

**EFFECT OF CURRICULUM CHANGES IN SCIENCE SUBJECTS ON
TEACHING AND LEARNING : A CASE STUDY OF SECONDARY
SCHOOLS IN MUSOMA MUNICIPALITY**

SUMI PASTORY

**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION IN
ADMINISTRATION, PLANNING AND POLICY STUDIES OF THE OPEN
UNIVERSITY OF TANZANIA**

2016

CERTIFICATION

The undersigned certifies that, he has read and hereby recommends acceptance by the Open University of Tanzania a dissertation entitled: *“The Effect of Curriculum Changes in Science Subjects on Teaching and Learning: A Case study of Secondary schools in Musoma Municipality”*, in partial fulfilment of the requirements for the degree of Master of Education in Administration, Planning and Policy Studies of the Open University of Tanzania

.....

Prof. E. Babyegeya
(Supervisor)

.....

Date

COPYRIGHT

This dissertation is a copyright material protected under the Berne Convention, the Copyright Act of 1999 and other international and national enactments, in that behalf, on intellectual property. It may not be reproduced by any means, in full or part except for short extracts in fair dealings, for research or private study, critical scholarly review or discourse with an acknowledgement, without the written permission of the Director of Post Graduate Studies, on behalf of both the author and the Open University of Tanzania.

DECLARATION

I, **Sumi Pastory**, hereby declare that, this dissertation is my own original work and that it has not been presented and will not be presented to any other institute of higher learning for a similar or other degree award.

.....

Signature

.....

Date

DEDICATION

This dissertation is dedicated to my beloved parents, **Mr. Pastory Munyeti** and the late mama **Elizabeth Munyeti**, who laid a substantive education foundation without which higher education for me could not have been successfully attained. The work is also dedicated to my family, my husband **Mr. Martin Maharangatta** and my children. It is further dedicated to my brothers, sisters and all my siblings whose tolerance and dedicated prayers contributed significantly to the successful completion of this work.

ACKNOWLEDGEMENT

This dissertation is a product of the cooperative efforts of many people all of whom it is not possible to mention by names. I convey my sincere gratitude to all of them. I thank our Almighty God through Jesus Christ who kept me healthy throughout the period of my studies, until I am about to attain the end of my program. I am particularly indebted to my supervisor Professor E. Babyegeya, who devoted his time and efforts tirelessly to guide, encourage and supervise my work as well as to read my drafts. His scholarly advice, critical mind and concern for accuracy have shaped my study into its present form. Despite his heavy workload in relation to other responsibilities, his supervision has been regular.

I wish to express my sincere appreciation to all heads of secondary schools who allowed me to collect data from their schools in collaboration with academic and science subjects' teachers and all form two and four students of the year 2015 for their cooperation and their contribution towards this work. I wish also to acknowledge the courage and passion of my family including my lovely husband Mr. Martin Maharangatta, my children, and all my relatives and friends who have been so supportive whenever needed and have kept me in touch throughout my course.

I owe much gratitude to all staff members of the Open University of Tanzania (Mara Centre) and my fellow students for the cooperation I got from them and for their suggestions, encouragement and academic advice right from the beginning of the programme. I must point out, however, that in case of any shortfalls in this dissertation, I remain responsible and accountable.

ABSTRACT

This study examined the effect of secondary school curriculum changes in science subjects on teaching and learning with reference to Musoma Municipality in Mara region. Specifically, the study explored if curriculum changes require changes in teaching methods, examined if teachers have mastery of subject matter required by changes in school curriculum and assessed if curriculum change goes with availability of teaching and learning materials. A qualitative research approach was employed whereby purposive and random sampling procedures were used to select a sample of one hundred and forty participants. Semi-structured interviews, documentary review and focus group discussions were used to collect data. The findings of the study revealed that any curriculum changes should also involve changes in teaching and learning methods in order to cope with newly introduced or transformed content. Also, the study discovered that many teachers had little mastery of subject matter required by changes in school curriculum particularly to those who start to implement the changes for the first time. Moreover, the study indicated that many changes in school curriculum particularly in science subjects do not consider the availability of teaching and learning materials. The study recommended that educational practitioners and authorities should not be drawn into changes of the curriculum before investigating out the types of teaching and learning methods to be used. Also, Schools should have science subjects' facilities like laboratories filled with all needed equipment and other related teaching and learning materials. Furthermore, Schools should have a timetable that allows for definite enough slots for science practical session participation. Further studies should examine the effects of curriculum changes in science subjects in a single subject and involve as many secondary schools and regions as possible to ascertain the entire situation.

TABLE OF CONTENTS

CERTIFICATION.....	ii
COPYRIGHT.....	iii
DECLARATION.....	iv
DEDICATION.....	v
ACKNOWLEDGEMENT.....	vi
ABSTRACT.....	vii
TABLE OF CONTENTS.....	viii
LIST OF TABLES.....	xii
LIST OF FIGURES.....	xiii
CHAPTER ONE.....	1
INTRODUCTION AND BACKGROUND TO THE STUDY.....	1
1.1 Introduction.....	1
1.2 Background to the Problem.....	1
1.3 Statement of the Problem.....	7
1.4 Purpose of the Study.....	8
1.5 Objectives.....	8
1.6 Research Questions.....	8
1.7 Significance of the Study.....	9
1.8 Delimitation of the Study.....	9
1.9 Limitation of the Study.....	10
1.10 Definition of terms.....	10

CHAPTER TWO	12
LITERATURE REVIEW	12
2.1 Overview	12
2.2 Conceptual Framework	12
2.3 Concept of Curriculum.....	14
2.4 Curriculum Change	19
2.5 Reasons for General Curriculum Change	24
2.6 Reasons for Science Subjects Curriculum Change	28
2.7 Effects of Curriculum Changes in Science Subjects.....	30
2.8 Teaching Science Subjects in Secondary Schools	35
2.9 Application of Constructivism Theory to Science Subjects Teaching and Learning.....	42
2.10 Empirical Review.....	45
2.11 Research Gap	47
CHAPTER THREE.....	49
RESEARCH METHODOLOGY	49
3.1 Overview	49
3.2 Research Approach	49
3.3 Research Design.....	49
3.4 Area of the Study	50
3.5 Target Population.....	51
3.6 Sample.....	51
3.7 Sampling Technique.....	52
3.8 Methods for Data Collection.....	53

3.8.1	Interview	54
3.8.2	Focus group discussion (FGD).....	54
3.8.3	Documentary Review.....	55
3.9	Validation of Instruments.....	55
3.10	Data analysis Procedure	56
3.10.1	Data Explanation from Interviews and FGDs	56
3.10.2	Data explanation from Documentary	56
3.11	Ethical Considerations	56
	CHAPTER FOUR.....	57
	DATA PRESENTATION, ANALYSIS AND DISCUSSION	57
4.1	Overview	57
4.2	Exploration of whether curriculum changes require changes in teaching methods.....	57
4.3	Examination on whether Teachers have Mastery of Subject Matter required by change in School Curriculum	66
4.4	Assessment on whether curriculum change goes with availability of teaching and learning materials	74
	CHAPTER FIVE	79
	SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	79
5.1	Overview	79
5.2	Summary of the Study.....	79
5.3	Summary of the Findings	80
5.4	Conclusions	81
5.5	Recommendations	82

5.5.1 Recommendations for action.....	82
5.5.2 Recommendations for further studies	83
REFERENCES.....	84
APPENDICES	91

LIST OF TABLES

Table 1.1 :	Number of Students Passing Science Subjects in Certificate of Secondary Education Examination for Five Years.....	4
Table 3.1 :	Composition of Respondents in the Study	53

LIST OF FIGURES

Figure 1.1 : The effect of secondary school curriculum changes in science
subjects on teaching and learning 14

Figure 4.1 : Problems faced by the teachers in preparing lesson plans..... 73

CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 Introduction

This chapter introduces the study about the effect of secondary school curriculum changes in science subjects on teaching and learning. The main purpose is to find out the impact that curriculum changes in science subjects has on teachers and learners as a whole. The study also focuses on the reasons behind frequent changes in science subjects' curricular and the best methods of teaching science subjects in secondary schools. The chapter contains sections on the background to the problem, statement of the problem, the purpose and objectives of the study, research questions, significance of the study, delimitation, limitation, theoretical basis and definitions of key concepts and terms.

1.2 Background to the Problem

Globally, educating a nation remains the most vital strategy for the development of a society. Many studies on human capital development agree that it is the human resources of a nation and not its fiscal or natural resources that ultimately determine the pace of its economic and social development. The principal institutional mechanism for developing human capital is the formal education system of primary, secondary and tertiary training (Nsubuga, 2003: 2). Since education is an investment, there is a significant positive correlation between education and socio-economic development. When people are educated, their standards of living are likely to improve, since they are empowered to embark on productive ventures, which will ultimately lead to an improvement in their livelihoods.

The role of education therefore, is not just to impart knowledge and skills that enable the beneficiaries to function as economies and social change agents in society, but also to impart values, ideas, attitudes and aspirations important for development. Therefore, due to this crucial aspect of education, educational practitioners are highly concerned with daily learners' and schools' academic performance as this is the strongest pillar of education development. Academic achievement in developing countries is measured according to the goals established in educational policies and national vision, this involves outstanding performance on teacher-made tests and examinations, national examinations and other benchmarks for quality assurance based on the formal curriculum (Mosha, 2006).

This means that the produced outcomes that are always experienced from annual and national examination are the very first determinants of learners' academic performance as well as the whole nation. Additionally, academic performance seems to determine the nation's education standards as it is argued by Njabili (1999) that public examination results are still the dominant tools which serve as an indicator of whether learning has taken place. Thus, the use of classroom made test results in schools and national examination performance help to determine the quality of a certain school in the nation. That is why each nation is tirelessly working on improving its learners' and schools/colleges' academic performance.

Unfortunately, poor academic performance in many Tanzanian schools specifically secondary schools in recent years and particularly in science subjects has raised concern and questions among educators and within the public and has called for a

search of solutions. Different factors have been identified as causes such as inadequate school facilities and a low morale among students and teachers (Makene, 2004); school management (Lyamtane, 2004), teachers' insufficient command to teach science subjects effectively (Allen, 2008) and inadequate use of teaching and learning materials in classroom situations (Anyakoha, 1992). However, with all efforts to solve the existing problems, science subjects' performance is still declining year after year. For many years there have been different efforts to rescue the situation of poor performance in science subjects including merging the subjects into one science subject, changing practical sessions to alternative practical where students have to sit for science practical examinations without involving laboratory works and overall changing of science subjects' curricular. According to Silla (2009), the standards of Science education in secondary schools are falling and students perform much better in other subjects because of the difficulties they face in learning the subjects as a whole. Table 1.1 indicates the pass rate of Science subject of CSEE for five years since 2009 – 2013 from two secondary schools in Musoma Municipality.

Table 1.1 : Number of Students Passing Science Subjects in Certificate of Secondary Education Examination for Five Years

Mwisenge Secondary School								Baruti Secondary School						
Year	Total	Passed			Fail			Total	Passed			Fail		
		Bio	Phy	Chem	Bio	Phy	Chem		Bio	Phy	Chem	Bio	Phy	Chem
2009	29	3	7	4	26	22	25	15	5	3	6	10	12	9
2010	30	10	7	3	20	23	27	22	8	4	9	14	18	13
2011	39	11	5	8	28	34	31	20	7	8	7	13	12	13
2012	39	8	4	7	31	35	32	26	8	9	6	18	17	20
2013	45	19	5	6	26	40	39	25	10	5	8	15	20	17

Source: NECTA, 2009 - 2013

Table 1.1 indicates that the number of students passing the science subjects in Certificate Secondary Education Examination (CSEE) was poor and declined year after year in relation to the number of students sat for the examination. This shows that despite the fact that students are passing their national examinations, the performance of science subjects is not convincing because many pupils fail the subjects. According to Vallet and Allen (2001), Tanzania is among the African countries, which right after independence started to take measures on education developments through policy formulation, reviews, adjustments, and improvements, these measures included curriculum design and development for schools to meet national goals on education. This includes science subjects which had to be taught according to the needs as clarified by Coleman (2010), that there have been different improvements on curricular so as to solve the challenges and shortcomings of the former curricular in order to meet the needs of the present time in secondary schools.

With the aim of improving the science subjects using different methods but specifically through curriculum changes the problems are still arising and students are still performing poorly while teachers are not comfortable with teaching due to immediate changes without any trainings to cope with new changes. According to Jones (2003), it is necessary to recognize that change is not always easy and that people may feel threatened by it. Educators need to be given the opportunity to talk about their fears and concerns both in groups and individually. Even educators who are open to changes feel uncertainty about what kind of changes will be most effective and how best to go about making them. Meanwhile, Grobler (2003) argues that the changing nature of content requires constant revision to update development

within the education system. The rapid change in knowledge, the information age and global interconnectedness all influence Tanzania's secondary schools and need to be addressed.

With all the efforts done to rescue the situation of science subject's failure to students, curricular changes, improvement or rather development seems to play a pivotal role so as to help students pass the subjects. However, many changes done to the curricular do not go hand in hand with changes in teachers' teaching and learning methodologies as result it seems that those changes have nothing to do with the improvement of science subjects' performance because teachers are not capable of delivering instructional materials to students due to new needed strategies. McCombs and Whisles (1997) argue that after the curriculum changes the educators (teachers) are not clear of what they are doing, they do hesitate when presenting the new knowledge due to the new innovation that they are not aware of and therefore their competency is questionable; thus, any effective change requires commitment to develop necessary resources including indispensable knowledge and skill training to teachers so as to develop their delivery capabilities.

In that sense to resolve this situation, in – service training is recommended to assist necessary adjustments to curriculum changes, that is sufficient time for training is required to avoid covering an excessive amount of work during too short time. This would enable educators to feel confident and competent during delivery of classroom instruction materials. Curriculum changes are intended to benefit both learners and educators. Educators should not be discouraged when they encounter some of the

more challenging effect of curriculum changes they should be well equipped so that they can solve all challenges encountered.

1.3 Statement of the Problem

The problem of this study was to examine the effect of secondary school curriculum changes in science subjects on teaching and learning with reference to Musoma Municipality in Mara region. Attitudinal data from many studies indicate that it is common for many school students to find little interest in their studies of science and often quite because of an active dislike of it compared to other subjects. These sources indicate that many students are complaining of subjects' difficulty and others complain of teachers' incompetence of teaching the subjects and lack of motivation from teachers to learn the subjects (Lema, 2008 and Wamuza 2005) while Mkumbo (2012) observes that it is due to poor commitment to teaching profession and poor working condition in schools that lead to the situation. However, these studies and others emphasise much on teachers' effectiveness in teaching the subjects so as to overcome the challenges in science learning in secondary schools while others centred on inadequate teaching facilities and poor science teacher's professional development with low morale of the students themselves to learn science subjects.

Researchers have not investigated and studied much on the effects of frequent and sudden curriculum changes in science subjects on the process of teaching and learning the subjects in the classrooms. Curriculum changes seem to compound the problem because these changes do not go hand in hand with teachers' training on pedagogical content knowledge and the use of various invented instructional

approaches and knowledge introduced in new curriculum so as to teach the subjects effectively. It is for this apparently bewildering and wanting situation that a field study seems to be necessary in order to place and judge educational decisions in proper context.

1.4 Purpose of the Study

The purpose of the study was to examine the effects of the curriculum changes in science subjects on teaching and learning in secondary schools.

1.5 Objectives

The study was guided by specifically objectives as follows:

- (i) To explore the changes in teaching methods due to curriculum changes.
- (ii) To examine the effects of curriculum changes on teachers' mastery of the subject matter.
- (iii) To assess the effect of curriculum change concerning the availability of teaching and learning materials.

1.6 Research Questions

With regard to objectives given, this study was guided by the following research questions:

- (i) Why is it necessary to change the teaching methods due to curriculum changes?
- (ii) Why is it important to determine teachers' mastery of the subject matter before the change of curriculum?

- (iii) Why should the availability of teaching and learning materials be known before the change of curriculum?

1.7 Significance of the Study

Since this study examined the effects of secondary school curriculum changes in science subjects on teaching and learning, its findings are expected to be useful in providing the following details to educational policy makers, planners, officials, practitioners and stakeholders, To learn and understand the effects of frequent changes in science subjects curriculum and hence take precaution before involving in those frequent changes, To prepare training programmes to teachers on how to go about new inventions introduced in the new curriculum so as to make teachers more competent to teach the subjects and helping students, To have a clear understanding on whether these changes require changes in teaching methods or not and if these changes go with availability of teaching and learning materials.

1.8 Delimitation of the Study

This study was conducted in only one Municipality; that is Musoma Municipality. It only involved four secondary schools of which two were public and two others private. The focus was mainly on students in form II and IV as these were mainly concerned with national examinations.

This study also confined itself to the exploration of whether curriculum changes require changes in teaching methods, examining if teachers have mastery of subject matter required by changes in school curriculum and to the assessment of if curriculum change goes with availability of teaching and learning materials.

1.9 Limitation of the Study

Several limitations were encountered in conducting this study

The first limitation was the institutional bureaucracy and complex time tables for official responsibilities resulted in more than anticipated time for data collection from students, teachers and heads of school. Thus, the researcher had to adjust time table to meet the appointments according to respondents' schedules. Secondly, some respondents especially teachers, wanted payment before being engaged in interviews and this was overcoming by seeking cooperation with those few respondents who were willing to help the researcher.

On the other side, due to over emphasis on academic activity, some school heads were not willing to let students to be involved in the study for reason that they had to study in classes up to when they are supposed to go home. Therefore, the researcher had to use the evening hours to meet with children for discussion which sometimes led to difficulties of gathering the children together because some had to go for extra studies out of their schools

1.10 Definition of terms

Science subjects: In this study this includes natural science subjects like Physics, Biology, Mathematics and Chemistry Curriculum: According to Apple (1997) this refers to the existing contract between the society, the state and educational professional with regard to the educational experience that learners should undergo during a certain phase of their lives.

Etymologically, the word Curriculum began as a Latin word which means "a race" or "the course of a race" (which in turn derives from the verb *currere* meaning "to run/to proceed". Curriculum field had its roots in the Herbartian movement of the late nineteenth century where theories of teaching and learning required that systematic attention be given to the selection and organisation of subject matter (Seguel, 1966). The subject matter emphasis led to a reawakening of interest in curriculum content in education. The term curriculum is used in many different ways that communication is sometimes is hampered; however, different specialists have defined curriculum depending on the context and the participants.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

This chapter reviews the literature related to the study on the effect of secondary school curriculum changes in science subjects on teaching and learning. It begins with the conceptual framework, concept of curriculum; curriculum change; reasons for curriculum change; teaching science subjects in secondary schools; effects of curriculum changes; teaching science subjects in secondary schools and moves on to application of constructivism theory to science subjects teaching and learning; empirical review. Finally, it points to the gap in the literature for which further research enquiry is necessary.

2.2 Conceptual Framework

According to Strauss and Corbin (1998), Conceptual framework is a basic structure of a research consisting of certain abstract ideas and concepts that a researcher wants to observe, experiment or analyse. This study based on Stufflebeam model (1971) which aims to examine the effect of secondary school curriculum changes in science subjects on teaching and learning. The model includes Context, Input, Process and Product (CIPP) as indicated in Figure 1.1

Context: Refers to particular circumstances that are likely to affect teaching and learning processes and performance in general. In this case, there are various conditions that may affect science subjects' performance such as changing of science

subjects' curriculum without consulting society needs, school time in learning and adapting to new introduced curriculum and presence of science subjects' curriculum.

Predictors/inputs: These refer to persons and resources that facilitate learning processes so as to attain outstanding academic performance. These variables include teaching and learning materials and methodologies, new science subjects' curriculum, time use and the learners themselves.

Process/Mediator: This involves procedures that are overlying interaction of different variables in school. It is the implementation stage that leads to desired outcomes. This involves variables such as management, in-service trainings on new introduced curriculum; professional competence and commitment of teachers; school time table and teaching and learning processes. All these variables should be properly managed in order to get the desired outcomes. This stage involves implementation of decisions which require the kind of information that indicates how things work and what might go wrong (Njabili, 1999).

Outcomes/products: These are results after the teaching-learning process and associated variables as mentioned above has taken place. These should ideally lead to good academic performance, knowledge, skills, values, attitudes and norms. They are the ultimate goals of an education system that are highly influenced by the preceding processes. Using this conceptual frame-work it helped the researcher to delimit the study to the intended concept and maintain the validity of the study. Moreover, it helped to directly derive the research questions and data collection instrument.

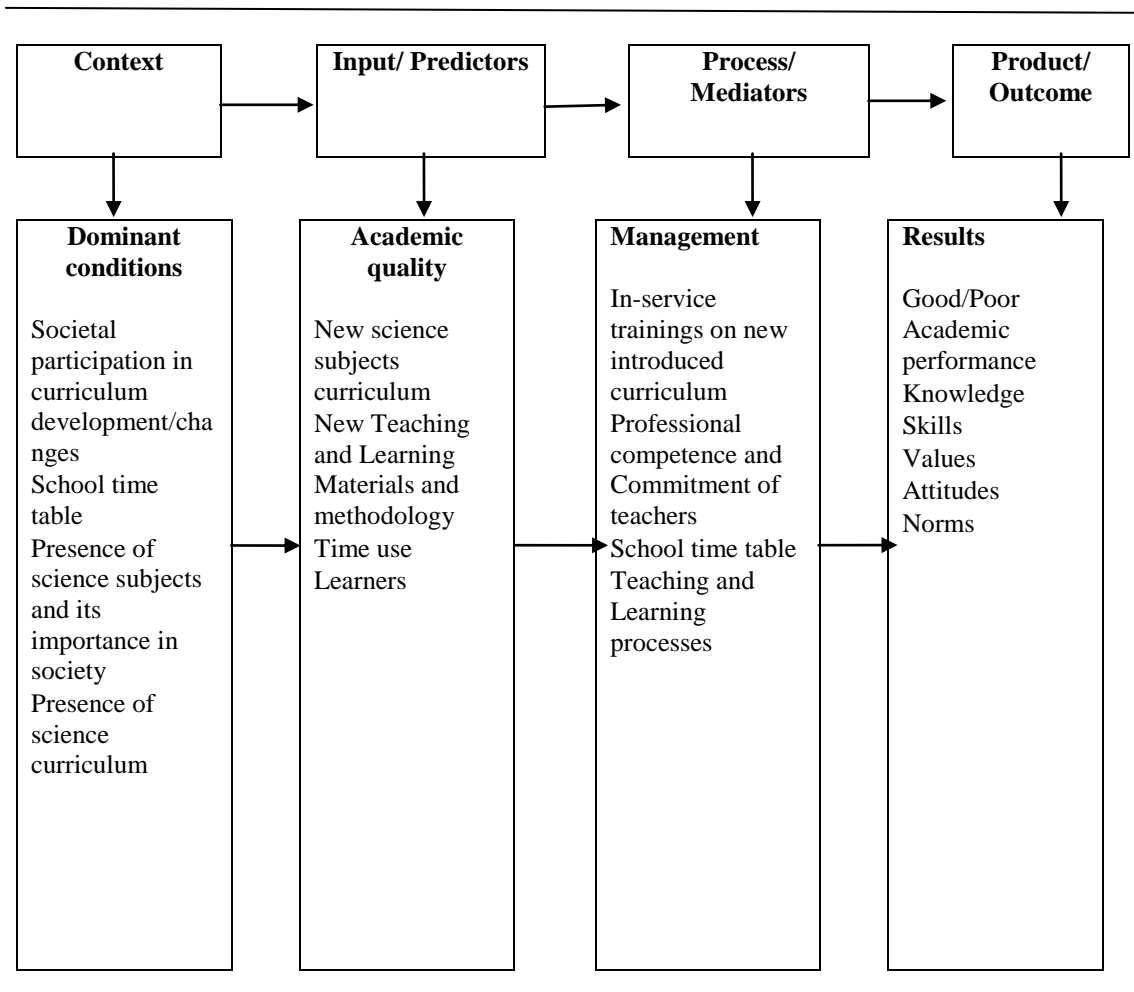


Figure 1.1 : The effect of secondary school curriculum changes in science subjects on teaching and learning

Source: Adapted from Stufflebeam (1971)

2.3 Concept of Curriculum

According to Apple (1997), Curriculum refers to the existing contract between the society, the state and educational professional with regard to the educational experience that learners should undergo during a certain phase of their lives including why learning something, what to learn, when to learn, how to learn and with whom to learn. It defines the educational foundations, contents and their sequencing in relation to the learning experiences, characteristics of the teaching institutions, methods to be

used, the sources for learning and teaching (for example textbooks), evaluation mode and teacher's profiles. Moreover, Gultig, Hoadley and Jansen (2002) define Curriculum as the formal academic programme provided by a school as reflected in subjects on the time table. In this sense it might also refer to a particular course of instruction or a syllabus, means and material with which students interact for the purpose of achieving identified educational outcomes. It prescribes course of studies which students must fulfil in order to pass a certain level of education, for example primary or secondary education.

On the other hand, Kearsley (1996) describes curriculum as a single most important instrument of structure in a course which outlines the goals and objectives of a subject, prerequisites the grading or evaluation scheme, material to be used (textbooks, software), topics to be covered a schedule and a bibliography. Each of these components defines the nature of learning experience. Goals and objectives identify the expected outcomes and scope of the subject as determined by the teacher or subject designer restricting the domain of knowledge for the learner. The grading or evaluation scheme tells students what kind of learning activities are to be valued (example assignments, tests, papers); that is, the currency of learning in particular subject or topics to be covered specify the content that the teacher feels is important.

Generally, there is no agreed upon definition of curriculum but some influential definitions that combine various elements to describe curriculum refer to as the totality of student experiences that occur in the educational process. The term often refers specifically to a planned sequence of instruction, or to a view of the student's

experiences in terms of the educator's or school's instructional goals. It is the set of learning goals articulated across grades that outline the intended mathematics content and process goals at particular points in time throughout the school programmes. Curriculum may incorporate the planned interaction of pupils with instructional content, materials, resources, and processes for evaluating the attainment of educational objectives; it is split into several categories including the hidden, the excluded and the extra-curricular.

Kelly (2009) prescribes that, curriculum has numerous definitions, which can be slightly confusing; however, in its broadest sense a curriculum may refer to all courses offered at a school (explicit); the intended curriculum, which the students learn through the culture of the school (implicit) and the extracurricular activities like sports, and clubs. This is particularly true of schools at the university level, where the diversity of a curriculum might be an attractive point to a potential student. Kelly also adds that curriculum may also refer to a defined and prescribed course of studies, which students must fulfil in order to pass a certain level of education.

For example, an elementary school might discuss how its curriculum, or its entire sum of lessons and teachings, is designed to improve national testing scores or help students learn the basics. An individual teacher might also refer to his or her curriculum, meaning all the subjects that will be taught during a school year. On the other hand, a high school might refer to a curriculum as the courses required in order to receive one's diploma. They might also refer to curriculum in exactly the same way as the elementary school, and use curriculum to mean both individual courses

needed to pass, and the overall offering of courses, which help prepare a student for life after high school.

According to Kim and Dopico (2014), curriculum can be envisaged from different perspectives. What societies envisage as important teaching and learning constitutes the "intended" curriculum. Since it is usually presented in official documents, it may be also called the "written" and/or "official" curriculum. However, at classroom level this intended curriculum may be altered through a range of complex classroom interactions, and what is actually delivered can be considered the "implemented" curriculum. What learners really learn (i.e. what can be assessed and can be demonstrated as learning outcomes/learner competencies) constitutes the "achieved" or "learned" curriculum. Additionally, Tomasa and Rodrigo (2008) point out to a "hidden" curriculum that is, the unintended development of personal values and beliefs of learners, teachers and communities; unexpected impact of a curriculum; unforeseen aspects of a learning process.

Those who develop the intended curriculum should have all these different dimensions of the curriculum in view. While the "written" curriculum does not exhaust the meaning of curriculum, it is important because it represents the vision of the society. The "written" curriculum is usually expressed in comprehensive and user-friendly documents, such as curriculum frameworks; subject curricula/syllabuses, and in relevant and helpful learning materials, such as textbooks; teacher guides; assessment guides.

In some cases, people see the curriculum entirely in terms of the subjects that are taught, and as set out within the set of textbooks, and forget the wider goals of competencies and personal development. This is why a curriculum framework is important. It sets the subjects within this wider context, and shows how learning experiences within the subjects need to contribute to the attainment of the wider goals (William et al, 1995).

There are many common misconceptions of what curriculum is and one of the most common is that curriculum only entails a syllabus. Smith (2000) says that, a syllabus will not generally indicate the relative importance of its topics or the order in which they are to be studied. Where people still equate curriculum with a syllabus they are likely to limit their planning to a consideration of the content or the body of knowledge that they wish to transmit. Regardless of the definition of curriculum, one thing is certain. The quality of any educational experience will always depend to a large extent on the individual teacher responsible for it (Kelly, 2009).

Curriculum is almost always defined with relation to schooling. According to some, it is the major division between formal and informal education. However, under some circumstances it may also be applied to informal education or free-choice learning settings. For instance, a science museum may have a curriculum of what topics or exhibits it wishes to cover. Moreover, curriculum can serve a wide variety of functions that will support and challenge students as they engage in their educational activities.

2.4 Curriculum Change

Hancock et al (2012) define curriculum change as the transformation of the curriculum schemes for example its design, goals and content. That is, it refers to the linkages or close working relationship between developers of syllabi, assessors of the syllabi (Examination bodies), implementers of the syllabi (Teachers), consumers of the syllabi (students), evaluators of implementation of the syllabi (school inspectors), consumers of the graduates (employers), and supporting education stakeholders (parents and community members). It means making the curriculum different in some way, to give it a new position or direction. This often means alteration to its philosophy by way of its aims and objectives, reviewing the content included, revising its methods and re-thinking its evaluation procedures. Curriculum change should have clear and definitive goals that can be easily understood to the targeted group and the society as a whole. For example, curriculum change that is multicultural should espoused democratic equality, by seeking to provide all children with the skills and knowledge they will need in a global and diverse society.

According to Dziwa et al (2013), curriculum change is not a matter of supply of appropriate technical information rather it involves changing attitudes, values, skills and relationship. It requires expert itself with motivated force to introduce and direct change, this means that the basic conditioning for change is the existence of school structures which can accommodate and accelerate change; thus, it is important to note that there must be readiness to accept these changes in the curriculum. Curriculum change has far reaching implications, it means changing some of the fundamental elements of the curriculum which are aims, content (what to be taught), methodology

(how it is going to be taught) and evaluation. This means or implies change of the internal organization of the school relationship, change of relationship between schools and government agents which control education (Gatawa 1999).

Since independence Tanzania's education system has gone through a number of significant changes but main changes in education curriculum have been observed at primary and secondary education level. Nyirenda (2012) argues that, there has been a dramatic change in the education system which affected syllabus, textbooks and many more, however these changes have not been due to changing of various socio-economic policies but due to the wishes of the prevailing political leaders. Nyirenda further argues that, the changes should aim at improving the content and activities of the syllabi to be competent-based and that if this is effectively implemented then students would acquire adequate skills to be competent indeed. Changes that centred on learners' improvement would enable them to explain phenomena, applying their knowledge in daily life, use and maintain domestic appliances, use sustainable energy conversion system for environmental conservation and use of I.C.T tools in accessing information.

Changes in curriculum should be societal- related; that is, it should involve needs from the society and their real-life situation. Curriculum changes should be the one that involve the multiplicity of reforms in schools that build relations around relevant cultural requirements. This implies that the curriculum in schools has to be about more than the academics. It must bring into the school conceptual understandings of student's daily life to enhance relational meaning for students. The curriculum that is

real-life cannot be disconnected from practical everyday knowledge of students. Integrating the curriculum of a real-life school involves a shared cultural understanding of the school curriculum reform with the community of the school.

This is emancipator curriculum reform. It is curriculum as praxis because it allows teacher and student to have a more committed action toward learning. Jones (2003) contends that recognising the ever-increasing technological influences combined with the inefficient levels of literacy within all levels of schooling, curriculum reform that is literacy collaborative will enable schools to produce students to develop skills requiring experimentation and trial and error in cultural learning settings that challenge teacher and student working together to confront the real problems of their daily existence.

Furthermore, Jackson (2006) maintains that, curriculum changes should involve society, teachers, students and other educational institutes, organisations and stake holders in the whole process of reformation. There is a clear lack of inter-linkage between various bodies which are under the same ministry; this means that there is no linkage or close working relationship between curriculum developers, assessors, implementers, consumers and evaluators. Lack of close working relationship hinders progress of implementation of the new changes in the curriculum and hence failure to meet the intended objectives.

Jackson adds that, students want interesting classes as they get older they want to deal with things they feel are relevant to their future, classes that teach them major

problems of their life for example poverty, health and the likes. Also, they need to learn things that help them to develop relationship with others and address deeply felt concern about their identity and value of living. Some simply want any kind of curriculum that allows them to pursue their own private agendas. They want the school to teach them what they believe prepares them for future and most of them prefer this to be done in an atmosphere of interest and congeniality.

Curriculum changes should be done in discretion that it does not affect teaching and learning development so as to maintain the status of education. Changing the way teachers and students learn requires specific approaches, in-service training of teachers is not enough, if curriculum reform aims at changing the ways students learn and teachers teach, more sophisticated implementation and in-service trainings to teachers should be emphasized; that is, teachers should be well equipped with the knowledge they should give to the learners and should have variety of teaching and learning methodologies to teach all the new concepts included in the developed curriculum.

Fazel (2009) asserts that curriculum change is a learning process for teachers and for their schools, good understanding of change and clear conceptions of curriculum are necessary condition for improved implementation of new curriculum into practice. Successful curriculum development requires better use of knowledge; failure is often a result of neglecting it. Policy makers, education leaders and teachers need to know more about the drivers of successful curriculum change in schools. Therefore,

learning about educational change and its key features should become integral elements of any curriculum reform process.

On the other hand, school environments need to be prepared with relevant facilities before introducing new curriculum changes, also teachers need to be prepared to cope with the changes and improve their skills and knowledge to implement to ensure that they are competent to implement and assess these new curriculum, and students as consumers of the curriculum need to be aware of the changes and give orientation of how they can go about learning. Teachers want to enjoy teaching and watching their students learn and develop interests and skills in the way as their teacher's esteem. The teachers also want to work at discovering and codifying the effective practices of their profession. They want to enjoy the esteem of the teachers who are competent in their profession. The education sector needs to realize the goals of curriculum transformation, it needs more than just sitting on a table and making changes in the curriculum and sending copies to teachers for implementation, it needs more than just good plans, needs more than just what is done (Nyirenda, 2012).

Additionally, Mahomed (2004) contends that there always some difficulties experienced by teachers during the implementation of a new curriculum especially when the new introduced concepts seem to be even new to themselves. Teachers needs more time to learn what have been introduced in the transformed curriculum, new teaching methods, teaching and learning aids and evaluation modes. Generally, there are some challenges that face curriculum changes; these include teacher

development and support, monitoring of the implementation, assessment and provision of support material.

2.5 Reasons for General Curriculum Change

Curriculum change is considered as an essential strategy for bringing about improvement in teacher education. It is any alteration in the aspects of a curriculum such as philosophy, values, objectives, organizational structures, materials, teaching strategies, student experiences, assessment and learning outcomes (Liston, Borko & Whitomb, 2008). The success of change or improvement and its implementation requires the application of a number of key features and will always originate from a variety of different sources and combination of sources. Several factors have influenced curriculum change; these include the political, social and cultural, psychological, pedagogical and knowledge, economic, technological and legal. However, according to Fullan (2000), some other curriculum change may result from external factors such as international educational policies or from internal needs such as educational values and goals of a group of people.

According to Mahomed (2004), science subjects' curriculum must change to stay current. Methods of teaching and transmitting new knowledge and concepts to the learners should change accordingly and new knowledge should be introduced to have a latest understanding on current facts. For instance, the geography curriculum for the fourteenth century included several references to a flat Earth. Instructors at that time spent countless hours devising lesson plans explaining the dangers of sailing off the edge but due to some new discoveries that the world is not flat but rather a round one

with an oval shape, all the teachings on the new knowledge should change to accomplish the current understanding. Notions about how things work constantly change. New facts are uncovered that take the place of old ones. New conclusions are arrived at, based on the discovery of new facts.

Today, the rate of change is very rapid. In some areas, new discoveries are made on a daily basis. In order to prepare our students, we must give them the latest information and theories. This means that curriculums must change to reflect the most current thoughts. Technology is another factor that drives about change in science subjects' curriculum. Jones (2002) expresses that, science subjects' curriculums often change based on the technological and delivery system. It is important to stay familiar with the latest technological developments in your field. Think of the impact that computers have on the educational system. Information to and from students can be processed and stored in ways that no one could have imagined years ago. Students, through distance learning, need not be in your classroom in order to be part of the class. A curriculum must change in ways that allow the computer to be used to support the educational process. Imagine teaching a science class before and after the development of the microscope. While the same concepts may be taught with or without a microscope, the use of the microscope certainly makes the subject easier to see and understand. Only a change in your science curriculum would allow you to take advantage of this technology. This step would then lead to other changes in what you teach and how you teach it.

A moment in time and political issues may be the impetus for a change in a curriculum, for instance recent events such as the attack on the World Trade Centre and some political conflicts that lead to fights may demand new approaches to current problems (Lawton, 2001). These create new fields of study and add new emphasis to existing ones particularly on security and political issues. Changes in curriculum would include such issues that build patriotism and self-security to allow people's involvement in their country and own security. On the other hand political issues may lead to curriculum changes. For example, introduction of multiparty system would lead to the changes of parliament set up, election systems, some political positions and the likes, as a result this would enforce changes in some subjects ultimately the whole curriculum.

In other circumstances curriculums change in order to be realigned with new degree requirements or state mandates. Policymakers may institute these changes either to have the new curriculums reflect current research and theory or to prepare students for the latest trend in the job market. New ideas and new skills may have to be taught, a revised curriculum is the game plan to make that happen and this is the interface between the student and the content. It is the map (Smith, 2000). In doing so some curriculum changes substitute one topic or bit of information for another, while others just get longer. Curriculums in history, for example, continually add new areas simply because of the march of time.

Another factor is a need for a paradigm shift; that is, a shift in focus towards learning, rather than teaching, and towards a competence-based rather than subject-based

curricula that combines knowledge with the development of personal qualities and social skills. It is a paradigm that results from a vision of a learning society focusing less on the acquisition of information and academic subject knowledge, and more on the competencies required to learn and continue learning throughout life.

It is a shift from highly centralized time and subject-bound curricula, to blocs of content comprised of knowledge and competencies. According to Jansen & Christie (1999), these competencies range from sound basic literacy and numeracy skills initially acquired in the learners' mother tongue, to analytical, problem solving and critical thinking skills, to the personal qualities and social competencies required for social inclusion, co-operation and participation in social and economic life in a way that is respectful of the dignity of all. The paradigm shift also translates into a more practical orientation, as suggested in the move toward more functional knowledge and skills in many countries' current curricula contents. In addition to the traditional concern with content, the new paradigm attaches equal importance to the process of learning and to the need for partnerships in ensuring the arrangements required for effective learning and development of social competencies.

Some curriculum changes may be done in order to be realigned with new degree requirements or state mandates. Policymakers may institute these changes either to have the new curriculums reflect current research and theory or to prepare students for the latest trend in the job market. New ideas and new skills may have to be taught. A revised curriculum is the game plan to make that happen. It is the interface between the student and the content. It is the map to guide the introduction of new invented

concepts. In doing so according to Mazano (2012), some curriculum changes substitute one topic or bit of information for another, while others just get longer. For instance, the changing of curriculum in science subjects to accommodate studying in gas and fuel knowledge so as to march with time and demand of gas uses.

2.6 Reasons for Science Subjects Curriculum Change

Curriculum change always comes as an idea for the purpose of developing some ideas and issues that need to be changed according to time and society. There are different reasons why curriculum in science subjects change. One was based on the principles of making people and particularly learners to make science subjects as simple subjects to learn as other subjects and feel the subjects as part of their daily lives. Killen (2000) states that science subjects' curriculum reforms are designed to encourage all the people to be lifelong learners who will be responsible and productive members of society; and allowing learners to continually evaluate the dynamic interaction between the goal, and their actions, and feedback. Killen further argues that without making that, learners cannot identify ways to take action, evaluate their impact of their actions, or recognize their responsibility as learners.

On the other hand, it is argued that science curriculum reforms is inevitable since that it allows change and shift in approaches that allow learners much participation rather than relying on what teachers produce in the lessons Luehman and Barab (2003) point out that this shift in approaches involve curriculum and teaching strategies that embed content in rich inquiry contents through which learners appreciate content and those situations in which content has value. This helps learners to feel themselves as

part subject's instructional materials and other classroom practices. This also helps to reduce the load that has been shouldered to teachers including administrative activities and supervision of learners' academic development. Therefore, by changing teaching and learning approaches that give learners much room to participate in the lesson it makes learners take teaching and learning responsibilities part of their studying life.

Additionally, change in technological development always lead to change in science subjects' curriculum reforms. The inventions of highly modernised equipment in teaching and learning of science subjects necessitate the change in some concepts in order to match with what is needed in the new concept(s). for instance, the introduction of automatic motorcars which do not use manual gear that need a driver to press a clutch to enter gear had led to change in physics topic concerning automobiles gear and its function. Now the system has changed and other teaching and learning instructional materials should change to cope with new invention. Yip (2001) science curriculums should change to accommodate all new inventions so that everyone concerned with teaching and learning understands the matters arise and become more competent and be able to produce the required results.

The outbreak of new diseases in different environments has made thing change in science subjects' curriculums especially in biology where students have to learn topics concerning different illnesses. Mazano (2012) argues that, in some occasions some new diseases arise and people within the society have to get required knowledge concerning the diseases in order to beware of the new deceases; take an

example of Ebola diseases which were formerly not known by the people but which are also destructive to many people and not easily escaped. In such circumstance school is a first and good place where people can get a necessary knowledge and easily spread to other people within the society, thus by doing so science curriculum and in this case biology subject has to change.

Furthermore, the arising of new matters that were not or even known in the environment and which need to be addressed for the development of people and the society as a whole also lead to change in the science curriculum. Killen (2000) reveals that sometimes new things appear to people's environment and obliged people to get knowledge that would help them to handle and use the matter effectively; for example, the discovery of some gases which are very important for the development of the society while the society itself has no prior knowledge to develop and utilize the gases. In that case the society has to develop or reform its curriculum to insert new knowledge concerning this new arising matter and that is where curriculum has to change.

2.7 Effects of Curriculum Changes in Science Subjects

According to Jones (2002) curriculum change means making the curriculum different in some way, to give it a new position or direction. This often means alteration to its philosophy by way of its aims and objectives, reviewing the content included, revising its methods and re-thinking its evaluation procedures. Curriculum changes in science subjects have been influenced by different factors including the needs, interests or abilities of the learner; elimination of unnecessary units, teaching methods

and contents; introduction of latest and update methods of teaching and content, new knowledge and practices; addition or deletion of number of lessons/periods hours of instruction. Also, to correlate between the student's theory courses and learning practices; population growth and population pattern.

The aim of science subjects' curriculum change is to have a desired achievement at the end of its implementation. However, the implementation of desired achievements depends much on different factors/resources. Rogan and Grayson (2003) emphasise that those who are responsible for science subjects' curriculum change activities should understand what resources are available and the degree of resources available to support the change. There is always a need for support from curriculum developers to monitor the implementation of new curriculum changes and processes in each and every school. Support provided may limit the challenges teachers are encountering in their daily process of dealing with problems and questions related to curriculum.

Changes in science subjects' curriculum always arouse emotions and despair and at the same time if taken positively it raise hope, growth and progress. According to Jacobs (2004), regardless of training on new changes in the science curriculum that is given to the teachers which is meant to prepare them for changes, teachers always show the sign of confusion and struggle to apply changes in their classrooms. The adoption of new approaches in teaching and learning that shift the emphasis of learning and teaching away from the teacher as the main source of knowledge to learner – centred approach has affected many teachers who still view learners as merely receivers of knowledge who should always spoon fed what they have to learn. Therefore, one of the effects of science subjects' curriculum changes is seen in

teaching and learning of science particularly in approaches behind the learning and teaching.

Curriculum changes in science subjects involve changes in teaching and learning strategies that need also changes in teachers' attitudes and abilities to implement or use new strategies in presenting instructional materials to learners. According to Weber (2007), many science subjects teachers seem to be overloaded with unprecedented decision making authority and administrative work which result in them not having time to have proper lesson preparation and therefore making them to apply a self-centred approach in teaching even to topics that need to be shared by the learners themselves including practical sessions; however, despite changes in science subjects' curriculum that put much focus on the learner and reduce burden to teachers, many teachers complain about the changes and strategies embedded in it. Many science teachers are still struggling with some changes of policies and approaches in the curriculum, and are still facing challenges on whether to adopt or resist the new changes while facing those challenges. The fact that science teachers are expected to implement one change after another in curriculum might be the cause of their attitudes toward science subjects' curriculum reforms which lead them to resistance in knowledge and skills. Hargreaves (1995) argues that when science subjects' teachers are exposed to or trained in new knowledge and skills they often resist or reject the new knowledge and skills. They sometimes select what they want and delay acceptance of new reforms until other innovations supersede them.

Another effect of science subjects' curriculum changes is on the part of learners themselves. Many science subjects' learners seem to be affected by traditional

methods of teaching and learning that rely on teachers to control all variables of teaching and learning processes in and out of classroom. Science subjects' students seem to favour methods and strategies that give teachers much room to present instructional materials and concepts rather than having time to discuss and find solutions to matter arise in the concept taught or learned. Fleit and Wallace (2005) point out that, sometimes new science curriculum changes fail because of ignorance on the implementation part and especially teachers and their learners who may be because of undesire to change or inability to implement the changes they do not implement the required changes. In case of new teaching and learning approaches that need students to be active members in the classroom during instructional material presentation, many students are inactive and uncooperative that makes the approaches introduced immaterial and not functioning.

On the other hand, science subjects' curriculum changes seem to impact on resources like teaching and learning facilities, equipment and time. Green (2005) argue that it is necessary to understand change environment and the degree of resources available to support the change effort. Therefore, science subjects' curriculum changes as a long term development needs arrangement of content including text book revision, preparation of teaching and learning aids, training programmes to implementers, enough time for implementation and financing systems that would help the implementation processes to take off. Furthermore, there is a problem of facilities and equipment needed in teaching and learning particularly in science subjects where presence of well-equipped laboratories is very necessary.

Many science subjects' curriculum changes are put into action without considering its implementation process. Science subjects should be studied theoretically and practically; therefore, putting that in mind laboratories should be well established and equipped with all necessary apparatuses in order to facilitate smooth learning of the science subjects. Any science subjects' curriculum changes should be given enough time before evaluated so as to get its desired impact. Effects of newly introduced changes should be evaluated intensively and extensively; this can only be done if there is enough period of its implementation. However, many changes in science subject curriculum are not given enough time to work out before its first evaluation; this may not give out proper results (Jones, 2002).

Additionally, curriculum changes in science subjects have effects on teachers' attitudes due to understanding changes in curriculum that always leads to hindrance of its implementation. It is important to understand changes before developing or altering any curriculum reforms. Understanding changes might help curriculum development to identify problems that can hinder the success of the implementation of curriculum in time before undergoing many implications in the process of implementing the desired curriculum. According to Fleit and Wallace (2005) it seems that curriculum developers in science subjects have a tendency of overlooking many hindrances of curriculum, which might be the reason why the science curriculum is not reaching the goals that we are expecting during the development of the new curriculum reform; that, factors impacting the success of science curriculum reform include the inability of reform makers to accurately diagnose the systemic problems or correctly evaluate programmes before implementation.

The inability to evaluate the process of science subjects' curriculum implementation by curriculum developers might lead to several wastage of different resources. A great deal of time, money and effort may be wasted, as good ideas are never translated into classroom reality, policy makers and politicians only focus on desired curriculum change and neglect how the curriculum can be implemented. Therefore, it is necessary to understand science curriculum changes environment before initiating any curriculum change activity.

2.8 Teaching Science Subjects in Secondary Schools

The purpose of education is to enable the society to have a command of knowledge, skills and values which are necessary for a highly competitive and globalised society, arising from the impact of rapid development in science, technology and information. To reach this purpose of education, science subjects are responsible and play an important role in developing children's well-defined abilities in cognitive, affective and psychomotor domains. Kendra (2013) asserts that science subjects augment the spirit of enquiry, creativity, objectivity and aesthetic sensibility studying science subjects helps to understand the natural world that also helps to inculcate scientific literacy and culture for all, so that people can make informed choices in their personal lives and approach challenges in the work place in systematic and logical order, and to produce competent professionals in various scientific disciplines.

The teaching and learning of science subjects according to Silla (2009) is a conscious effort to raise the level of scientific literacy of all students and equip them with the

relevant basic integrated scientific knowledge needed for their own survival and for the development of the country. Also, it cultivates in learners an interest and love for science that argues for some to seek further studies in science as preparation for careers in science.

Lee (2005) contends that science subjects are being taught at all levels from primary school to university level to equip the learners with the fundamental scientific skills. This is to enable them to use the scientific knowledge in different situations. Hence, the science programmes focus on the skills that engage learners with the process of science like observing, recording, drawing, tabulation, plotting graphs; and abstraction and quantitative reasoning to occupy a more central place in the teaching and learning science. Lee furthermore argues that, science subjects are an integral part of the whole National Education System, which is based on the National Education Philosophy. It acknowledges that knowledge is the key determinant of the destiny and survival of the nation.

Teaching and learning of science subjects in Tanzania has been negatively affected by different factors that lead to some difficulties in effective implementation, this includes inadequate or lack of teaching and learning aids, teaching and learning methodologies, teachers' mastery of knowledge to teach the subjects, students' congestion in classes, inadequate or lack of laboratory facilities and frequent changes of the science subjects syllabus. Some science subjects' teachers have been criticised for not having or use different teaching and learning methodologies to enable learners to learn the subjects properly. Many of the teachers seem to employ lecture method

even in topics that need some practical works as a result students fail to capture the core concept of the taught subject matter.

Teachers seem to utilise teacher-centred methods that do not give enough chance to participate in the learning session ultimately learners becoming listeners and receiving end that rely much on what teachers teach. According to Nyoni (1990), teachers are encouraged to use different methods of teaching depending on the objectives of the topic and nature of the subject matter, however, they are encouraged to avoid the teacher-centred method as it does not give learners much room for critical analysis of issues; rather it enables to return facts to the sender. Therefore, whatever strategies the teacher determines to use for a particular topic, the aim should be to promote learner's participation for in depth understanding of the content taught because through the teaching strategies that involve learners' participation, the teacher motivates the learners to learn and helps them focus attention on the content, teaching and learning materials and objectives of the content.

Teaching methods applied by science subjects' teachers in the classroom have a great role in initiating classroom teaching and learning practice. The teaching approach that encourages collaboration between the teacher and the learner increases the rate of remembering basic concepts of the subject matter and allows more participation on the part of students (Dziwa et al, 2013). This includes teaching methods like discussions, practical works, problems solving and debates or motions. The transformation approach requires learners to participate in the generation of ideas like

in field trip or case studies or problem solving activities followed by reflection on issues involved.

Big number of students within a single class seems to be another setback to teaching and learning of science subjects in Tanzania secondary schools. Due to inadequate science facilities and equipment it becomes difficult to run some programmes especially practical session where apparatus are not enough to run the session within a given time of period. Teachers should have some skills that would help them to teach their students well despite their congestion in the classroom. That is, teachers must employ methods that would make all students participate in the learning session so as to understand the concept of the taught subject matter. Okeke (1990) says that, promoting students' learning processes is not an easy task especially in mass-instruction classrooms like many of the secondary school classes in Tanzania, teachers should be very careful and enough creative when teaching language skills in large classes of more than 40 students.

That is to succeed in proper teaching of such classes the best strategy is to group students and then assign each group a task which would give each student some practice in the targeted skill. If the class is divided into group of ten or less, it is easy for the teacher to move from group to group noticing individual problems and assisting them. This is purely student-centred strategy which helps to promote smooth science learning to students.

Teachers are asserted to use learner-centred method as this seems to be the best way of teaching and learning the science subjects. It is viewed as a free acquisition of knowledge by the learner through metacognitive, cognitive and socioaffective teaching and learning methods (Brown, 2007). Hence, free practice activities and group discussions should prevail. The teacher mainly supports the learning as an advisor or facilitator. In this view, there is learner-learner interaction whereby the learners exchange their experiences and learn from one another and from the teacher, who also learns from them. Sheri and Alison (2007) contend that learner-centred teaching-learning approach is very active as it presents a fundamental shift from the teacher being the centre of attention in the classroom to the learners as the centre of learning. In learner-centred approach pupil self-evaluation and full participation dominate in the learning process.

Metacognitive teaching-learning methods are kinds of methods that involve teachers and learners in planning for learning, thinking about the learning process itself as it is taking place, monitoring of learner's production or comprehension and self-evaluation of teachers and learners themselves (Brown, 2007). These strategies include pictorial demonstration that results into learner transferring the knowledge from the picture to the skill they learn and then the learner internalises the knowledge.

Cognitive teaching-learning methods are those which allow learners to use previous knowledge to solve some new learning problems. Thus are more limited to specific learning tasks and involve more direct manipulation of learning materials

(Thompson, 2001). This can also be achieved by the teacher involving learners actively in other classroom activities like practicing the tasks.

Teachers' mastery of knowledge to teach the subjects is very important aspect to the development of science subjects' teaching and learning. According to McGraner and Saenz (2009) learners' achievement depends to a great extent on teachers' abilities to foster rich conceptual understanding of academic content. However, many teachers are faced by the requisite content and pedagogical knowledge to teach for conceptual understanding.

This suggests that deficiencies in teachers are attributed to low quality teacher preparation programmes that fail to deepen teachers' knowledge of content and how learners learn content. Kim & Dopico (2014) maintain that teachers should have enough knowledge to understand the key concepts, fundamental principles and tools of enquiry in science subjects - a knowledge that would be utilised and transformed into sound instruction for learners learning. Additionally, Lee (2005) argues that science subjects' teachers must recognize the types and forms of curricular resources that facilitate learners learning content as well as appropriate assessment that serve as instructional, learning and assessment tools. Therefore science subjects' teachers must have solid knowledge of teaching the subjects.

In any situation, science subjects teaching and learning should involve a two way process between teachers and learners rather than employing banking approach where an instructor (teacher) simply makes deposits in to the learner. Education should be a

dialogical process; it should not involve one person acting on another, but rather people working with each other. Learners should not be viewed as an empty account to be filled by the teacher, should not be transformed into receiving objects and controlled their minds that inhibits their creative thinking, they should rather be involve in dialogue between them and the teacher. Therefore, the dialogic approach is needed in science subjects classes as this is very natural and involves mutual informal conversation between the teacher and learner and it thus helps learning to easily take place since both the teacher and the learner become part of learning process.

For good understanding of concepts and subject matter, teachers must be aware that learners are abstracting, and therefore meaning does not exist in isolation or in the words but in the context which the concepts are used. In that case learners must be well exposed to meaning of concepts through teaching and learning aids and other materials. According to Silla (2009), in order to make science lessons easy and enjoyable there should be a good use of instructional materials and aids because the poor performances in science subjects in most schools are the fact that the teaching and learning of it is verbal dominated. That the teachers and students do not have regular supply of the teaching and learning materials and where they are available they are so inadequate and obsolete. Teachers and their learners should be well supplied by enough teaching and learning materials to ease the whole teaching and learning process in and out of classes.

2. 9 Application of Constructivism Theory to Science Subjects Teaching and Learning

The desire to develop competence in learners especially in their study and acquisition of the science subjects' knowledge and skills suggests the building of scientific skills including observation, recording, computation, drawing, tabulation, plotting graphs and giving solutions to some scientific problems as attributed to Jean Piaget who articulated mechanisms by which knowledge is internalized by learners. According to Widdowson (2008) individuals are able to construct new knowledge from their own experiences through processes of accommodation and assimilation. When individuals assimilate, they incorporate the new experience into an already existing framework without changing that framework. This may occur when individuals' experiences are aligned with their internal representations of the world. On the other side accommodation reframing one's mental representation of the external world to fit new experiences. The theory describes how learning happens, when learners construct knowledge out of their experiences thus through this mode learners of science would be able to learn the subjects appropriately and develop their scientific knowledge and skill.

Teachers and learners of science subjects are urged to employ constructivism theory during teaching-learning sessions as this involves total participation of the learners under the guidance of their teachers. According Wood (2000), constructivist teaching is based on the belief that learning occurs as learners are actively involved in a process of meaning and knowledge construction as opposed to passively receiving information; that, learners are the makers of meaning and knowledge. This theoretical

framework holds that learning always builds upon knowledge that a student already knows; this prior knowledge is called a schema. Because all learning is filtered through pre-existing schemata, constructivists suggest that learning is more effective when a student is actively engaged in the learning process rather than attempting to receive knowledge passively. A wide variety of methods claim to be based on constructivist learning theory. Most of these methods rely on some form of guided discovery where the teacher avoids most direct instruction and attempts to lead the student through questions and activities to discover, discuss, appreciate, and verbalize the new knowledge.

Constructivist learning theory says that all knowledge is constructed from a base of prior knowledge. Children are not a blank slate and knowledge cannot be imparted without the child making sense of it according to his or her current conceptions. Therefore, children learn best when they are allowed to construct a personal understanding based on experiencing things and reflecting on those experiences (Eggen, 1979). Furthermore, in the constructivist classroom, students work primarily in groups and learning and knowledge are interactive and dynamic. There is a great focus and emphasis on social and communication skills, as well as collaboration and exchange of ideas. This is contrary to the traditional classroom in which students work primarily alone, learning is achieved through repetition, and the subjects are strictly adhered to and are guided by a textbook.

Constructivism theory is highly encouraged in science classrooms because it involves scientific activities like Experimentation by which students individually perform an

experiment and then come together as a class to discuss the results; Research projects whereby students research a topic and can present their findings to the class; Field trips which allows students to put the concepts and ideas discussed in class in a real-world context; Films which provide visual context and thus bring another sense into the learning experience and Class discussions which involve all of the methods described above.

Additionally, Coyle (1999) insists that, cognitive constructivism insists on learner's own responsibility to discover how new knowledge connects with prior knowledge. The learner continuously asks questions and guides his/her own learning process. The learner learns that there is not just one way to solve problems, but rather multiple ways to finding answers. The teacher's role is to anticipate and address student misconceptions while presenting authentic questions and real-world problems or situations. The teacher does not provide clear answers on how to solve these problems or questions, but guides students to make sense of how meanings of words work according to what their past experiences are and how it applies to the new knowledge they are constructing.

The constructivist view of learning is very important in teaching and learning science subjects as it gives learners the opportunity for concrete and contextually meaningful experience through which they can search for patterns, raise their own questions and construct their own models, concepts and strategies. Teachers apply collaborative learning that involves joint intellectual effort by learner, or learners and teachers together. Usually, students are working in groups mutually searching for

understanding, solutions, or meanings, or creating a product. However, in these collaborative classrooms, the lecturing/listening/note-taking process may not disappear entirely, but it lives alongside other processes that are based on learners' discussion and active work with the course material.

2.10 Empirical Review

A research done by Litshan L (2013) on the impact of the curriculum change revealed that inadequate resources, skills and knowledge and lack of pre-planning on new curriculum development adversely affect the teaching and learning of science in schools, hence it is proposed that curriculum development and reform be piloted before it is implemented as proposed in the model for the preparation of effective curriculum changes and development in science, the provision of science with well-equipped laboratories will play a greater role in effective teaching and learning of science in schools.

The paper conducted by Tupeni (2006) examined that the introduction of an innovation careful planning is necessary and this requires formulation of new goals and directions, and corresponding set of strategies and teaching materials appropriately designed to achieve the goals. It is usually concerned with improvement of ways and means of achieving established goals. Innovation and change make different demands on teachers and such demands have implications for teacher education program. But any teacher education programme designed to equip teacher with new curricula or to up- date their ideas and practices with respect to on-going curricula needs to be properly based on an understanding of the roles of teachers,

their tasks and responsibilities and their problems in curriculum development and/or implementation.

Jenkins (2001) in his study pointed out that many of the changes might have been anticipated, others are surprising and a cause for concern. The evidence suggests that in a significant number of schools less time is being spent upon practical activities in the laboratory and pupils are presented with a narrower range of laboratory activities. A substantial proportion of teacher's judge national curriculum science to be insufficiently flexible to allow them to meet the needs of all their pupils and provide them with an enjoyable scientific education.

Again, the study done by Litshan (2013) on the impact of curriculum change revealed that teachers feel that it is not necessary for them to change the way they teach, especially those who did not receive training on the new curriculum changes during their tertiary education. Also the finding indicate that lack of resources impact negatively on the implementation of curriculum reform in teaching and learning of science in many under resourced schools in rural areas, not easy for subject advisors to give relevant support because of inadequate resources and lack of human capacity.

Also Ajuwape and Olatoye (2004) in their study on the impact of planning on teaching and curriculum development of teaching and learning found that lack of qualified teachers, lack of practical work as well as lack of equipment's and facilities for teaching, insufficient allotment of time for integrated science on the school time

table and poor methods of teaching are the major factors militating against the successive implementation of the changed curriculum in integrated science.

Furthermore, Tobin and Imwold (1992) in their study viewed that teacher's experience difficulty during the implementation of a new curriculum and illustrate the efforts which can be applied to render the implementation effective. Also the study showed the dilemmas teachers experience and the obstacles they must overcome as they deal with the task of familiarizing themselves with the new concepts and approaches required. It emphasizes what students expect from their teachers and from school in general while they show limited interest in ways and means to reach their ultimate goals.

2.11 Research Gap

Many studies that involve the issues on science subjects' curriculum changes have documented much about the effects of science curriculum changes on presence of teaching and learning facilities and equipment (Kendra, 2013; Jones, 2002; Jansen & Christie, 1999); education development (Nyoni, 1990; Silla, 2009; Wamuza, 2005) and effects of science subjects' curriculum changes on students' academic performance (Jackson, 2006; Jones, 2002). Yet other studies have documented episodes about the challenges of science subjects' curriculum changes on teaching new concepts (Mohamed, 2004).

Despite the fact that some studies have documented much on sciences subjects' curriculum changes, not all researches have documented on the effect of sciences

subjects' curriculum changes on teaching and learning science subjects particularly in secondary schools, thus warranting further examination to determine unequivocally the role that science subjects' curriculum changes play with regard to teaching and learning of science subjects. Moreover, of all the studies done about relationships between science subjects' curriculum changes and its effect on teaching and learning science subjects, apparently, no study has been conducted on this particular relationship within Tanzania. The proposed study therefore sets out to bridge this gap by examining the effect of secondary school curriculum changes in science subjects on teaching and learning in Tanzania.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Overview

This chapter presents the research methodology that guided the study. The sections included are research approach, research design, the area of the study, the population sample, sampling techniques, data collection methods and instruments, validation of instruments, the data analysis plan, and issues relating to the ethics in conducting this particular study.

3.2 Research Approach

This study employed qualitative research approach. The study made in-depth inquiry through interviews, focus group discussions and documentary review. This qualitative approach was used to explore if curriculum changes require changes in teaching methods, examining if teachers have mastery of subject matter required by changes in school curriculum and to assess if curriculum change goes with availability of teaching and learning materials. Moreover, the approach was used to examine the rate of performance of science students before and after science subjects' curriculum changes using written documents. Qualitative research approach provides opportunities for the researcher to obtain detailed, thick description, in-depth inquiry, direct quotations capturing people's personal perspectives and experiences (Patton, 1990).

3.3 Research Design

According to Kothari (2004), research design is the conceptual structure within which research is conducted; it constitutes a blueprint for the collection, measurement and

analysis of data. Research design helps to facilitate the smooth sailing of the various research operations thereby making research as efficient as possible yielding maximal information with minimal expenditure of effort time and money.

This study based on Descriptive Survey Design. According to Omari (2011), Descriptive Survey Design is very analytical, conceptual and inferential which describes existing conditions and comparing groups of respondents. Therefore, in this study descriptive survey was used to gather and analyse data in the context of qualitative approach.

3.4 Area of the Study

Area of the study refers to the place where the data of a certain given study are to be collected by the researcher (Frankfort, 1996). The study was conducted in Mara region particularly in Musoma Municipality secondary schools. Musoma municipality is one among the six districts in Mara region in Tanzania. It is situated on the shore of Lake Victoria (peninsula) whereby the whole municipal is a peninsula. It is bordered by Bunda district in the South, Musoma rural and Rorya districts to the West; and Tarime and Serengeti to the East.

Musoma Municipality was purposely selected because it has many public and private secondary schools that helped to provide the needed information from teachers and students of different background and socio-economic status. Moreover, the researcher is a student of the open university of Tanzania at Mara regional Centre, thus it was easy for her to collect data in those selected secondary schools.

3.5 Target Population

Population is any group of individual who have one or more characteristics in common that are of interest to the researcher from which one can collect data for the study (Kothari, 2004). For sake of this study the population was all form two and form four students from all secondary schools in Musoma Municipality, all heads of schools, all academic mistress/masters and all science subject teachers in Musoma Municipality.

3.6 Sample

Sample refers to the relatively small part of the population who are actually chosen to participate in the study (Denscombe , 2010). Since it was difficult for the researcher to gather information from the whole population, four secondary schools out of 25 located in Musoma municipality and a total of 109 respondents including head masters/mistresses, teachers and students were involved in the study. The sample population represents the actual characteristics of the whole population (Cohen et al, 2000).

Public and private schools were randomly selected in order to cross link and get a holistic picture on how curriculum changes in science subjects affect teaching and learning in secondary schools. The names of all 25 public and private secondary schools in Musoma municipality were written in pieces of paper, the papers were then thoroughly mixed in two small boxes where one of the boxes had the names of public secondary schools and the other had the names of all private schools. Then, two pieces of papers from each box were picked up to find out which schools have been

selected to represent other schools in the municipality. The selection of both public and private schools helped to diversify the context of the study in order to collect comprehensive information.

3.7 Sampling Technique

Kothari (2004) maintains that, sampling technique is a procedure that the researcher adopts to select items for the sample. It is the process of selecting a sample from the target population to represent the population in the study. The sample for this study was selected using two techniques, namely; simple random and purposive sampling techniques. Purposive sampling is the one in which the researcher selects samples based on certain purposes. It helps the researcher to increase the utility of findings (Enon, 1998). Simple random sampling refers to the method of selection which gives each sample combination an equal probability of being picked up and equal chance of being included in the sample (Kothari 2004).

Students: Form two and four classes were purposively selected from each school to participate in the study. They were purposively selected because of being in classes which do national examination. In collaboration with teachers from each school, the participants were randomly selected to get ten pupils from form two and ten others from form four. Then these students were involved in interview to find out what were the reason behind of their performance (pass or fail) and also how the changes of curriculum affected their learning of the subjects and their performance in general. However, the simple random technique was also used to get few students who participated in the focused group discussion.

Teachers: Teachers from all four-selected public and private secondary schools were purposively selected to get all science subject teachers and academic teachers on the basis that all these are concerned with science subjects' development and its teaching – learning process.

Heads of Schools: All four heads of schools of the sampled schools were purposively selected because of their responsibilities in school leadership and supervision of school's daily routines including academic matters. Heads of schools are in charge of schools so they are always aware of whatever is happening in their schools with how teachers teach and how students learn; and are the first to be informed about all changes in academic issues in their respective schools. Table below shows the details of the sample.

Table 3.1 : Composition of Respondents in the Study

Categories of Respondents	Expected (N= 124)	Studied (N=0)	Percent
Heads of Schools	4	4	100
Teachers	16	12	75
Students	120	93	77.5
Total	140	109	78

Source: Field data, 2015

3.8 Methods for Data Collection

Data were collected using Interview, Focus group discussion (FGD) and document analysis.

3.8.1 Interview

In this research the researcher employed semi-structured interview to gather information from respondents. This involved heads of school, academic teachers, science subjects' teachers and few students.

Semi-structured interview was employed in this study because of its flexibility in collecting data that is focused to the intended information. Also, the information from interview helped to supplement information collected through documentary analysis and group discussion. This method allowed the researcher to find out what is in and on someone else mind and enabled the researcher to obtain information that is not directly observable. It is a method that builds trust and rapport with the informants thus it is possible to obtain information that individuals would not reveal by any other data collection methods (Robson, 1999).

3.8.2 Focus group discussion (FGD)

According to Mbogo et al (2012), Focus group discussions are basically discussions conducted by a researcher with a group of respondents who are considered to be representatives of the target population; such meetings are usually held in an informal setting and are moderated by the researcher. Focus group discussions were conducted with students. The discussion involved two groups of twenty students each. The first group was formed by students from two selected public secondary schools while the second group was from two selected private secondary schools. Since all schools were within the Municipality and students can be easily collected, then the discussion were conducted after normal class hours in order to avoid interruption in classroom

instructional hours. FGDs were considered necessary because they give an opportunity for in-depth discussion with a large group of people in a relatively short time and can provide a certain synergy that can explore new or unexpected information or reactions. Basically, open ended questions were used to allow flexibility and additional information on the intended concept.

3.8.3 Documentary Review

Through documentary vast amount of information are conveniently available without much cost, without delay, without prior appointment, without the need for authorization and without any likelihood of ethical problems, (Denscombe , 2010). From documents the researcher was able to obtain data on teachers' schemes of work, lesson plans and lesson notes. The information helped the researcher to find out how teachers do prepare their lessons while not competent with the subject matter.

3.9 Validation of Instruments

The following techniques were used to ensure the validity of instruments and data collected.

Back Translation: Interview and group discussion questions were initially prepared in English and then translated in Kiswahili which is the most known and widely spoken language in Tanzania to facilitate effective and easy communication with participants.

Expert opinions: The interview and group discussion questions were given to some experts so as to provide their comments on the content validity of instruments in relation to the focus of the study. Invalid questions were rephrased and others were removed.

3.10 Data analysis Procedure

3.10.1 Data Explanation from Interviews and FGDs

Interviews and focused group discussion were conducted in the Kiswahili language to allow participants freedom of expression. The notes taken from interviews and FGDs were translated *in English without distracting the original meaning from respondents. To maintain the realistic* nature of data collected the researcher had different files to keep responses from each category of participants and from focused group discussion that were labelled to differentiate them. This helped to avoid mixing of data during analysis stage. Data collected from interview and group discussion were coded and categorised according to research questions, and in some cases were presented as quotations

3.10.2 Data explanation from Documentary

Information obtained were summarized and presented in table

3.11 Ethical Considerations

In order to abide by research ethics, the researcher obtained a research clearance from the Director, Research and Publications of the Open University of Tanzania, the Regional Administrative Secretary (RAS) of Mara region, and District Administrative Secretary (DAS) of Musoma Municipality. Institutional informed consent to conduct the study and participants consent to participate in the study were sought from the Municipal Director, secondary schools' heads, teachers, and students. On meeting the participants, the researcher introduced herself and explained the purpose of the study. Participants were further informed that they have a right to participate in the research or not to. To ensure confidentiality, the researcher protected all information obtained from respondents and their identities were kept anonymous.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Overview

This chapter presents; analyses and discusses the findings on about the effect of curriculum changes in science subjects on teaching and learning in the study location. The findings of the study are organized and presented in accordance with the three research tasks that guided the study. The tasks focused on the exploration of whether curriculum changes require changes in teaching methods, examining the effects of curriculum changes on teachers have mastery of subject matter, and assessing the effects of curriculum change concerning the availability of teaching and learning materials.

4.2 Exploration of whether curriculum changes require changes in teaching methods

The objective was to find out whether curriculum changes require changes in teaching methods. Interviews and group discussions were conducted to both teachers and students. They were asked to give views on whether there is a need to have changes in teaching methods after having the curriculum changes. In an interview with the heads of schools, it was revealed that, generally, curriculum changes should go hand in hand with changes in teaching methods so as to cope with the new inventions introduced in a new curriculum. That is, teaching and learning methods should be transformed in accordance with the new introduced concepts that are to be taught and learned in classes and that curriculum changes are made to match with time and technological development which change time after time though many

transformations done to our curricular do not consider country's economic and technology development and ability.

One of the head of school had this to say:

“Basically, curriculum development or changes particularly in the science subjects are important and inevitable; however, these changes would have better academic achievements to students enrolled if issues of teaching and learning methods, and technological development had been considered. It is really difficult to change our curriculum and introduce new ideas that need teachers to have new skills and modern teaching methods and also schools to have very advanced labs while we even do have simple labs in schools. We would always end up in failing science subjects’ examinations with whatever efforts we put in.”

The finding above indicates that curriculum changes are inevitable as it aims at developing subjects’ instructional materials delivered to students. However, there would be good science subjects’ academic performance if those changes consider the changes of teaching and learning methods in order to enhance fruitful teaching and learning of science subjects. Changes should be made to teaching methods to enable smooth teaching for the new invented concepts and allow both teachers and students to have a good understanding of the subject matter. Silla (2009) contends that any curriculum change should consider different factors before it is put in place for utilization, that changes should consider most important issues needed to be addressed like teaching and learning methods, aids, skills and presence of text books;

and should not be done for the sake of promoting certain class or group of people within the society.

It was further disclosed in the interview with one of academic teachers that changes should always be done together with changes in teaching and learning methodologies as long as these changes aim to insert new innovations and important needed materials that would be useful for the academic development of teachers, students and the society as a whole, but problem is how these changes are done in our country.

One respondent had this to say

“These curriculum changes particularly in science subjects are astonishing the ways are done. As I said before that changes are important especially in relation to the change of time and environment, but problem is how these changes occur. For instance, you may see changes are done in a curriculum by inserting new inventions that are supposed to be taught using new teaching methods; however, no changes are made to teaching methods as a result compelling teachers to teach new concepts using existing or old teaching methods.”

The finding above implies that many changes done to the science subjects' curriculum are improperly done as they do not consider changes in teaching methods. It is argued that these changes are not perpendicular to the changes in teaching and learning methods that causes problems to teachers during implementation of the curriculum in classrooms. Any curriculum change should consider technical advice from the related expert in order to come out with important and needed issues to be

invented and not just introducing new concepts while teaching and learning methods remain unchanged to cope with new introduced concepts. Gatawa (1999) argues that for renovation/change to occur it requires expert itself and should be motivated by the desire to learn new concepts and inventions, these should be taken as the basic condition that can accommodate and accelerate change; and therefore, it is important to note that there must be all the needed ingredients that would help to accomplish the required changes like teaching and learning equipment and facilities, teaching and learning methods; and qualified implementers of the curriculum. It is also added by Dziwa et al (2013) that curriculum change is not a matter of supplying appropriate technical information, rather curriculum reformation involves changing of attitudes, values, skills and relationship. This means that changing curriculum is not merely an issue of just changing subject contents it should cut across different factors in and out of school.

It was further reported by students that changes in teaching methodology is inevitable. This is because in science things change day after day, thus it is necessary that when changes are done to incorporate the new concepts in the curriculum, teaching and learning methods should also change to facilitate the learning of the concepts. It was exemplified by one student that nowadays there are some epidemic diseases arising like Ebola and Zika that were not studied in biology syllabus and which also should be addressed to the society starting from school level so as to learn on how these diseases are transmitted, the signs and prevention; eventually this needs some changes or improvement in the curriculum to accommodate them.

Therefore, since these are new concepts to be learned, there should be new or transformed teaching and learning methods that would help to easily learn these diseases. On the other hand, students argued that it is essential that teaching and learning methods are transformed so as to simplify the learning process of the science subjects; claiming that, science subjects seem to be difficult to learn because of the ways they are taught by the teachers. In that sense there is a need of transforming teaching and learning methods in order to attract many students to learn the subjects. This argument is supported by Dziwa et al, (2013) that, teaching methods applied by science subjects' teachers in the classroom have a great role in initiating classroom teaching and learning practice; the teaching approach that encourages collaboration between the teacher and the learner increases the rate of learning and remembering basic concepts of the subject matter and allows more participation on the part of students. Therefore, teachers are encouraged to apply approach that requires learners to participate in the generation of ideas.

Again, from the group discussions with students, 75 out of 93 students (80%) supported the idea of having changes in science subjects' curriculum but argued against having changes in the curriculum without changing teaching and learning methods. It was affirmed that if changes are properly done and effectively implemented then secondary school graduates will acquire adequate skills to be enough competent. They will be able to explain phenomena, applying their knowledge in daily life, use and maintain domestic appliances, use sustainable energy conversion system for environmental conservation and also use of I.C.T tools in accessing information (Nyirenda, 2012). The students further explained that studying

science subjects in Tanzania nowadays seems to be an unbearable burden that many cannot carry. This is because the subjects are hard to learn and understand but also teachers are not competent enough to teach these subjects particularly to new introduced topics that have been put due to curriculum changes while teaching methods remain unchanged and teachers have not undergone any courses to sharpen their skills and teaching methods to teach those new introduced and changed topics.

The discussion equally revealed that changes in science subjects' curriculum are important as they allow new innovations that occur in this world day after day. That, there is no way you cannot allow changes in science subjects' curriculum because scientists are tirelessly working to discover new things and highly proving the existing ones. But the students further maintained that any changes done to our curriculum should first consider changing in teaching methods and teachers' competency and abilities to handle those new teaching methods so as to be able to teach the new introduced topics. If curriculum changes do not go hand in hand with changes in teaching methods and teachers are not well equipped with technical skills to handle new teaching methods, they would not be confident in teaching as a result they would not teach that particular subject or topic and no any student would be eager to learn ultimately there would be a great failure as it is always happening.

One of the students said that

“Curriculum changes are important in academic development but if they do not consider changing in teaching methods then they seem to be insignificant. Teaching methods are very important in transferring new knowledge to the

learner, thus it is very essential to change teaching methods according to the changes of curriculum so as to enable proper teaching and learning.”

The finding suggests that any curriculum changes should first consider changes in teaching methods and teachers' abilities to employ these new teaching methods to enable them teach newly introduced topics or concepts because if that would not happen teachers would be incapable of delivering intended materials to the learners ultimately students will learn nothing from them. It is important to consider teaching and learning methods including teachers' abilities to use the methods to teach and facilitate learning to their learners as teachers are first and prime facilitators to students, in that case if teachers are not well equipped with enough skills to employ required methods to deliver what is needed to the learners then there would not be effective teaching and learning and eventually students will fail their examinations. Lee (2005) explains that, curriculum changes should always involve changes in teaching and learning methodologies and teachers need to be prepared to cope with the changes.

Their teaching skills and knowledge to implement new introduced concepts should be improved and ensure that they are competent to implement and assess the new changes so that students as consumers of the implemented curriculum are comfortable and aware of the changes and give orientation of how they can go about learning. This means that, going through changes without involving changing in teaching methods and teachers' abilities to implement the new methods is like sailing in a big sea without direction. Teachers are the ones who show direction to students and direct them what and how to learn, they simplify what has been briefly written in

the curriculum, with what teaching-learning aids to be used and proper methodology to learn such a needed topic or concept.

Moreover, the focused group discussions disclosed that changing in teaching methods in curriculum changes is very important because one of the reasons to change curriculum is to change ways of teaching and learning and the subject matter to be taught and learned. In respect to the changing of teaching and learning methods, curriculum changes are done to allow methods that involve learner's much participation rather than relying to what teacher is teaching. The changes should allow methods that give students enough room to participate in the learning process and be as source of knowledge instead of being passive in the classroom and expecting to get much only from the teacher.

One student stated:

“We all agree that there are important reasons for curriculum changes including development, time changes, new knowledge and society as a whole. But one of the prime reasons is to change teaching methods that make a learner depending much on what teacher teaches and make the learner as a blank slate that has nothing to contribute in the whole learning process.”

The above finding contends that it is important to make changes in teaching methods because the methods should be the ones that allow learners to fully participate in the learning process rather than relying much to what teacher teaches them. That the changes of curriculum should involve changes in teaching methods in order to reform the traditional methods that make the teacher as centre of learning and source of

instructional materials. There should be new teaching methods that arouse students' participation so as to improve their thinking capacity and memory of learned concepts.

This view is substantiated by Nyoni (1990) that, teachers are encouraged to use different methods of teaching depending on the objectives of the topic and nature of the subject matter, however, they are encouraged to avoid the teacher-centred method as it does not give learners much room for critical analysis of issues; rather it enables to return facts to the sender. Therefore, whatever strategies the teacher determines to use for a particular topic, the aim should be to promote learner's participation for in depth understanding of the content taught because through the teaching strategies that involve learners' participation, the teacher motivates the learners to learn and helps them focus attention on the content.

Therefore, on the basis of the arguments given by the respondents, it is clearly agreed that any curriculum changes should also involve changes in teaching and learning methods in order to cope with newly introduced or transformed content. However, many respondents validated that, the reformation of those teaching and learning methods should be the ones that present a fundamental shift from the teacher being the centre of attention in the classroom to the learners as the centre of learning whereby learners' self-evaluation and full participation dominate in the learning process.

4.3 Examination on whether Teachers have Mastery of Subject Matter required by change in School Curriculum

The second task was to examine if teachers have mastery of subject matter required by changes in school curriculum. The researcher was interested to know whether teachers have mastery of subject matter required by change in school curriculum. Therefore, documentary review, interview and focused group discussion were used to acquire the needed data.

In an interview with the teachers, it was revealed that, generally many teachers have little mastery of subject matter required by changes in school curriculum particularly to those who start to implement the changes for the first time. This happens to both teachers and students and in most cases it affects students who have to be evaluated through examinations. It was found that many teachers are faced by inadequate skills to implement the content required by the changes in curriculum especially during the time of teaching some new concepts that they are not familiar with.

It was stated by one of the teachers.

“It is true that students are highly affected because they have to be judged for what they have learned through examinations regardless of whether they have been effectively taught or not. However, even teachers are affected with the changes because many of them have no or have little mastery of the subject matter that is required by the changes of the curriculum. We seriously need trainings soon after the changes in order to have full mastery of the subject matter required by the changes in school curriculum. Standing before

students and teach something that you are not competent with is a big problem because it reduces your confidence and eventually despised by the learners.”

This finding shows that many science subjects' teachers lack or have little knowledge of the subject matter required by the changes in school curriculum as a result it affects their ability to teach in classes. This shortage of mastery in subject matter leads to students' poor performance in science subjects. This is happening early from teaching stages whereby teachers are incompetently presenting the subject matter to students thus misleading the students, and at the same time students are studying something they believe to be true but at the end of the course they meet with different concepts from the ones taught to them, as a result it leads to total failure of the students.

The finding further explains that, whenever changes are done there should be in-service training to acquaint teachers with proper and required skills that would help them to teach their subjects without problems and confidently. According to Spyker and Malone (1996), there are always some difficulties experienced by teachers during the implementation of a new curriculum especially when teachers have no essential skills and knowledge to present the required content. There should be some efforts which can be applied to render the implementation effectively and remove all the dilemmas and obstacles that are faced by teachers as they deal with the task of familiarizing themselves with the new concepts and approaches required. Meanwhile, Clabaugh and Rozycki (1999) add that teachers want to enjoy teaching and watching their students develop interests and skills and esteem for what they as teachers expect,

and they also want to work at discovering and codifying the effective practices of their profession. Therefore, they often need to belong to subject matter that they are familiar with in terms of knowledge and skills.

Again, it was disclosed by teachers that due to lack of mastery of the subject matter required by the changes in school curriculum, some teachers tend to skip some topics or concepts that should be taught to a certain level of classes as teachers have nothing to present or share with students. This was highly lamented by mathematics teachers who complained about the inclusion of accounts topic in mathematics subjects while the teachers themselves have never studied accounts before or even trained on how to teach accounts when come across such topic. Due to this situation teachers have to hire some teachers who teach accounts to help them teach the topic/concept, but this happens to those schools which also have a combination of Commerce and Book-keeping because it is easy to acquire that service from teachers within the school itself.

However, it is always difficult and impossible for those schools that have no accounts combination as teachers who have to teach the topic should come from other schools and they have to be paid by the teacher who is responsible to teach mathematics as a result no any mathematics' teachers is bothered to bear that burden for students and ultimately students miss opportunity to learn that topic.

One of the mathematics teachers who was complaining about teachers' lack of mastery of subject matter required by changes in school curriculum stated that:

“It is always easy to sit in the office and thinking of changes that you want to put in the curriculum but when it comes to the implementation, it is the teachers who suffer consequently. For instance, you include accounts topic in mathematics subject while we teachers have not studied accounts or even attended service course for teaching the topic and other topics with the same systems and you expect me to teach the topic for students to pass, do you think am I going to deliver?”

The above finding shows that if teachers lack mastery of subject matter that is needed in the changes of curriculum it would affect students’ learning flow as some topics may not be taught to them. That, lacking mastery of the subject matter causes some teachers not to teach some topics that are in the curriculum and by doing so it affects students’ academic performance because they may fail their examinations due to the little knowledge they have or do not have concerning such particular topics. Teachers should have enough knowledge and mastery of the content they have to implement so as to facilitate the meaning of curriculum changes in schools. Fazel (2009) asserts that, curriculum change is a learning process for teachers and for their schools thus good understanding of the content that is, mastery of the subject matter and clear conceptions of curriculum are necessary conditions for improved implementation of new curriculum into practice.

Changing the way teachers teach and students learn requires specific approaches, if curriculum reform aims at changing the ways students learn and teachers teach, more sophisticated implementation and in-service trainings to teachers should be emphasized; that is, teachers should be well equipped with the content they should

give to the learners and should have variety of teaching and learning methodologies to teach all the new concepts included in the changed curriculum.

From Fazel's view point, it shows that any fruitful implementation of new curriculum should put forward teachers' abilities to implement it. This includes teachers' mastery of the subject matter required by the changes in the curriculum. Teachers should be well trained before involved in the implementation stage so as to find out the strengths and weaknesses of the changes made in order to rectify the setbacks seem to raise and impede the prosperity of the new changes.

It was further disclosed in the discussion with the students that curriculum changes in this country does not give enough opportunity for teachers to learn and familiarise to the required subject matter ultimately makes teachers to implement the changes aimlessly. Students argue from that many teachers who are to implement the changes particularly for the first time seem to face many difficulties because they always lack mastery of the required subject matter and teaching and learning skills. Students argue that, many teachers lack control of the subject matter in the new changes school curriculum as a result they merely teach based on their former experience which sometimes does not work due to needed new skills.

One of the students contented that:

“It seems that many curriculum changes do not consider or give opportunity for teachers to change. The changes are done in papers but not to those who have to implement them in classes. Teachers do not get in-service training to

brush their skills so as to properly implement what is needed in the curriculum.”

This finding justifies that many teachers do not have mastery of subject matter required in the changes of school curriculum this is because the changes made do not consider them as part of those changes as far as implementation of the changes is concerned. This means that teachers should be trained to handle and implement the changes in terms of subject matter and teaching and learning methodologies. Teachers should be facilitated to have mastery of the subject matter required in the changed curriculum so as to implement it to the learners as it is supposed to be.

This view is supported by McCombs and Whisles (1997) who argue that after the curriculum changes the educators (teachers) competency in terms of knowledge should not be questionable as they should be made capable of handling and manipulate the subject matter, they should not hesitate when presenting new knowledge; therefore, it should be made clearly that curriculum changes do not adversely affect learners' academic performance due to inappropriate teaching and learning rather it should make them easily accept new inventions from knowledgeable teachers.

It was further revealed by students that, in many cases teachers do not have required subject matter because they are not involved in any stage of the curriculum changes. The changes are made are at the top and sent down at school levels for implementation while implementers have no knowledge of how to implement the newly introduced concepts. There is no any point where teachers are contacted for

their inputs so as to get their views especially on the part of implementation at the school levels; lack of close working relationship always hinders progress of implementation of the new changes in the curriculum and hence to meet the intended objectives.

Lawton (2001) asserts that, teachers and other education stake holders need to be involved in the process of curriculum amendments to instil them with the required knowledge and understanding in order to facilitate smooth implementation of the curriculum content. Also, teachers and learners need to be prepared to cope with the changes and improve their skills and knowledge so that their competence is ensured in the implementation stage.

From the documentary review, the researcher was also able to obtain the data on teachers' schemes of work, lesson plans and lesson notes. The researcher was interested in finding out how the lack of mastery of subject matter affects the ability of teachers preparing their schemes of work, lesson plans and students' lesson notes. The researcher recognised that many teachers had problems with their lesson plans particularly on presentation stage, types of teaching aids to be used and evaluation stage.

When asked to explain what was the problem behind that many teachers complained about the changes of school curriculum which demands them to have required knowledge to prepare the lesson plans on a learner-centred basis of which none of them had even the knowledge on how to prepare the lesson plans. It was found that

out of 12 teachers who were involved in this category, 6 (50%) teachers had problems in presentation stage while 3 (25%) teachers had problems in evaluation stage and other 3 (25%) teachers had problems in preparing types and teaching aids to be used. Figure 4.1 provides a visual picture of the problems faced by the teachers in preparing lesson plans.

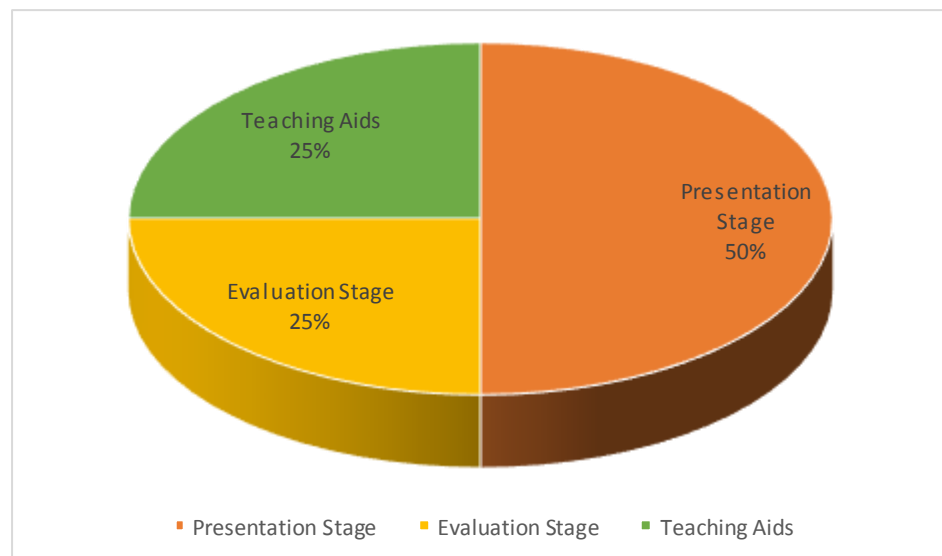


Figure 4.1 : Problems faced by the teachers in preparing lesson plans

Therefore, concerning the question of if teachers have mastery of subject matter required by changes in school curriculum, the study found out that many teachers have little mastery of subject matter required by changes in school curriculum particularly to those who start to implement the changes for the first time. Moreover, it was found that due to lack or inadequate mastery of the subject matter, many teachers tend to skip some topics which should be taught to the students ultimately it highly affects students who have to be evaluated through examinations regardless of

whether they have been taught or not as a result it leads to students' poor academic performance.

On the other hand, based on the details given by both teachers and students and other data from documentary review, it was generally found that due to shortage of mastery of subject matter required by the changes in school curriculum many teachers are faced by inadequate skills to implement the content especially during the time of teaching some new concepts that they are not familiar with. Fazel, (2009) expresses that teachers should be well equipped with the content they should give to the learners and should have variety of teaching and learning methodologies to teach all the new concepts included in the changed curriculum.

4.4 Assessment on whether curriculum change goes with availability of teaching and learning materials

The third task was to assess on whether curriculum change goes with availability of teaching and learning materials. The researcher wanted to know if whenever there is a change in curriculum teaching and learning materials are made available in relation the changes done. To get the views, interview with teachers and focus group discussion with the students were conducted. It was disclosed in the discussion with the students that many changes of curriculum do not go hand in hand with the availability of teaching and learning materials because some newly introduced concepts are started to be implemented to students while there are no enough materials that have been prepared to support learning as a result many students fail in their subsequent examinations.

This was referred to the changes that led to the merging of two science subjects of Physics and Chemistry to come out with one subjects known as Physics with chemistry. It was said that, the introduction of this new subject was put into implementation while there were no any teaching and learning materials prepared like books or others manuals to help students and teachers.

One of the students explained:

“It should be remembered that in the early 2004, the government made some change in the science subjects’ curriculum by merging two science subjects Physics and Chemistry to get one subject known as Physics with Chemistry or Physi-chemistry while removing agricultural subjects and Bookkeeping and Commerce. These changes highly affected students because there were no any preparations for teaching and learning materials for this new subject while teachers were also not prepared or even trained on how to teach the subject, eventually, teachers decided to teach the subject separately as it was before thus put students in dilemma whether they learn Physi-chemistry as a single subject or Physics and Chemistry as two different subjects.”

From the above finding, it is clearly shown that when the changes are done the issue of teaching and learning materials are not considered as important part of curriculum changes. This seems to affect students’ trend of learning from one system to another as explained by one of the students above. Teaching and learning materials are very essential tools to simplify teaching and learning processes and help both teachers and learners to acquire the required content of the subject. It seems that some changes are put into implementation without undergoing proper investigation on what kind of

teaching materials to be used and its availability especially in peripheral areas where studying of science subjects meet with many challenges.

According to Silla (2009), in order to make science lessons easy and enjoyable there should be a good use of instructional materials and aids because the poor performances in science subjects in most schools are the fact that the teaching and learning of it is verbal dominated. That the teachers and students do not have regular supply of the teaching and learning materials and where they are available they are so inadequate and obsolete. Teachers and their learners should be well supplied by enough teaching and learning materials to ease the whole teaching and learning process in and out of classes.

Again, it was said in the discussion that curriculum changes do not put in place the availability of teaching and learning materials according to the changes occurred as a result it compels teachers to teach science subjects like other social science subjects like History, Language and Geography. In most cases due to lack of teaching and learning materials science subjects are taught through lecture method while students experience very few practical sessions.

One of the students contended that:

“Learning of science subjects needs more student participation in every step of learning. Furthermore, it needs more practical works instead of relying much on lecture method like language subjects learning. However, big problems in schools is lack of teaching and learning materials including scientific facilities like laboratories and other related equipment as a result

students learn more theoretically with merely the use of diagrams for further elaborations.”

Additionally, in the interview with teachers it was pointed out that, in many occasions changes in curriculum do not consider the availability of teaching and learning materials. Changes are introduced and implemented while materials are not available ultimately teachers and students end up in studying practical sessions in a theoretical manner. This even led to the introduction of alternative to practical examinations where students have to do practical sessions without entering in the laboratory only doing theoretically. Students do not have enough laboratory sessions because of the inadequate or lack of facilities. That, students do not work in labs particularly in Physics and Chemistry where you need to have some chemicals and other electrical equipment. It is at least simple to have practical session in Biology subject because you can even use natural specimens found within the school or home surroundings.

The teacher continued by saying that:

“The only method of teaching Science subjects is through theory perpendicularly with practical sessions and not teaching science as if you preach in the church. A student who learns science is prepared to be more practical oriented therefore he/she needs to spend much time in practical works. It is difficult to have practical sessions in Physics or Chemistry because you must have scientific materials; however, it is sometimes simple to have Biology practical sessions because some needed materials can be found within our own environment.”

From the two above findings it is clearly that changes that are done in the curriculum do not consider the availability of teaching and learning materials ultimately it affects the whole teaching and learning process of science subjects as the subjects are taught more theoretically. Kinder et al (1999) argue that, the availability of teaching and learning materials should never be underestimated in any learning stage as these are very crucial devices to enable the learners to capture what is taught and helping them to build up an inner memory of the concept learned.

Therefore, from both findings from the students' discussions and teachers interview it is found that the many changes in school curriculum particularly in science subjects do not consider the availability of teaching and learning materials which seems to negatively affect the teaching and learning of science subjects in secondary schools. Bailey (2006) argues that learning of science subjects in developing countries is more dominated by teachers and little chance is left for exploration on the part of the learner and in most cases it is a textbook talk that is often tightly controlled and generally lacks many substantial elements of learner's participation due to limited teaching and learning materials. Despite some improvements made in the developing countries subjects' curriculum at least to cope up with the changes in time and scientific development there is still a problem of inadequate supply of teaching and learning materials to support learning in schools thus affecting the learning of science subjects.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Overview

This chapter summarises the research findings, makes conclusions and gives pertinent recommendations.

5.2 Summary of the Study

This study sought to examine the effect of secondary school curriculum changes in science subjects on teaching and learning. Specifically, the study sought to: explore if curriculum changes require changes in teaching methods, examine if teachers have mastery of subject matter required by changes in school curriculum and to assess if curriculum change goes with availability of teaching and learning materials.

This study was conducted among teachers and students of form two and forms four in four selected secondary schools in Musoma municipality, in Mara region. The study involved heads of school, academic teachers and science subject teachers who were purposively selected. All four heads of schools of the sampled schools were purposively selected because of their responsibilities in school leadership and supervision of school's daily routines including academic matters. Heads of schools are in charge of schools so they are always aware of whatever is happening in their schools with how teachers teach and how students learn; and are the first to be informed about all changes in academic issues in their respective schools whereas teachers from all four selected public and private secondary schools were purposively selected to get all science subject teachers and academic teachers on the basis that all

these are concerned with science subjects' development and its teaching and learning processes. On the other hand students in form two and four were purposively selected from each school to participate in the study because of being in classes which do national examination. Hence, they were expected to give their experience and provide information relevant to the study.

A total of 109 respondents (16 teachers and 93 students) participated in the study. Semi-structured interview, documentary review and focus group discussion were used to collect the needed information for the study. Qualitative data from interviews and focus group discussions were analysed, with some direct quotations from respondents used to verify the findings, whereas descriptive statistics were used to summarize some quantitative information.

5.3 Summary of the Findings

The study came up with three major findings in accordance with the three research questions.

(i) With respect to the first question on the exploration on whether curriculum changes require changes in teaching methods, the findings indicated that any curriculum changes should also involve changes in teaching and learning methods in order to cope with newly introduced or transformed content. However, many respondents validated that, the reformation of those teaching and learning methods should be the ones that present a fundamental shift from the teacher being the centre of attention in the classroom to the learners as the centre of learning whereby learners' self-evaluation and full participation dominate in the learning process.

(ii) With regard to the second question on the examination of whether teachers have mastery of subject matter required by changes in school curriculum, it was discovered that many teachers had little mastery of subject matter required by changes in school curriculum particularly to those who start to implement the changes for the first time and are also are faced by inadequate skills to implement the content especially during the time of teaching some new concepts that they are not familiar with.

(iii) With reference to the third question on the assessment whether curriculum change goes with availability of teaching and learning materials, the study findings indicated that many changes in school curriculum particularly in science subjects do not consider the availability of teaching and learning materials which seems to negatively affect the teaching and learning of science subjects in secondary schools.

5.4 Conclusions

On the basis of the findings recounted above, four principal conclusions can be made as follows:

- (i) Any school curriculum changes should also involve changes in teaching and learning methods in order to cope with newly introduced or transformed content.
- (ii) Teachers should have enough mastery of subject matter required by changes in school curriculum particularly to those who start to implement the changes for the first time and should also have adequate skills to implement the content to the learners.

- (iii) Changes in school curriculum particularly in science subjects should first put in place the availability of teaching and learning materials that goes hand in hand with the changes done in order to ease the implementation process.
- (iv) Teachers should be well trained to implement a newly introduced curriculum before they are allowed to implement it to students so as to make them well equipped with the related knowledge that has to be taught to students.

5.5 Recommendations

Arising from the conclusions that have been made above, the following recommendations are made:

5.5.1 Recommendations for action

- (i) Educational practitioners and authorities should not be drawn into changes of the curriculum before investigating out the types of teaching and learning methods to be used and ways in which are going to be applied by both teachers and learners. Pilot studies should be applied to check out the effectiveness of the newly introduced curriculum before it is put into implementation to the whole country.
- (ii) It is important for curriculum planners and developers to learn from the mistakes or success of previous science subjects' curriculum changes. It shows that teachers' limited knowledge and expertise in newly introduced curriculum concepts, inadequate resources and enough time of implementation are affecting the effectiveness of new changes in science curriculum. It is advisable that, people who are planning the curriculum must learn from the success and mistakes made by previous curriculum changes and from other countries to make new changes in curriculum affect teaching and learning the way it is expected.

- (iii) Curriculum support forums should be established at the school and district levels. Functional cohesion of curriculum support forums would assist unveiling input on how well the new changes are affecting teaching and learning of science subjects; which changes should be made to make the new changes in curriculum affect teaching and learning in a positive way; the resources that need to be provided for positive effect of the new changes in curriculum and the evaluation plan to assess effectiveness of the pilot project. All these could help to forecast curriculum hiccups before and during the implementation of changes in curriculum.

5.5.2 Recommendations for further studies

- (i) This study was conducted only in Musoma municipality with only four selected secondary schools. There is a need to conduct similar studies that involve as many secondary schools and regions as possible so as to ascertain the entire situation of the effects of secondary school curriculum changes in science subjects on teaching and learning in the whole country. This is because we need more and current studies instead of relying on outdated or exclusively western studies that may not effectively represent the real situation in Tanzania.
- (ii) Future research should further examine the effects of secondary school curriculum changes in science subjects on teaching and learning in a single specified subject like Physics, Chemistry, Biology or Mathematics. Results from this type of research could help curriculum planners to rectify the effects of each subject independently.

REFERENCES

- Ajuwape, H. & Olatoye, D. (2004). *The impact of planning on teaching and curriculum development of teaching and learning*. Nigeria: Nigeria Educational System.
- Allen, K. (2008). Primary school teachers and the problem faced with teaching the science subjects. *Journal of Applied Science*. Vol. 15, 76-91.
- Bailey, J. (2006). *Motivating students to learn*. New York: Macmillan.
- Brown, C. (2007). *Principles of science learning and teaching* (5th Ed). San Francisco: Pearson Education Incorporation.
- Cohen, L., Manion, L., & Morrison, K. (2000). *Research methods in education*. London: Rutledge Falmer.
- Coleman, H. (2010) *Teaching and learning in Pakistan: The role of language in education*. Leeds: International Organization for Education Press.
- Coyle, A. A. (1999). *Developing questioning techniques*. Ohio: Charles E. Merrill Publishing Company.
- Clabaugh, G. & Rozycki, E.(1999).*The foundation of curriculum*. New York: McGraw-Hill
- Dziwa, D. et al,. (2013). *Curriculum innovation or renovation: Feasibility in Zimbabwean secondary schools*. Masvingo: Great Zimbabwe University.
- Eggen, P. D. (1979). *Strategies for teachers: Information model in the classroom*. New Jersey: Prentice-Hall Inc.
- Enon, J. (1998). *Education research: Statistics and measurement*. Kampala:Makerere University Press.

- Fazel, J. (2009). *Planning education systems for future excellence*. Dar es Salaam: Dar es Salaam University Press.
- Fleit, J. D. & Wallace, J. (2005). *Change dilemmas for curriculum leaders: Dealing with mandated change in school*. Johannesburg: Kagiso Education Publishers.
- Fullan, M. (2000). *The new meaning of education change*. London: Cassell Educational Limited.
- Gatawa, B. M (1999). *The politics of the school curriculum: An introduction*. Harare: Harare College Press.
- Gultig, J., Hoadley, U. & Jansen, J. (2002). *Curriculum from plans to practices*. Cape Town: Oxford University Press.
- Green, R. K. (2005). *Infusing gerontological content into curricula effective change strategies*. New York: Taylor and Francis Press.
- Hargreaves, A. (1995). *Changing teachers, changing times*. London: Redwood Books.
- Hancock, D., Dyk, H., & Jones, K. (2012). Adolescent Involvement in Extracurricular Activities. *Journal of Leadership Education*, 11(1), 84–101.
- Jackson, P. (2006). *Life in classrooms*. New York: Holt, Rinehart, and Winston Publishers.
- Jacobs, M. (2004). *Teaching-learning Dynamics: A participative Approach for OBE*. Sandown, South Africa: Heinemann.
- Jenkins, E. W. (2001). The impact of the national curriculum on secondary school science teaching. Longman: England and Wales.
- Jansen, J. D & Christie, P. (1999). *Changing curriculum: Studies on outcomes based education in South Africa*. Cape Town: Juta Publishers.

- Jones, B. (2003). *Curriculum and methods of teaching*. Australia: Prentice Hall Limited.
- Jones, E. A. (2002). *Transforming the curriculum: Preparing students for a changing world*. New, York: Cambridge University Press.
- Kearsley, F. (1996). *Structural issues in distance education*. Washington D.C: George Washington University.
- Kelly, A. V. (2009). *The curriculum: Theory and practice*. Newbury Park, CA: Sage Publishers.
- Kendra, S. (2013). *Secondary school curriculum and the community centre*. Delhi: VikasMarg.
- Killen, R. (2000). *Teaching strategies for outcomes-based education*. Onsdowne: Juta Publishers.
- Kim, M. & Dopico, E. (2014). Science education through informal education. *Cultural Studies of Science Education*, 1–7.
- Kinder, K., Wilkin, A., Moor, H., Derrington, C. & Hogarth, S. (1999). *Raising behaviour 3: A school view*. London: NFER.
- Kothari, C. R. (2004). *Research methodology: Methods and techniques*. (2nded.). New Delhi: New Age International Publishers.
- Lawton, D. (2001). *The politics of the school curriculum*. London: Hodder and Stoughton.
- Lee, C. (2005). *Teaching subject matter*. San Francisco CA: Jossey – Bass.
- Lema, V. (2008). Teacher factors that lead to student motivation not to learn Science in Tanzania secondary schools. *Journal of Research in Educational Psychology*. Vol.4(1), 35 – 46.

- Litshan, L. (2013). *The impact of the curriculum change in teaching and learning science Subjects*. Pretoria: University of South Africa.
- Liston, D., Borko, H, & Whitomb. J. (2008). The teacher educators' role in enhancing teachers' quality. *Journal of Teachers Education*, 59(2), 111-116.
- Luehman, L. L. & Barab, A. S. (2003). *Building sustainable science curriculum: Acknowledging and accommodating local adaptation*. Miami: Willey Periodicals.
- Lyamtane, E. C. (2004). *Managerial aspects influencing performance of catholic seminaries in national examinations*. Unpublished M.A. (Education) Dissertation, University of Dar es Salaam.
- Makene, M. (2004). *The effects of underfunding on performance of community secondary schools in Tanzania*. Unpublished M.A. (Education) Dissertation, University of Dares Salaam.
- Mazano, R. (2012). *What works in schools: Translating research into action*. Alexandria, VA: ASCD.
- Mbise, A. S. (1976). *Student participation in Tanzania secondary school classrooms*. Unpublished M. A. (Education) Dissertation: University of Dar es Salaam.
- McCombs, B. L & Whisler, J. S (1997). *The learner-centred classroom and school: Strategies for increasing student motivation and achievement*. San Francisco: Jossey – Bass Publisher.
- Mtae, H. (2012). *Research Methodology*. India: Excel learning PTY Ltd.
- Mohamed, H (2004). *Challenges in curriculum transformation*. Dar es Salaam: Dar es Salaam University Press.

- Njabili, F. A. (1999). *Public examination: A tool for curriculum evaluation*. Dar es Salaam: Mture Educational Publishers.
- Nsubuga, Y. K. (2003). *Development and examination of secondary in Uganda: Experience and challenges*. Kampala: A paper presented at the 5th ACP Conference.
- Nyirenda, D. M. (2012). *Involvement of stakeholders in curriculum changes*. Oxford: Macmillan Publishers Limited.
- Nyoni, W. N. (1990). *Teaching science for development of scientific competence: The case of biology teaching in Coast and Dar es Salaam regions of Tanzania*. Unpublished M.A. (Education) Dissertation. University of Dar es Salaam.
- Okeke, S. (1990). *Improving teachers' quality through school practice*. Dar es Salaam: Dar es Salaam University Press.
- Patton, M. (1990). *Qualitative evaluation and research methods*. Thousand Oaks, CA: Sage Publications.
- Rogan, M. J. & Grayson; D. J. (2003). *Towards a theory of curriculum implementation with particular reference to science education in developing countries*. Johannesburg: Kagiso Education Publishers.
- Seguel, M. L. (1966). *The curriculum field: Its formative years*. New York: Teachers College Press.
- Silla, H. (2009). *Teaching Science in Secondary Schools*. Oxford: Macmillan Publishers Limited.
- Sheri, B & Alison, R. (2007). *Active teaching strategies*. Retrieved on September 26th 2012 from <http://www.baker.edu/departments/etl/training/resources.cfm>.

- Smith, M. K. (2000). *Curriculum theory and practice: The encyclopedia of informal education*. Retrieved on December 18 2015 from [.www.infed.org/bibli/bcurric.htm](http://www.infed.org/bibli/bcurric.htm).
- Spyker, G and Malone, J. (1996). *Impact of Mathematics Curriculum changes upon senior high school teachers in Western Australia*. Australia: Curtin university of Technology Press.
- Stufflebeam, D. L. (1971). *The CIPP model for program evaluation*. Boston: Kluwer Nijhoff.
- Tobin, K. & Imwold, D. (1992). *Constructivist Interpretations of teaching and learning Mathematics*. Curtin University: Perth Western Australia.
- Tomasa, C. & Rodrigo, B. (2008). *Curriculum Development*. Quezon City: Lorimar Publishing, Inc.
- Thompson, H. (2001). *Teaching science in secondary schools*. Oxford: Macmillan Publishers Limited.
- Vallet, R. M. & Allen, E. D. (2001). *Modern language classroom techniques: A handbook*. New York: Harcourt Brace Jovanovich Incorporation.
- Wamuza, K. (2005). *Attitudinal and motivational factors influencing performance in Science subjects among Tanzania primary pupils*. Unpublished M.A (Education) Dissertation, University of Dar es Salaam.
- Weber, E. (2007). *Education change in South Africa: Reflections on local realities, practices, and reforms*. Johannesburg: University of Witwatersrand.
- Widdowson, G. (2008). The theory and practice of critical discourse analysis. *Applied Science* 15 (1), 136–151.

- William, F., William, M., Reynolds, P. & Taubman, M.. (1995).*Understanding Curriculum:An introduction to the study of historical and contemporary curriculum discourses*. New York: Peter Lang.
- Wood, J. (2000). A study of assisted problem solving. *British Journal of Psychology*.66(2), 181-191.
- Yip, D.Y. (2001).Promoting the development of a conceptual change model of science instructions in prospective secondary biology teachers. *Journal of Curriculum Education*, 23(7) 755-770.

APPENDICES

APPENDIX A Interview Schedule for Teachers

You are warmly invited to participate in the interview session about the **effect of Secondary school curriculum changes in science subjects on teaching and learning**. The purpose of this discussion is to collect information about the effects which occur when science subjects' curriculum changes are frequently done. The information given will be used for academic purposes only, and will be treated as strictly **confidential** and your identity will be kept **anonymous**.

A: Background Information

1. Name of school.....
2. Gender (male or female).....
3. Education levels e.g., form six.....
4. Professional qualification in teaching.....
5. Science subjects taught.....
6. Teaching experience.....

B: Questions

1. Do curriculum changes require changes in teaching methods?
.....
.....
.....
2. Do teachers have mastery of the subject matter required by changes in school curriculum?
.....
.....
.....

- 3. Is it necessary to involve other education practitioners in preparing or developing curriculum before put it into implementation?

.....
.....

What are the effects of the curriculum changes in science subjects on teaching and learning?

.....
.....
.....

- 4. What problems do science subjects' teachers face when implementing a newly introduced curriculum in classes?

.....
.....
.....

- 5. Does curriculum change go with availability of teaching and learning materials?

.....
.....

- 6. What are your general suggestions to the Curricular Developers in relation to changing of science subjects' curriculum?

.....
.....
.....

APPENDIX B

Focus Group Discussion Guide for Pupils

You are warmly invited to participate in the interview session about the **effect of Secondary school curriculum changes in science subjects on teaching and learning**. The purpose of this discussion is to collect information about the effects which occur when science subjects' curriculum changes are frequently done. The information given will be used for academic purposes only, and will be treated as strictly **confidential** and your identity will be kept **anonymous**.

A: Background Information

1. Name of school.....

B: Questions

1. Many students are concerned with curriculum changes and sometimes complain about the changes. For you students, what are the effects of the curriculum changes in science subjects on learning?

.....
.....
.....

There is always a concern on teaching and learning methods used in science subjects. Do you think the curriculum changes that are done in science subjects do also require changes in teaching methods?

.....
.....
.....

Do teachers have mastery of the subject matter required by changes in school curriculum?.....

.....

Does curriculum change go with availability of teaching and learning materials?

.....

.....

2. What problems do science subjects' teachers face when implementing a newly introduced curriculum in classes and what are the problems you as student face when learning under the same curriculum?

.....

.....

.....

3. Many students are concerned with curriculum changes and sometimes complain about the changes. For you students, what are the effects of the curriculum changes in science subjects on learning?

.....

.....

APPENDIX C

Documentary Search Guide

Name of School.....

Teachers' Name.....

A: SEARCH GUIDE FOR TEACHERS' LESSON PLANS

STAGE	GRADING							REMARKS
INTRODUCTION								
PRESENTATION								
EVALUATION								

APPENDIX D

Documentary Search Guide

Name of School.....

Teachers' Name.....

B: SEARCH GUIDE FOR TEACHERS' SCHEMES OF WORK

STAGE	GRADING								REMARKS
TOPICS									
TEACHING METHODS AND AIDS									
REFERENCES									
GENERAL SCHEME'S PREPARATION									