.2.3 Students Rating of Learning Activities

Students' rating of learning activities for chemistry were established and presented in Table 4.2.3.

Table 4.2.3: Students' Rating of Learning Activities

	V.R	**R**	**U**	**F**	**V.F**	**TOTAL**
Chemistry Projects	35(20.6%)	55(32.4%)	12(7.1%)	59(34.7%)	9(5.3%)	170
Teacher demonstrations	47(27.6%)	14(8.2%)	2(1.2%)	31(18.2%)	76(44.7%)	170
Group experiments	39(22.9%)	86(50.6%)	12(7.1%)	27(15.9%)	6(3.5%)	170

KEY
V.R :-Very Rare
R : - Rare
U : - Undecided
F : - Frequent
V.F :- Very Frequent

From Table 4.2.3, thirty five students (35) (20.6%) indicated that chemistry projects were very rare. Fifty five students (55) (32.4%) indicated that the projects were rare. Twelve students (12) (7.1%) were undecided while fifty nine students (59) (34.7%) indicated that chemistry projects were frequent. Nine students (9) (5.3%) indicated that chemistry projects were very frequent. Majority of students indicated that chemistry projects were rare. This agrees with teachers' rating for majority of teachers stated that projects were rare. This implied that there was little room for learning by discovery among students.

Chemistry projects are learning activities which contribute greatly to development of technical skills required for industrialization.

It is hoped that Kenya will achieve high level of industrial and technological development by the year 2030 (Republic of Kenya , 2007). Innovation, research and science which form one of the key pillars of education and training (MOEST, 2005) will enable Kenya attain Vision -2030. The low frequency of chemistry projects undermine the hope of attaining industrialization.

Forty seven students (47) (27.6%) indicated that teacher demonstrations were very rare. Fourteen students (14) (8.2 %) indicated that teacher demonstrations were rare. Two students (2) (1.2%) were undecided while thirty one students (31) (18.2 %) indicated that they were frequent. Seventy six students (76) (44.7%) indicated that teacher demonstrations were very frequent. Majority of students indicated that Teacher demonstrations were frequent.

Whereas Teacher demonstrations are necessary for safe and accurate performance of experiments, their high frequency could imply that there was shortage of materials and equipment for group experiments. Such a state could deny the learners the chance to acquire more creativity and psychomotor skills.

Thirty nine students (39) (22.9%) indicated that group experiments were very rare. Eighty six students (86) (50.6%) indicated that they were rare. Twelve students (12) (7.1%) were undecided while twenty seven students (27) (15.9%) indicated that they were frequent.
Six students (6) (3.5%) indicated that group experiments were very frequent. Majority of students indicated that group experiments were rare.

Group experiments promote motivation, enthusiasm and active learning. The low frequency of group experiments implied that the learners could have had little gains in knowledge and practical skills.

MOE (2008) stated, ‘ At present most subjects have maximum six titles approved but each school is required to select only one title per subject per class from the list of the approved titles and the list updated annually’. It is considerable whether only one title is adequate noting that Ogula (1990) said no needs assessment surveys among students and the general public were carried out before the development of new materials. ‘Views of teachers who participated in the development of curriculum and its materials were not representative of the views of other teachers’, he added. On the other hand, Hofstein (2005) clarified that information regarding the teachers’ classroom environment was obtained by probing into chemistry students’ perceptions.

4.3.1 Availability of Materials and Equipment

Learning materials and equipment are crucial in inquiry based instruction for learners to make reasonable gains. The study established the availability of materials and equipment for implementation of the chemistry curriculum.

The findings were as shown in Table 4.3.1.

Table 4.3.1: Teachers` rating of Materials and Equipment Availability

	V.U	U.A	U	A	V.A	TOTAL
Chemistry Textbooks	9(36.0%)	8(32.0%)	3(12.0%)	3(12.0%)	2(8.0%)	25
Teachers' guides	7(28.0%)	5(20.0%)	3(12.0%)	6(24.0%)	4(16.0%)	25
Laboratory manuals	12(48.0%)	6(24.0%)	5(20.0%)	1(4.0%)	1(4.0%)	25
Charts	7(28.0%)	9(36.0%)	2(8.0%)	6(24.0%)	1(4.0%)	25
Models	13(52.0%)	5(20.0%)	0(0.0%)	6(24.0%)	1(4.0%)	25
Mass media programmes	23(92.0%)	0(0.0%)	2(8.0%)	0(0.0%)	0(0.0%)	25
Journals	16(64.0%)	8(32.0%)	0(0.0%)	1(4.0%)	0(0.0%)	25
Fume cupboards	15(60.0%)	8(32.0%)	0(0.0%)	2(8.0%)	0(0.0%)	25
Fire Extinguishers	4(16.0%)	10(40.0%)	0(0.0%)	8(32.0%)	3(12.0%)	25
Gas supply	2(8.0%)	11(44.0%)	2(8.0%)	5(20.0%)	5(20.0%)	25
Electricity supply	12(48.0%)	1(4.0%)	2(8.0%)	3(12.0%)	7(28.0%)	25
Tap water supply	12(48.0%)	5(20.0%)	0(0.0%)	7(28.0%)	1(4.0%)	25

KEY: V.U. :- Very Unavailable; **U.A. :-** Unavailable; **U:-** Undecided; **A :-** Available; **V.A. :-** Very Available

Two teachers (2) (8.0%) indicated that chemistry text books were very available. Three teachers (3) (12.0%) indicated that they were available. Three teachers (3) (12.0%) were undecided while 8 (32.0%) indicated that chemistry textbooks were unavailable. Nine teachers (9) (36.0%) indicated that chemistry text books were very unavailable.

Ten teachers (10) (40.0%) indicated that teachers' guides were available. Three teachers (3) (12.0%) were undecided while twelve teachers (12) (48.0%) indicated that teachers guides were unavailable. Majority of teachers indicated that chemistry text books and teachers guides were unavailable. The findings reveal that there was shortage of text books for both teachers and students. Since the materials are crucial for studies, desired level of learning may not have been attained in the schools.

One of the major roles of KIE and commercial publishers is to develop relevant curriculum support materials which include text books. However, there were still subject areas where curriculum existed but the materials were yet to be developed(KIE, 2006). The low availability of chemistry text books according to findings of this study imply that there was a problem.

Twelve teachers (12) (48.0%) indicated that laboratory manuals were very unavailable. Two teachers (2) (8.0%)indicated that they were available. Majority of teachers indicated that laboratory manuals were unavailable. Laboratory manuals offer cost effective innovations and solutions to problems in practical (Durbach, Bell and Liwanga,1997). They allow every student the opportunity deserved-hands on practical work and improved safety.

Seven teachers (7) (28.0%) indicated that charts were very unavailable. Nine teachers (9) (36.0%) indicated that they were unavailable. Two teachers (2) (8.0%) were undecided while seven teachers (7) (28.0%) indicated that charts were available. Majority of teachers indicated that charts were unavailable.

Since charts summarize concepts and make lessons interesting, learners may have got difficulty in understanding concepts with subsequent little knowledge acquisition.

Thirteen teachers (13) (52.0%) indicated that models were very unavailable. Five teachers (5) (20.0%) indicated that they were unavailable. Seven teachers (7)(28.0%) indicated that models were available. Majority of teachers indicated that models were unavailable. This could contribute to little knowledge acquisition by students.

Twenty three teachers (23)(92.0%) indicated that mass media programmes were unavailable. Two teachers (2) (8.0%) were undecided.

The indication that mass media programmes were unavailable by a vast majority of teachers implies that lessons which enhance listening skills among learners were poorly provided. Twenty four teachers (24) (96.0%) indicated that journals were unavailable while one teacher (1) (4.0%) indicated that they were available. This implies that newly emerging knowledge may not be acquired by learners' sufficiently. O' Hearn and George (2008) observed that a new curriculum required the materials, teachers' guides, students' textbooks, programmed instructional materials and supplementary readings for its successful implementation.

Two teachers (2) (8.0%) indicated that fume cupboards were available. Eight teachers (8) (32.0%) indicated that they were unavailable while fifteen teachers (15) (60.0%) indicated that they were very unavailable.

Majority of teachers indicated that fume cupboards were unavailable. Fourteen teachers (14) (56.0%). indicated that fire extinguishers were unavailable. Eleven teachers (11) (44.0%) indicated that fire extinguishers were available. Majority of teachers indicated that fire extinguishers were unavailable. Since fume cupboards and fire extinguishers are installed for safety in the laboratories, the findings suggest that certain uses of the school laboratories could be unsafe. This could discourage teachers from conducting certain experiments and hence inefficient use of the laboratories result.

Thirteen teachers (13) (52.0%) indicated that laboratory gas was unavailable.

Two teachers (2) (8.0%) were undecided while ten teachers (10) (40.0%) indicated that laboratory gas was available. Majority of teachers indicated that laboratory gas was unavailable. This could hinder teachers from conducting experiments which require the use of gas.

Thirteen teachers (13) (52.0%) indicated that electricity supply to the laboratories was unavailable. Two teachers (2) (8.0%) were undecided while ten teachers (10) (40.0%) indicated that electricity was available. Majority of teachers indicated that electricity was unavailable. Availability of electricity supply leads to adequate preparation for some practical lessons and adequate teaching. Therefore the related lessons such as ones involving distillation and the use of high precision electronic weighing balance could have been inadequately conducted.

QASO (2011) emphasized that the envisaged vision 2030 can only be a pipedream if we do not provide electricity in our schools and embrace technology through electrification.

Seventeen teachers (17) (68.0%) indicated that tap water was unavailable. Eight teachers (8) (32.0%) indicated that tap water was available. According to majority of teachers, tap water was unavailable. This has the serious implication that experiments in which water is required would not be carried out adequately.

4.3.2 Students' Rating of Availability of Materials and Equipment

The study established students' rating of availability of materials and equipment. The findings were as shown in Table 4.3.2.

Table 4.3.2: Students' Rating of Availability of Materials and Equipment

	V.U	U.A	U	A	V.A	TOTAL
Chemistry Textbooks	42(24.7%)	77(45.3%)	19(11.2%)	27(15.9%)	5(2.9%)	170
Laboratory manuals	83(48.8%)	52(30.6%)	8 (4.7%)	20(11.8%)	7 (4.1%)	170
Charts	48(28.2%)	59(34.7%)	19(11.2%)	38(22.4%)	6(3.5%)	170
Models	39(22.9%)	60(35.3%)	8(4.7%)	20(11.8%)	43(25.3%)	170
Distillation apparatus	47(27.6%)	65(38.2%)	2(1.2%)	44(25.9%)	12(7.1%)	170
Kipp's apparatus	33(19.4%)	49(28.8%)	32(18.8%)	42(24.7%)	14(8.2%)	170
Hoffmann Voltammeters	32(18.8%)	78(45.9%)	14(8.2%)	34(20.0%)	12(7.1%)	170

KEY
V.U: Very Unavailable
U.A: Unavailable
U : Undecided
A : Available
V.A: Very available

One hundred and nineteen students (119) (70.0%) indicated that chemistry text books were unavailable. Nineteen students (19) (11.2%) were undecided while twenty seven students (27) (15.9%) indicated that chemistry text books were available. Five students (5) (2.9%) indicated that chemistry text books were very available. A large majority of students indicated that chemistry text books were unavailable. Text books are vital learning materials which are organized into statements and illustrations which clarify and reinforce information gathered from lessons. Revision and self evaluation by learners are enabled by availability of text books. The unavailability of chemistry textbooks imply that learning progress of students could have been retarded.

Eighty three students (83) (48.8%) indicated that laboratory manuals were very unavailable. Eight students (8) (4.7%) were undecided, twenty seven students (27) (15.9%), indicated that laboratory manuals were available. Majority of students indicated that, laboratory manuals were unavailable. One hundred and seven (107) (62.9%) indicated that charts for chemistry were unavailable. Nineteen students (19) (11.2%) were undecided while thirty eight students (38) (22.4%) indicated that they were available. Six students (6) (3.5%) indicated that charts for chemistry were very available. Majority of students indicated that charts for chemistry were unavailable. Charts make the ideas that are being imparted to learners clearer and in addition make the lessons captivating. Their unavailability implies that lesser gains were being got from the lessons.

Ninety nine students (99) (58.2%) indicated that models were unavailable. Eight students (8) (4.7%) were undecided while (20) (11.8%) indicated that they were available. Forty three students (43) (25.3%) indicated that models were very available. Majority of students indicated that models were unavailable.

Shortage of models denies students the opportunity to learn concepts using more concrete materials and hence they get difficulty in the learning. Hence the students could have learnt less of the concepts.

One hundred and twelve (112) (65.8%) indicated that distillation apparatus were unavailable. Two students (2) (1.2%) were undecided. Forty four students (44) (25.9%) indicated that distillation apparatus were available.

Twelve students (12) (7.1%) indicated that distillation apparatus were very available. Majority of students indicated that distillation apparatus were unavailable. This implied that the students could have learnt the process of distillation theoretically and hence failed to link it with real life experience.

KNEC (2007) stated that scientific skills taught in properly constructed and equipped laboratories are demanded worldwide. MOEST (2002) observed that apparatus are affordable by most schools yet KNEC (2004) noted that some candidates see apparatus for the first time at the time of examinations. Availability of apparatus in Rachuonyo District schools was low and this indicated a serious problem.

Eighty two students (82) (48.2%) indicated that Kipp's apparatus were unavailable. Thirty two students (32) (18.8%) were undecided. Forty two students (42) (24.7%) indicated that Kipps apparatus were available while fourteen students (14) (8.2%) indicated that they were very available.

Majority of students indicated that Kipp's apparatus were unavailable. This implied that there was shortage of some crucial apparatus for experiments in schools. Thirty two students (32) (18.8%) indicated that Hoffmann Voltammeters were very unavailable. Seventy eight students (78) (45.9%) indicated that they were unavailable. Fourteen students (14) (8.2%) were undecided. Thirty four students (34) (20.0%) indicated that they were available while twelve students (12) (7.1%) indicated that Hoffmann Voltammeters were very available. Majority of students indicated that Hoffmann Voltammeters were unavailable. This implied that students would not adequately acquire the skills that are taught using this kind of apparatus.

Strictly, the specified apparatus for teaching and examinations should be provided. Other apparatus which are not specified may give undesirable results. QASO (2011) urged schools to purchase the right apparatus for teaching and examinations in order to obtain the right results. The low availability of apparatus was an indication of a problem.

4.3.3: Evaluation of Curriculum Implementation

In order to establish whether the existing curriculum is meeting its intended objectives sufficiently, evaluation is done. Hence the study investigated students' assessment, inspection of learning materials, formative evaluation of students and evaluation of curriculum by KIE. The findings were as shown in Table 4.3.3.

Table 4.3.3 : Curriculum Evaluation

	V.R	**R**	**U**	**F**	**V.F**	**TOTAL**
Students' assessment	0(0.0%)	3(12.0%)	3(12.0%)	17(68.0%)	2(8.0%)	25
Inspection of learning materials	5(20.0%)	10(40.0%)	3(12.0%)	7(28.0%)	0(0.0%)	25
Formative evaluation	3(12.0%)	5(20.0%)	2(8.0%)	6(24.0%)	9(36.0%)	25
Evaluation of curriculum by KIE	7(28.0%)	10(40.0%)	0(0.0%)	6(24.0%)	2(8.0%)	25

KEY
V.R: Very Rare
R : Rare
U : Undecided
F : Frequent
V.F: Very Frequent

From table 4.3.3 three teachers (3) (12%) indicated that students' assessment methods were rare. Three teachers (3) (12%) were undecided while nineteen teachers (19) (76.0%) indicated that students' assessment methods were frequent.

Majority of the teachers indicated that students' assessment methods were frequent. The high frequency of assessment is helpful for teachers because it immediately enables them to realize whether students are learning. (Kempa,1983) noted that objective testing was emphasized in relation to how its diagnostic features could be enhanced: features such as the alternatives yielding more information on students' prior knowledge and conceptual understanding. Hence findings of this study showed that students' assessment was suitably done.

However, QASO (2011) noted , 'The case of an academy in the district was unique. One candidate presented two answer sheets in an exam. The said candidate got grade Y and the school was in turn not graded. This was an indication of examination irregularity. Such irregularity result in wastage.

Considering learning materials, fifteen teachers (15) (60.0%) stated that their inspection by education officials was rare. Three of the teachers were undecided while (7) (28.0%) teachers stated that inspection of learning materials was frequent. Majority of teachers stated that inspection of learning materials was rare. This aspect of evaluation was poorly done. Consequently, the education officials would not know much about availability and efficiency of the materials in schools.

Financial constraints were facing evaluation. It is at this stage of curriculum implementation when its use is justified. QASO (2011) warned that the defaulting schools in MOCK fee payments risk their results being withheld. This was an added problem in the process.

Considering formative evaluation, eight teachers (8) (32%) stated that this evaluation was rare. Two teachers (2) were undecided while fifteen teachers (15) (60.0%) stated that

formative evaluation was frequent. Seventeen teachers (17) (68%) indicated that curriculum evaluation by KIE was rare. Eight teachers (8) (32.0%) indicated that evaluation by KIE was frequent.

Majority of teachers indicated that evaluation by KIE was rare. Since evaluation at this stage of curriculum development is done to determine whether educational purposes are being attained, the findings suggest that the curriculum developer may not have known how well the curriculum was meeting its objectives.

However, formative evaluation was frequent. This indicated the extent to which Educational Objectives were being attained.

The outcomes of chemical inquiry enhance students' conceptual understanding which is gauged in formative evaluation (Kempa,1983). Whereas formative evaluation was frequent, the MOCK examination of a summative evaluation had a problem. QASO (2011) reported that there was an ambiguous question on radioactivity in the chemistry theory paper 233/2 (p3). Such anomaly waters down the quality of evaluation.

4.4.1: In-service Rating

Analysis of in-service attendance and teachers' rating of in-service provision were done to gauge the influence of in-service on curriculum implementation.

Seven teachers (7) (28.0%) out of 25 attended in-service (Refer to Table 4.1.3). The findings indicated that attendance of in-service was poor. This implies that a number of teachers could have gone lacking in some information about the revised curriculum. Teachers who fail to obtain instructional strategies of the revised curriculum that are offered during in service may not implement in the curriculum efficiently.

The induction enables the teachers to implement the curriculum effectively (KIE,2006). The poor attendance of in-service could have led to implementation of lower quality.

4.4.1.1: Adequacy of in -service provision

Analysis of the adequacy of in-service provision for chemistry teachers was done and the results were shown in Table 4.5.1.

Table 4.5.1: Teachers' Rating of Adequacy of In-service Provision

	Adequacy of in-service
Mean	2.3
N	7
Standard deviation	1.2

As noted from Table 4.5.1 , there was a mean of 2.3 for adequacy of in-service provision. The standard deviation was 1.2. The mean for in-service was very low. This is an indication that in-service was poorly provided and therefore the teachers may have ended up less conversant with instructional requirements of the revised curriculum.

4.4.2 Teachers' Rating of Learning Activities

Analysis of Teachers' rating of learning activities was done and the results were shown in Table 4.5.2.

Table 4.5.2: Analysis of Teachers' Rating of Learning Activities

Learning activities	N	Mean	Standard Deviation
Chemistry projects	25	2.3	1.0
Chemistry assignments	25	3.4	1.1
Field trips	25	1.6	0.9
Club activities	25	3.8	1.3
Class discussions	25	4.4	0.5
Teacher demonstrations	25	3.9	0.9
Group experiments	25	2.4	1.3
Overall	25	3.1	1.0

The means for chemistry assignments (3.4), club activities (3.8), class discussions (4.4) and Teacher demonstrations (3.9) were high implying that the learning activities were being carried out fairly frequently. Means for chemistry projects (2.3), field trips (1.6) and group experiments (2.4) were very low implying that they were rarely carried out. The overall mean for learning activities was 3.1 while the standard deviation was 1.0. Frequency of the learning activities was moderate and the low standard deviation imply that there was little variation in the frequencies.

4.4.3 Students' Rating of Learning Activities

Students rating of learning activities was analyzed and presented in Table 4.5.3.

Table 4.5.3 : Students' Rating of Learning Activities

Learning activities	**N**	**Mean**	**Standard Deviation**
Chemistry projects	170	2.7	1.3
Teacher demonstrations	170	3.4	1.7
Group experiments	170	2.3	1.7
Overall	170	2.7	1.4

The means for chemistry projects (2.7) and group experiments (2.3) were low. This implies that the learning activities were poorly carried out.

The mean for Teacher demonstrations (3.4) was higher than the rest implying that it was performed more frequently than the other learning activities.

4.5.1: Teachers' Rating of Availability of materials and equipment

Analysis of teachers' rating of availability of materials and equipment was done and presented in Table 4.6.1.

Table 4.6.1 : Teachers' Rating of Availability of Materials and Equipment

Materials/equipment	N	Mean	Standard deviation
Chemistry text books	25	2.2	1.1
Teachers guides	25	2.8	1.3
Laboratory manuals	25	1.9	1.1
Charts	25	2.4	1.3
Models	25	2.1	1.3
Mass media programmes	25	1.2	0.6
Journals	25	1.4	0.7
Fume cupboards	25	1.6	0.9
Fire extinguishers	25	2.8	1.3
Gas supply	25	3.0	1.4
Electricity supply	25	2.7	1.8
Tap water supply	25	2.2	1.5
Overall	25	2.2	1.2

The means for chemistry textbooks (2.2), Teachers' guides (2.8) laboratory manuals (1.9), charts (2.4), models (2.1), mass media programmes (1.2), journals (1.4), fume cupboards (1.6) fire extinguishers (2.8) electricity supply (2.7) and tap water supply (2.2) were very low. This implies that most materials and equipment were insufficiently provided. The mean for gas supply (3.0) was higher than the rest. Shortage of the important requirements for learning could lead to low achievement of learners.

4.5.2: Students' Rating of Availability of Materials and Equipment

Students' rating of availability of materials and equipment was analyzed. The analysis was as shown in Table 4.6.2

Table 4.6.2 : Students' Rating of Availability of Materials and Equipment

Materials/ Equipment	N	Mean	Standard deviation
Chemistry textbooks	170	2.3	1.1
Laboratory manuals	170	1.9	0.1
Charts	170	2.4	0.4
Models	170	2.8	1.2
Distillation apparatus	170	2.5	0.3
Kipp's apparatus	170	2.7	1.3
Hoffmann Voltammeters	170	2.5	1.2
Overall	170	2.4	0.8

The means for chemistry textbooks (2.3) laboratory manuals (1.9), charts (2.4), Models (2.8), distillation apparatus (2.5), Kipp's apparatus (2.7) and Hoffmann voltammeters (2.5) were low. The overall mean was 2.4 and this implies that the materials and equipment were insufficiently provided. The low standard deviation of 0.8 implied that there was little variation in availability of materials and equipment. Shortage of these requirements could hinder learners from acquiring some of the desired skills such as process skills in scientific inquiry. A teachers' workshop which provided the educators with materials helped them to develop confidence, skills, enthusiasm and motivation to use the materials with students (Diane, 1987). The low mean obtained in this study therefore implied that materials and equipment for chemistry were insufficiently provided and hence teachers and students gained little confidence, skills, enthusiasm and motivation in teaching/ learning process.

4.5.3 Means for Curriculum Evaluation

Analysis of Teachers' rating of curriculum evaluation was done and presented in Table 4.6.3.

Table 4.6.3 Means for Curriculum Evaluation

Activity	**N**	**Mean**	**Standard Deviation**
Students' assessment	25	3.7	0.8
Inspection of learning materials	25	2.5	1.1
Formative evaluation	25	3.5	1.5
KIE Evaluation of chemistry curriculum	25	2.4	1.4
Overall	25	3.0	1.2

The means for inspection of learning materials (2.5) and evaluation of curriculum by KIE (2.4) were low implying that the evaluation activities were not carried out sufficiently. The means for students' assessment (3.7) and formative evaluation (3.5) were high. These forms of evaluation were seemingly well done. The overall mean of 3.0 suggest that curriculum evaluation was fairly well done.

QASO (2010) stated that our examinations were prepared despite the difficulties which arose in the process of scaling the success ladder. Some schools did not adhere to exams regulations such as ensuring that there was proper sitting arrangements and accurate exam timing. In addition, a number of candidates absented themselves, and there were some isolated cases of collusion among the candidates in some examination centres. Finally, the high turn out of inexperienced examiners who were BOG employed teachers did not augur well with the exercise (QASO,2010).

4.5.4 Summary of Data collected from Students and Teachers

The means for activities and materials which were rated by both students and teachers have been entered in Table 4.7.3 to summarize the data.

Table 4.7.3 : Summary of Data collected from students and Teachers

Activity/ materials	Students		Teachers		Overall mean
	Mean	Std deviation	Mean	Std deviation	
Chemistry Projects	2.7	1.3	2.3	1.0	2.5
Teacher demonstrations	3.4	1.7	3.9	0.9	3.7
Group experiments	2.3	1.1	2.4	1.3	2.4
Chemistry textbooks	2.3	1.1	2.2	1.1	2.3
Laboratory manuals	1.9	1.2	1.9	1.1	1.9
Charts	2.4	1.2	2.4	1.3	2.4
Models	2.8	1.5	2.1	1.3	2.5

The summary Table 4.7.3 consists of means and standard deviations for both students' and teachers' data. Teacher demonstrations (3.7) were highly rated by students and teachers implying that this learning activity was carried out frequently. The majority of learning activities were rated low implying that the learning activities were carried out insufficiently. Regarding materials and equipment, there was insufficient provision.

The insufficiency in learning activities and materials provision was one of the impediments to curriculum implementation and the problem requires to be addressed.

4.6.1 Summary of Main areas Studied

Summary of main areas that were studied was given. The means and standard deviations for, in-service provision, availability of materials and equipment, frequency of learning activities and curriculum evaluation were determined and presented in Table 4.8.1.

Table 4.8.1: Means and Standard deviations for Main areas Studied

Area	Mean	Standard deviation
In-service provision	2.3	1.3
Learning activities	2.9	1.0
Availability of materials and equipment	2.3	1.0
Curriculum evaluation	3.0	1.2

As noted from Table 4.8.1, the means for in-service provision (2.3), availability of materials and equipment (2.3) and learning activities (2.9) were low. This implied that serious constraints were facing implementation of chemistry curriculum in the areas of, in-service, materials and equipment and learning activities. However, the mean for curriculum evaluation (3.0) implied that this aspect of curriculum implementation was moderate in efficiency.

4.6.2 Correlations between variables Rated Students and Teachers

Relationships between curriculum evaluation, in-service, learning activities and materials and equipment were examined. Pearson correlations between the variables were calculated and the results were as shown in table 4.8.2.

Table 4.8.2: Pearson correlations between curriculum Evaluation and other factors in curriculum implementation

Variables	Pearson Correlation γ	Significance
Students' assessment / class discussions	0.537	0.000
Students' assessment / Teacher demonstrations	0.671	0.004
Students' assessment / Group experiments	0.526	0.005
Students' assessment / charts	0.577	0.003
Students' assessment /Kipp's apparatus	0.452	0.004
Inspection of schools/ Chemistry text books	0.592	0.003
Inspection of schools/ Tap water supply	0.498	0.038
Formative evaluation/Chemistry assignments	0.515	0.003
Formative evaluation/ chemistry club activities	0.614	0.000
Formative evaluation/ class discussions	0.553	0.002
Formative evaluation/ Teacher demonstrations	0.609	0.000
Formative evaluation/ Group experiments	0.637	0.001
Formative evaluation/ chemistry textbooks	0.498	0.003
Formative evaluation/ charts	0.501	0.005
Formative evaluation/ distillation apparatus	0.505	0.003
Formative evaluation/ Fire extinguishers	0.697	0.002

Correlations between students' assessment and class discussions, students' assessment and Teacher demonstrations, students' assessment and group experiments and students' assessment and charts were strong and significant ($p<0.05$). From the findings, it could be deduced that students' assessment could be predicted from the learning activities and teaching materials.

Efficient implementation of the curriculum require among other things adequate instructional materials and the application of appropriate learning activities. These in turn determine the frequency and adequacy of student assessment methods applied.

Correlation between inspection of schools and chemistry textbooks was strong and significant. It could be deduced that availability of textbooks could predict frequency of inspection. The findings imply that availability of learning materials in schools may influence frequency of inspection in schools and hence improve the level of evaluation of this kind.

Correlations between formative evaluation and chemistry assignments, formative evaluation and chemistry club activities, formative evaluation and class discussions, formative evaluation and teacher demonstrations, formative evaluation and group experiments, formative evaluation and charts and formative evaluation and distillation apparatus were strong and significant ($p<0.05$).

From the findings it could be deduced that frequencies of formative evaluation could be predicted from the frequencies of learning activities and the learning materials. The implication is that provision of sufficient and adequate appropriate learning activities improve the quality of formative evaluation.

Correlations between formative evaluation and fire extinguishers and formative evaluation and chemistry text books were strong and significant ($p<0.05$).

This implied that availability of fire extinguishers and chemistry text books had influence on the frequency of formative evaluation.

4.7.3.0 Examining Relationship between Constraints and Curriculum Implementation

The study sought to establish the relationship between constraints and curriculum implementation. Factors, in-service, learning activities and materials and equipment were examined to establish their relationship to curriculum implementation.

Multiple linear regression was used to establish the relationship between in-service, learning activities, materials and equipment and curriculum implementation.

4.8.3.1 Relationship between constraints and Teachers' Implementation (Students' Assessment)

A multiple linear regression examining the relationship between, in-service, learning activities and materials and equipment and Teachers' implementation (Students' Assessment) was calculated. The result was in Table 4.8.3.

Table 4.8.3 : Relationship between Constraints and Teachers' implementation (Students' Assessment)

Model 1	1		
R	0.819		
R Square	0.671		
Adjusted R square	0.639		
Standard error of the estimate	0.65626		
Model 1	Regression	Residual	Total
Sum of Squares	135.229	66.324	201.553
d.f.	15	154	169
Mean square	9.015	0.431	
F	20.933		
Sig	0.000		

Predictors (independent variables) ; Teachers' guides , In-service, Chemistry projects, Group experiments, Teacher demonstrations, Class discussions, Chemistry textbooks, Models, Fume cupboards, Charts, Electricity supply, Chemistry assignments, Field trips, Gas supply, Tap water supply.

Dependent variable ; Teachers' Implementation (Students' Assessment).

Refer to Appendix iva : Coefficients of Regression (p101).

The multiple linear regression which was calculated to predict Teachers' Implementation (Students' Assessment) based on factors of curriculum implementation was significant [$F(15,154) = 20.933$, $P < 0.05$], and an $R^2 = 0.671$. The independent variables could predict Teachers' Implementation (Students' Assessment) at the level of 67.1%. This means that 67.1% of variance of Teachers' Implementation (Students' Assessment) could be explained by variation in the constraints. Hence there was a strong relationship between constraints and Teachers' Implementation (Students' Assessment).

The regression analysis revealed that Teachers' Implementation (Student Assessment) could be predicted from these factors.

The Null hypothesis H_0 stated that "There is no relationship between constraints and curriculum implementation".

$H0_1$:- There is no relationship between teachers' guides in-service, learning activities and materials and equipment and Teachers' Implementation (Students' Assessment).

Since there was a strong significant relationship between the Constraints and Teachers' Implementation (Students' Assessment), the null hypothesis $H0_1$ was rejected.

This implies that teachers'guides in-service, learning activities and materials and equipment determined Teachers' Implementation (Students' Assessment).

4.8.3.2 : Relationship between Constraints and KIE Implementation (KIE Evaluation) of Curriculum

A multiple linear regression examining the relationship between teacher demonstrations, in-service, learning activities and materials and equipment and KIE Implementation (KIE Evaluation) of curriculum was calculated. The result was in Table 4.9.2.

Table 4.9.2: Relationship between constraints and KIE Implementation (KIE Evaluation) of curriculum

Model 1	1		
R	0.923		
R Square	0.853		
Adjusted R square	0.764		
Standard error of the estimate	0.38431		
Model 1	Regression	Residual	Total
Sum of Squares	12.825	2.215	15.040
Df	9	15	24
Mean square	1.425	0.148	
F	9.648		
Sig	0.000		

Dependent variable: KIE Implementation (KIE Evaluation)

Predictors (Independent variables): Teacher demonstrations, in-service, charts, chemistry assignments, club activities, chemistry projects, laboratory manuals, models, chemistry textbooks.

Refer to Appendix iva: Coefficients of regression (p102).

The multiple linear regression which was calculated to predict KIE implementation of curriculum based on constraints was significant [F (9,15) = 9.648, $p<0.05$] with an R^2 =0.853.

The constraints could predict KIE implementation of curriculum at the level of 85.3%. This means 85.3% of variance of KIE implementation can be explained by variation in the constraints. Hence there was a strong relationship between the constraints and KIE implementation. The regression analysis revealed that KIE implementation could be predicted from the constraints.

The Null hypothesis $H0_2$ was stated that "There is no relationship between teacher demonstrations in-service, learning activities and materials and equipment and KIE Implementation." The Null hypothesis $H0_2$ is rejected. This implies that adequately of teacher demonstrations, in-service, learning activities and learning materials and equipment determined curriculum implementation by KIE.

4.8.3.3: Summary

This chapter covered the analysis, interpretation, presentation and discussions of data with regard to constraints facing implementation of chemistry curriculum, as perceived by respondents. Data analysis revealed that implementation of chemistry curriculum was faced with constraints. To overcome the constraints, the next chapter provides proposals for the improvement of chemistry curriculum implementation.

CHAPTER FIVE

5.0 Summary, Conclusion and Recommendations

5.1 Introduction

In this chapter, conclusion of findings reported in chapter four are done. As a result of this, recommendations regarding constraints facing implementation of secondary school chemistry curriculum have been made.

The researcher sought to investigate the constraints facing implementation of secondary school chemistry curriculum. The need to investigate these constraints arose from the fact that over the years, there has been outcry over the poor performance of students in Rachuonyo District from stakeholders in education.

Education is important in boosting National Development. Given that teachers are the ones charged with the core responsibility of implementing the curriculum, the researcher endeavored to engage them in the study and subsequently suggested ways of minimizing the constraints. Given that the scope of curriculum implementation is very wide, the researcher found it necessary to limit the study to some selected relevant areas.

5.2 Summary

From the selected areas, specific items were generated and presented to the respondents in the study.

The selected learning activities had been listed in secondary chemistry teachers' handbook for the revised curriculum (MOEST, 2006) and were therefore deemed to be authentic. On the basis of responses given by respondents, the findings in chapter four were obtained. Following is the conclusion of the study.

5.3 In-service

Provision of teachers' in-service training is an important stage in curriculum change. This exercise prepares teachers for efficient implementation of the revised curriculum. In this study it was revealed that teachers' attendance of in-service for implementation of the revised curriculum was poor. Seven (7) out twenty five teachers (25) attended the course. Adequacy of in-service had a mean of 2.3.

Ogula (1990) argued that although there was extensive consultation between KIE and teachers during curriculum planning by1990, no needs assessment surveys among students and the general public were carried out before the development of new materials.

Regression analysis revealed that in-service of chemistry teachers partly influenced student assessment methods. In-service provision was inadequate and its influence on student assessment methods compounded the problems of curriculum implementation.

5.4 Learning Activities

The selection and utility of appropriate and relevant learning activities have profound influence on achievement of students in schools. In this study, the learning activities that were selected and studied had a mean of 3.1 from teachers' responses. The highest mean was obtained in club activities at 3.8 followed by

chemistry assignments (3.4).The lowest mean was obtained in field trips in which it was 1.6. KNEC (2003) noted that many candidates did not understand some concepts and the examinations council argued that these were manifestations of poor tuition and non coverage of some topics. Learning activities were not adequately carried out.

Student rating of learning activities had a mean of 2.7. The combined mean of teacher's and students' responses was 2.9 and this was a low mean. Learning activities were inadequately provided. The findings of this study revealed that correlations between some curriculum evaluation methods and a number of learning activities were strong and significant: students' assessment/class discussions $\gamma = 0.537$, significant at 0.000. Formative evaluation /teacher demonstrations $\gamma = 0.609$, significant at 0.000.

Regression analysis revealed that a number of learning activities had influence on some evaluation methods: learning activities/students' assessment , $F = 20.933$, ($p<0.05$). The fact that the mean of the learning activities had influence on some evaluation methods made it clear that curriculum implementation was faced with compounded constraints.

The efficiency of both the learning activities and curriculum evaluation required a lot of improvement for the attainment of better gains from the curriculum. Regression analysis revealed that improvement in a number of learning activities had influence on KIE evaluation and students' assessment : learning activities/ KIE evaluation, $F = 9.648$ ($p<0.05$).

5.5 Availability of Materials and Equipment

Materials and equipment are among the most instrumental requirements in the implementation of any curriculum.

In this study, the mean of availability/ utility of the selected materials and equipment was 2.3. MOEST (2002) stated that required apparatus are affordable by most schools yet KNEC (2004) noted that some candidates were seeing some apparatus for the first time at the time of examinations. Material whose availability had the highest mean was gas supply (3.0), followed by fire extinguishers (2.9) then electricity supply (2.7). The lowest means were for journals (1.4), laboratory manuals (1.9), and fume cupboards (1.6).

All means were low except the ones for gas supply (3.0).

Urgent measures should be taken to improve the situation. This would involve urgent planning for provision of the requirements.

Correlation between some curriculum evaluation methods and a number of materials and equipment were strong and significant: students' assessment /charts, $\gamma = 0.577$, significant at 0.003. Regression analysis revealed that a number of materials and equipment had influence on students' assessment.

The ministry of Education, KIE and parents could lessen the problems by planning for provision of more learning materials, inspection of schools and student assessment. Regression analysis established the influence of charts for chemistry, models, laboratory manuals, and Hoffman voltammeters and textbooks on student assessment. Hence the inadequate assessment of students could partly be attributed to low availability of materials and equipment. There was urgent need for sufficient provision of chemistry text books.

One of the challenges which was facing education provision was that some District Education Officers did not distribute revised syllabuses to schools (KIE,2006).

Materials and equipment should be sufficiently provided for efficient implementation of the chemistry curriculum and subsequent enhancement of students' knowledge in this field.

5.6 Evaluation of curriculum Implementation

Evaluation of curriculum enables all stakeholders in education to know how well the curriculum is serving them. Chemistry curriculum may be appraised through survey that KIE may conduct in schools, reports from QASO and KCSE examination results.

The study revealed that evaluation of curriculum by KIE, students' assessment methods, inspection of learning materials and formative evaluation had means 2.4, 3.7, 2.5 and 3.5 respectively. Curriculum evaluation had an overall mean of 3.0. Correlation between the evaluation methods and some learning activities and some materials and equipment were strong and significant: student assessment/group experiments $\gamma = 0.526$,significant at 0.005

Regression analysis revealed that, in-service, some learning activities and some materials and equipment influenced student assessment methods, and formative evaluation. QASO (2010) noted that some candidates could not answer questions from form four syllabus well in the district MOCK resulting in chemistry mean of 2.2 points (D-) (P.27). There was evidence that evaluation had problems. Evidently, the combined effect of in-service, learning activities and materials and equipment which were inadequately provided had negative impact on curriculum evaluation making it inadequate.

5.7 Conclusion

There has been a great concern over the implementation of curricula in Kenya. The government has recognized the strategic importance of improving the overall education level of Kenyans within the context of poverty reduction and economic growth (MOEST, 2005).

Over the years, the government's commitment to the development of education and training through sustained allocation of resources to the sector has been demonstrated. However, despite the substantial allocation and notable achievements attained, the education sector still faces major challenges some of which relate to quality, relevance, efficiency and cost. In-service provision was inadequate.Its mean was low at 2.3. Since the process enables teachers to implement the curriculum more effectively, the implementation faced some challenges. Learning activities had a mean of 2.9. their influence on evaluation and hence implementation were shown by correlation and regression analyses.

Correlation between formative evaluation and class discussions was strong: $\gamma = 0.553$, significant at 0.002(Refer to p.72). The low frequency of learning activities partly lowered the quality of curriculum implementation. Availability of learning materials and equipment was low at a mean of 2.3. Correlation between formative evaluation and charts was strong and significant. $\gamma = 0.501$, significant at 0.005. Therefore, availability of materials and equipment had influence on evaluation and hence on curriculum implementation. The mean for evaluation was 3.0. The low mean showed that evaluation of the curriculum contributed to making implementation inadequate.

Altogether, the means for the areas that were studied in-service (2.3), learning activities (2.9), materials and equipment (2.3) and curriculum evaluation (3.0) had an overall mean of 2.6.
It could be inferred that chemistry curriculum implementation, had a mean of 2.6 which was low on the likert scale that was used for rating and hence was poor. Serious constraints were facing the curriculum implementation.

This study endeavored to establish constraints that were facing implementation of chemistry curriculum. The hope was to identify ways of minimizing the constraints for a more efficient implementation. The observation that the chemistry curriculum was faced with constraints sent the strong signal that a comprehensive review was needed to minimize the constraints.

5.7.1 Recommendations on the Implementation of Curriculum

In order to implement the secondary school curriculum efficiently in Kenya, the following recommendations were made:-

1. Heads of schools and teachers should plan for more learning activities especially the ones which had very low frequencies such as field trips and group experiments.
2. KIE, MOEST,QASOs and schools should plan for the production and provision of more learning materials and equipment in schools to cater for the shortage.
3. KIE, should plan for provision of adequate in-service training for all teachers of secondary schools for them to be equipped with relevant knowledge, skills and attitude.

4. KIE, Ministry of Education, QASOs, school heads, parents and other stakeholders in education should strengthen their support for the curriculum by providing more funding, inspection and formative evaluation.

5.7.2 Suggestions for Further Research

In this study, it was suggested that the following study areas could be researched to fill up the likely missing components

1. A study be conducted to establish attitude of students and teachers towards secondary school chemistry.
2. A study that seeks ways of making the curriculum both vocational and academic should be conducted so that secondary school leavers may use vocational skills for self-employment.

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Appendix i

Questionnaire for Secondary School Students

Please answer all of the following questions. Whatever responses and information provided herein will be treated with utmost confidentiality. Sincerity is important in filling this questionnaire. All answers provided will be considered correct.

Section A

Bio-Data (Personal Details)

District_____

School_____

Class_____

Gender_____

SECTION B

Information pertinent to chemistry curriculum

Please answer all of the questions below by putting a tick for the right response.

Statement/title	
Projects: i) How frequently do you carry out chemistry projects? How well do the projects help you to learn?	Very rarely Rarely Undecided Frequently Very frequently [ ] [ ] [ ] [ ] [ ] Very poorly Poorly Undecided Well Very well [ ] [ ] [ ] [ ] [ ]

Experiments:	
2.i. How frequently are teacher demonstrations carried out?	Very rarely Rarely Undecided Frequently Very frequently [ ] [ ] [ ] [ ] [ ]
Ii.How helpful are teacher demonstrations for your learning?	Very Unhelpful Unhelpful Undecided Helpful Very helpful [ ] [ ] [ ] [ ] [ ]
iii.How frequently do you do group experiments in chemistry?	Very rarely Rarely Undecided Frequently Very frequently [ ] [ ] [ ] [ ] [ ]
Text books/charts and models: Rate the availability of:	Veryunavailable Unavailable Undecided Available Veryavailable
4.i .Main chemistry text books	[ ] [ ] [ ] [ ] [ ]
ii. Reference chemistry text books	[ ] [ ] [ ] [ ] [ ]
iii. Charts for chemistry	[ ] [ ] [ ] [ ] [ ]
iv. Chemistry laboratory manual	[ ] [ ] [ ] [ ] [ ]

v. Models for chemistry	[ ] [ ] [ ] [ ] [ ]

	Very unavailable	Unavailable	Undecided	Available	Very available
Apparatus:					
Rate the availability of Distillation apparatus	[ ]	[ ]	[ ]	[ ]	[ ]
Kipp's apparatus	[ ]	[ ]	[ ]	[ ]	[ ]
Hoffmann voltammeters	[ ]	[ ]	[ ]	[ ]	[ ]

Appendix ii

Questionnaire for Secondary School Teachers

Please answer all of the following questions. Whatever responses and information provided herein will be treated with utmost confidentiality. Sincerity is important in filling this questionnaire. All answers provided will be considered correct.

Section A

Bio-Data (Personal Details)

District_____

School_____

Teaching subject(s)_____

Gender_____

SECTION B

Information pertinent to chemistry curriculum

Please answer all of the questions below by putting a tick for the right response.

In-service If you attended in-service, evaluate adequacy of: Your attendance of KIE in-service for chemistry teaching from year 2003	Very inadequate Inadequate Undecided Adequate Very adequate [ ] [ ] [ ] [ ] [ ]
Materials and equipment: Assess the availability of the following: i.Students' chemistry text books ii.Teachers' guides iii.Laboratory manuals iv.Charts for chemistry v.Models for chemistry vi.Mass media programmes	Very Unavailable undecided available Very Unavailable available [ ]

vii.Journals	[ ] [ ] [ ] [ ] [ ]
viii.Fume cupboards	[ ] [ ] [ ] [ ] [ ]
ix Fire extinguishers	[ ] [ ] [ ] [ ] [ ]
x. Laboratory gas supply	[ ] [ ] [ ] [ ] [ ]
xi Electricity supply	[ ] [ ] [ ] [ ] [ ]
xii.Tap water supply	[ ] [ ] [ ] [ ] [ ]
Evaluation: Evaluate the following:	Veryinadequate Inadequate Undecided Adequate Very Adequate
Student assessment methods	[ ] [ ] [ ] [ ] [ ]
KIE Evaluation of chemistry curriculum	[ ] [ ] [ ] [ ] [ ]

Appendix iii

Interview Schedule for Secondary School Teachers

Please answer the following questions. Whatever responses and information provided will be treated with utmost confidentiality. Sincerity is important for this exercise.

Section A

Bio-Data (Personal Details)

District_____

School_____

Teaching subject(s)_____

Gender_____

SECTION B

Information pertinent to chemistry curriculum

Please give your responses for the following items.

1) The following are some stages in curriculum development and implementation. State how adequately they were / are carried out for the revised chemistry curriculum.

2. Were you in-serviced for the new chemistry curriculum?

No [ ] Yes [ ]

If your answer to item 2 is no, give reasons

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………..

3. Below are some teaching / learning activities. State how frequently you do carry them out with students.

Teaching / learning activity:	Very rarely	Rarely	Undecided	Frequently	Very frequently
i. Chemistry projects	[ ]	[ ]	[ ]	[ ]	[ ]
ii. Field trips	[ ]	[ ]	[ ]	[ ]	[ ]
iii. Chemistry club activities	[ ]	[ ]	[ ]	[ ]	[ ]
iv. Class discussions	[ ]	[ ]	[ ]	[ ]	[ ]
v. Teacher demonstrations	[ ]	[ ]	[ ]	[ ]	[ ]
vi. Small group experiments	[ ]	[ ]	[ ]	[ ]	[ ]
vii. List other(s)	[ ]	[ ]	[ ]	[ ]	[ ]
	[ ]	[ ]	[ ]	[ ]	[ ]
	[ ]	[ ]	[ ]	[ ]	[ ]

Give your opinion in relation to item 3 _

_ _

……

……

……

4. Below are some stages in curriculum implementation. State how adequately they were/are carried out for the new curriculum.

Evaluation	Very inadequate	Inadequate	Undecided	Adequate	Very Adequate
Formative evaluation of students.	[ ]	[ ]	[ ]	[ ]	[ ]
Inspection of learning materials and equipment by Education officials	[ ]	[ ]	[ ]	[ ]	[ ]
State other(s)	[ ]	[ ]	[ ]	[ ]	[ ]
	[ ]	[ ]	[ ]	[ ]	[ ]
	[ ]	[ ]	[ ]	[ ]	[ ]

5. Give your opinion regarding item 4 above

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6. What are some of the constraints facing implementation of the chemistry curriculum?

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Appendix iv (a)

Coefficients of Regression

Model	Unstandardized coeffients	Standard error	Standardized coeffients	T	Level of significance
Constant	0.285	0.203		1.404	0.162
Teachers guides	-0.011	0.017	-0.015	-0.159	0.874
In-service	0.173	0.092	0.242	1.873	0.063
Chemistry projects	-0.121	0.051	-0.142	-2.377	0.019
Group experiments	0.192	0.057	0.192	3.368	0.001
Teacher demonstrations	0.188	0.077	0.297	2.439	0.016
Class discussions	0.090	0.066	0.119	1.366	0.174
Chemistry text books	0.289	0.053	0.324	5.498	0.000
Models	-0.024	0.038	-0.033	-0.618	0.537
Fume cupboards	-0.003	0.063	-0.003	-0.044	0.965
Charts	0.022	0.043	0.025	0.419	0.676
Electricity supply	-0.036	0.059	-0.047	-0.605	0.546
Chemistry assignments	-0.087	0.091	-0.130	-0.960	0.339
Field trips	0.102	0.061	0.113	1.672	0.096
Gas supply	0.176	0.056	0.213	3.159	0.002
Tap water supply	-0.153	0.054	-0.165	-2.850	0.005

Dependent Variable: Teachers' Implementation (Student assessment)

Coefficients of Regression

Model	**Unstandardized coefficients**	**Standard error**	**Standardized coefficients**	**t**	**Level of significance**
Constant	-3.004	0.910		-3.302	0.005
Teacher demonstrations	0.043	0.113	0.042	0.302	0.767
In-service	-0.241	0.098	-0.380	-2.469	0.026
Charts	0.227	0.087	0.361	2.606	0.020
Chemistry assignments	0.252	0.056	0.572	4.514	0.000
Club activities	0.554	0.101	0.926	5.489	0.000
Chemistryprojects	0.378	0.109	0.416	3.483	0.003
Laboratory manuals	0.517	0.171	0.729	3.027	0.008
Models	-0.083	0.069	-0.146	-1.215	0.243
Chemistry text books	-0.246	0.119	-0.356	-2.063	0.057

Dependent Variable: KIE Implementation (KIE Evaluation)

Appendix iv (b) Map of Rachuonyo District

Appendix v Letter of Introduction of the Researcher to the Respondents

Appendix vi Research Permit

Appendix vii: Research Authorization by Ministry of Education, Science and Technology

Appendix viii : Research Authorization by District Education Officer, Rachuonyo District.