INFLUENCE OF FORMATIVE ASSESSMENT ON STUDENTS' PERFORMANCE IN KENYA CERTIFICATE OF SECONDARY EDUCATION IN PHYSICS: CASE OF ELGEYO MARAKWET COUNTY, KENYA

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A RESEARCH THESIS SUBMITTED TO THE SCHOOL OF EDUCATION IN PARTIAL FULFILLMENT FOR THE REQUIREMENTS OF THE AWARD OF THE DEGREE OF MASTER OF EDUCATION IN EDUCATIONAL RESEARCH, EVALUATION AND ASSESSMENT OF KENYATTA UNIVERSITY.

NOVEMBER, 2020

DECLARATION

I confirm that this research thesis is my original work and has not been presented in any other university for certification. The thesis has been complemented by referenced works duly acknowledged. Where text, data, graphics, pictures or tables have been borrowed from other works including the internet, the sources are specifically accredited through referencing in accordance with anti-plagiarism regulations.

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This work is dedicated to my family; Zipporah Chumo, Chepng'eno Chumo, Kimutai Chumo and Cherop Chumo for their moral and financial support.

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ABBREVIATIONS AND ACRONYMS

BOM	Board of Management
CATs	Continuous Assessment Tests
CBC	Competency Based Curriculum
CCSSO	Council of Chief State School Officers
CR	Classroom Assessment
CVR	Content Validity Ratio
EVMA	Expectancy Value Model of Achievement
FA	Formative Assessment
HOD	Head of Department
JICA	Japan International Cooperation Agency
KCSE	Kenya Certificate of Secondary Education
KICD	Kenya Institute of Curriculum Development
KNEC	Kenya National Examination Council
MOE	Ministry of Education
NACOSTI	National Commission for Science, Technology and Innovation
PA	Peer Assessment
PBA	Performance Based Assessment
QASO	Quality Assurance and Standard Officers
ROK	Republic of Kenya
SA	Summative Assessment
SDGs	Sustainable Development Goals
SMASSE	Strengthening of Mathematics and Science in Secondary Education

SMEs Subject Matter Experts

SPSS Statistical Package for Social Science

STEM Science, Technology, Engineering and Mathematics

ABSTRACT

Since the year 2013, performance of learners in Physics has consistently been low in Elgeyo Marakwet County. This is worrying because Physics plays a central role in Kenya's Vision 2030 and global development as envisioned in SDG. Therefore, this study was conducted to establish if the practice of formative assessment has an influence on students' performance in Kenya Certificate of Secondary Education in Physics in public secondary schools in Elgeyo Marakwet county. The study objectives were: to find out how planning of formative assessment influences students' performance in Physics, to determine how the application of Bloom's taxonomy in FA tools influence students' performance in Physics, to find out how techniques of FA used by teachers influence students' performance in Physics and to find out how the application of results from FA influence students' performance in Physics. The study was guided by Title's Theory for Classroom Assessment Practice (1994). Explanatory sequential mixed method design was used in the study. A population of 73 public schools, 126 Physics teachers and 13,101 Physics students was targeted in the study. Schools were categorized into extra county, county and day schools using stratified sampling. Schools were arranged alphabetically in each stratum where interval sampling was applied to sample 21% of schools from each strata. In total, 15 schools were sampled to represent 21% of the total population. Simple random technique was used to select two Physics teachers from each of the 15 sampled schools. In total, 30 teachers were sampled to represent 24% of the total population. In the study, 12 students were sampled for interviews. Random sampling was used to select one school from each strata upon which one student from each form was selected using simple random sampling technique. Further, the researcher collected copies of the most recent end of term question papers from the 12 interviewed students for document analysis. A questionnaire for teachers, document analysis sheet and interview schedule for students were used for data collection. Teacher's questionnaire and students' interview schedule were piloted in two secondary schools where four teachers and four students of Physics were sampled from each school. Validity of research instruments was tested using content validity while reliability was tested using internal consistency method by computing Cronbach's alpha coefficient. Qualitative data were collected using the questionnaire and interview schedule. Responses from the interview were analyzed thematically by identifying key concepts and themes and presented in narrative form supported by evidence from raw data. Additionally, qualitative data from the questionnaire was coded to translate responses into specific categories. The coded responses were analyzed using the Statistical Package for Social Sciences (SPSS), version 22.0. Linear regression analysis, frequency, mean and standard deviation were used to establish influence of each objective on students' performance in Physics. Charts and tables were used to present data. The research findings showed that failure by Physics teachers in Elgeyo Marakwet county to plan for FA and inability to balance all the cognitive domains according to Bloom's taxonomy have a significant influence on students' performance in Physics. The study showed that various assessment techniques are not utilized well by majority of Physics teachers in the county and that application of results from FA by a majority of Physics teachers were not used to the required standard. However, this did not show a significant influence on students' performance in Physics. The study concluded that Physics teachers in Elgeyo Marakwet County should plan for FA and balance all the cognitive domains according to Bloom's taxonomy because they influence leaners performance in Physics. The study recommended for retraining of Physics teachers in the county on good practices of FA so that they are effective in assessing learners.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter presents the background to the study, statement of the problem, purpose of the study, study objectives, research questions, significance of the study, limitations, delimitation and assumptions of the study. It also highlights the theoretical and conceptual frameworks and operational definition of terms.

1.2 Background to the Study

Physics is an important subject recognized globally. It emphasizes not only the understanding of important scientific concepts and principles, but also the experimental approaches in solving problems encountered in day-to-day experiences (Kenya Institute of Education, 2002). Physics plays a big role in training of professionals for different fields such as engineering, medicine, military science, aerodynamic and geophysics. It is because of these reasons that Kenya stresses the need to improve the quality of teaching sciences in secondary schools in a bid to attain its Vision 2030 (GOK, 2007) and industrialize as envisioned in Sustainable Development Goals SDGs (Derek, Amy and Farooq, 2015).

The government of Kenya has, therefore, put in place initiatives such as integration of ICT in teaching of Physics, retraining of Physics teachers through Strengthening of Sciences and Mathematics in Secondary Schools (SMASSE), purchase of Physics text books and stocking school laboratories (Republic of Kenya, 2005). These efforts have resulted in improved performance of Physics nationally. However, although the national mean for Physics is high, the contrary is true in Elgeyo Marakwet County as indicated in Table 1.0 below.

Table 1.0: ***Comparison between Physics' KCSE Mean Score Nationally and in Elgeyo Marakwet County from 2011 to 2014 in %***

Year	National Mean	Elgeyo Marakwet County Mean	Difference
2011	73.28	31.14	-42.14
2012	75.72	32.87	-42.85
2013	80.20	40.01	-40.19
2014	77.68	51.50	-26.18

Source: Kenya National Examination Council (2015) and County Education Office, Elgeyo Marakwet (2016)

Although there are a number of factors that have been shown to contribute to the low performance of students in Physics, little has been done to show how FA influences their performance in the subject in Elgeyo Marakwet County. Yet, according to Barchfeld-Venet (2005), FA can help to improve students' performance in Physics if it is effectively used by paying attention to four key areas; planning of assessment, balancing various cognitive domains of Bloom's taxonomy in FA tools, utilization of various techniques of formative assessment and application of results from formative assessment.

Planning for FA entails a set of factors such as identification of learning concepts to be assessed, preparation of students by informing them the rules to be adhered to during the assessment (Alison, 2010; Lord and Baviskar, 2007; Nitko, 2004 and Wilson, 2000). Further, planning of FA also involves identification of examination rooms, the duration of assessment and the manner in which the assessment will be supervised (Wilson, 2000). However, there is lack of information on how the planning of FA influences students' performance in Physics in Elgeyo Marakwet County.

In order to effectively balance questions in FA tools using Bloom's Taxonomy, Sivaraman and Krishna (2015) argue that assessment tools should be designed such that knowledge and

comprehension covers 20% to 30%, application and analysis 40% to 50% while synthesis and evaluation to cover 30% to 40% of the set questions. The researcher will be interested in knowing if this principle is followed by teachers when designing FA tools that are used during the end of term assessment.

The technique of formative assessment entails the method used in assessing students once the learning concepts to be assessed have been identified. A suitable assessment technique is employed by a teacher because it determines the quality of feedback from the students (Tanner and Jones, 2003). The techniques of FA are self-assessment, classroom assessment, peer assessment and performance based assessment (Hamilton and Klein, 2002; Topping, 2005; Palm, 2008; Reynolds, Livingstone and Wilson, 2009). This study was interested in knowing the level at which teachers use these four types of FA as one of the independent variables under techniques of FA.

Once teachers have assessed students work, the results obtained from formative assessment are used to give feedback to students in the following ways: correction of students' mistakes from a particular assessment task, suggesting more study work to students, promoting cognitive thinking and encouraging students to carry out more tasks on their own (McMillan, 2001; Gibbs and Simpson, 2004). In FA, feedback is also important in helping students to critique their learning and empowering themselves to be in control of their own studies (Nichol, 2007). Based on the assessment results, teachers make decisions about students' learning programmes to parents, students themselves and concerned stakeholders (Wilson, 2002). This therefore means that through FA, teachers can make modifications and improvements in their style of teaching thereby improving students' interest in Physics and their academic performance. The study therefore sought to provide information about how the use of results from FA influences students' performance in Physics.

In stressing the importance of FA in improving students learning, Lindstrom, Taylor and Weleschuk (2017) argue in their Principles for Assessment of Students Learning that among the key principles in FA are aligning of assessment with learning outcomes and teaching strategies which makes planning for FA important. In addition, assessment feedback should be used to improve students learning as opposed to ranking. This can be done by applying various assessment techniques so as to optimize learner's involvement in assessment processes (Lindstrom, Taylor and Weleschuk, 2017). These principles are in line with policies of assessment by the Kenya Institute of Education (KIE) which require that Physics syllabus should ensure that there is appropriate balance in the development of learners' cognitive, psychomotor and affective skills (KIE, 2002). In this case, Physics teachers are challenged to make the study of Physics appealing to learners through experimental approach and by conducting effective formative assessment by: doing a proper planning of FA, designing FA tools that test higher, intermediate and lower cognitive domains in a balanced manner, applying various assessment styles and providing assessment feedback that aid students' learning (KIE, 2002 and MOE, 2012).

The Kenyan government, in recognizing the role played by FA practice, emphasizes the need to streamline assessments so that teachers can get reliable feedback from students in science and mathematics to allow them make necessary guidance to learners (SMASSE, 2005). According to the SMASSE program, formative assessments are very important as they highlight to students and teachers the gaps to be worked on for purposes of making improvements. Furthermore, formative assessment plays an important role in informing policy makers on the gaps to be filled in the existing curriculum so as to suit local needs and holding educational institutions responsible in assisting learners to meet the set standards as measured by summative assessment (Looney, 2011).

In supporting the importance of FA, Cross Sartorial Assessment Working Party (2011) argues that the primary reason for formative assessment is to help students to improve their learning and teachers to plan and teach to the required standards. This places FA at the centre of other factors influencing students' academic performance in Physics.

Although it has been shown by Muchwe (2014) that poor attitude towards science subjects contributes to low performance of students, this did not apply to this study because Physics is an elective subject. Students who opt to enroll for Physics do so because they have a positive attitude towards it. As noted by Wanyama (2013), inadequate number of teachers plays a role in lowering the performance of students in KCSE in Narok North District. Elgeyo Marakwet County faces a similar challenge since the Teachers Service Commission (TSC) is the only institution that is tasked with employment and distribution of teachers across the country. The low teacher to student ratio is therefore a challenge that is faced by all other regions in Kenya.

The MOE has been carrying out an in-service training for teachers of sciences and mathematics on the best teaching practices that are aligned to the needs of the 21st century (SMASSE, 2015). In this case, it is expected that Physics teachers have benefitted from SMASSE program by improving their teaching skills. Therefore, the contribution to dismal performance in KCSE by poor pedagogical skills in sciences as noted by Muchwe (2014) and Munene (2014) was not considered to play a major role towards the low performance in Physics in Elgeyo Marakwet County.

Since the year 2008, the government of Kenya has been subsidizing secondary school fees at Kshs 12,870 per student (ROK, 2005). According to the subsidization guideline, the Boards of Management (BOM) of secondary schools are required to purchase text books, exercise books, printing papers and laboratory chemicals and equipment. Given that government introduced

subsidization of school fees 12 years ago, factors such as problems in the payment of school fees, insufficient teaching resources, inadequate laboratory equipment and books as noted by Amukowa (2013), Wanyama (2013) and Muchwe (2014) have already been addressed or are in the process of being addressed by the government and were not therefore expected to play out as major variables leading to dismal performance of students in Physics in the location of study.

Given that FA practice being an integral part in the teaching and learning process, low performance in Physics therefore raises doubts about how FA is conducted. It is in light of this that one would wonder if the poor performance of students in Physics in Elgeyo Marakwet is influenced by the way FA is practiced. What was not clear is how Physics' FA is planned, how various cognitive domain of Bloom's taxonomy are balanced in FA tools, the level at which teachers utilize various techniques of FA and how results from FA are used and how they influence student's performance in Physics in Elgeyo Marakwet county.

It is based on these reasons that the study was conducted so that more information about teachers' inefficiencies in conducting FA in Physics would be revealed and corrective measures proposed. It is hoped that the suggestions made by the study will help in addressing the problem of poor performance in Physics in Elgeyo Marakwet County.

1.3 Statement of the Problem

In Elgeyo Marakwet County, students' performance in Physics has consistently been low compared to the national performance as indicated by KCSE results. As a science subject, the low performance in Physics is a great challenge because it weakens the role of Science, Technology and Innovation which are key pillars in Kenya's Vision 2030. Further, the low performance in Physics undermines Kenya's ability to take part in global development as envisioned in SDGs plan. In addition, students from Elgeyo Marakwet County will continue to be disadvantaged when selecting career courses related to physics in tertiary institutions. This will further compromise the efforts by Elgeyo Marakwet County to develop and increase the number of skilled personnel needed to realize some of its visions such as: increasing electricity and water connectivity in the county as envisioned in its County Integrated Development Plan. A number of studies have been conducted to show how factors such as inadequate teaching resources, overpopulated classes, low number of teachers and inability to pay school fees by parents affect learners' performance. However, there is little that is known about how the practice of formative assessment influence learners performance in Physics in Elgeyo Marakwet County. This study was therefore conducted to establish if the practice of FA by teachers has an influence on learners performance in Physics by investigating four variables; planning of FA, application of Bloom's taxonomy in FA tools, techniques used in FA and application of results from FA. This was done with an aim of finding out if there are flaws in how teachers conduct FA and how they can be addressed so that learners' performance in Physics in Elgeyo Marakwet county can be improved.

1.4 Purpose of the Study

The purpose of this study was to establish if the practice of FA has an influence on students' performance in Kenya Certificate of Secondary Education in Physics in public secondary schools in Elgeyo Marakwet County with an aim of establishing if there are flaws originating from how teachers conduct FA and how they can be resolved so that students' performance in Physics can be improved.

1.5 Objectives of the Study

The study focused on the following objectives:

i. To determine if planning of formative assessment influence student's performance in Physics.
ii. To find out if the application of Bloom's taxonomy in formative assessment tools influence students' performance in Physics.
iii. To determine if techniques of formative assessment used by teachers influence students' performance in Physics.
iv. To find out if the use of results from formative assessment influence students' performance in Physics.

1.6 Research Hypotheses

Based in the research objectives, the following hypotheses were tested:

Ho_1. Planning of formative assessment does not influence students' performance in Physics.

Ho_2. Application of Bloom's taxonomy in formative assessment tools do not influence students' performance in Physics.

Ho_3. Techniques of formative assessment used by teachers do not influence students' performance in Physics.

H_{O_4}. The use of results from formative assessment do not influence students' performance in Physics.

1.7 Significance of the Study

It was hoped that information gathered from this study on how the practice of formative assessment influences students' KCSE performance in Physics will be significant to the following:

Teachers. Given that Physics teachers play an important role in the implementation of curriculum's objectives, it is anticipated that information from this study will be important in directing them on how to plan for FA in Physics in line with the curriculum. It is also hoped that this will help them to discover better ways of utilizing results from formative assessment as a way of improving teaching and learning in Physics.

Students. Through this research, it is hoped that teachers will use the proposed recommendations to make necessary improvements in FA at the right time and encourage many students to enroll for Physics and attain better grades. This will in turn help them to choose their desired careers based on their quality grades in Physics.

Education administrators. It is believed that directors of quality assurance and standard officers (DQASOs), principals and heads of departments (HODs) will find information from this study helpful. Since they are tasked with monitoring the progress of curriculum implementation in public schools, it is hoped that findings from this study will help them to appreciate the need for conducting proper formative assessment as a way of improving performance in Physics.

The Kenya Institute of Curriculum Development (KICD) is tasked with reviewing existing educational policies and introducing new ones. However, these decisions are informed by research

findings. The weaknesses in conducting FA in Physics by teachers as pointed out in this study is expected to help KICD to make reviews on the existing policies on FA.

1.8 Limitations of the Study

The following were the limitations of the study;

a) Elgeyo Marakwet is a vast region, covering 3029.9 Km^2. The researcher designed a data collection schedule by mapping out the county into four regions. This made it possible to reduce the distance covered and the time needed to collect data.

b) Assessment tools used by teachers such as end of continuous assessment tests were not uniform. In order to remedy this challenge, the researcher requested for the most recent end-of-term question papers which were nearly similar in terms of the type of questions set and the number of questions that were set.

c) One respondent declined to fill the questionnaire. However, this did not have an adverse effect on the findings since a precaution was taken by sampling 24% of teachers against the recommended 10%.

1.9 Delimitations of the Study

The study was conducted in Elgeyo Marakwet County. It was limited to teachers and students of Physics. The study focused on public secondary schools only because Elgeyo Marakwet County has one private secondary school which was used during piloting of data instruments. The private school was therefore not sampled during the actual study.

1.10 Assumptions of the Study

The following assumptions were made in the study;

i. That Physics teacher adhere to the syllabus guidelines when planning to assess learners.

ii. That Physics teacher are conversant with the principles of Bloom's taxonomy and various cognitive domains that ought to be tested using assessment tools.

iii. That Physics teacher are aware of various techniques of assessing learners' tasks during formative assessment.

iv. That Physics teachers give learners assessment feedback after administering assessment tasks.

1.11 Theoretical Framework

This study was guided by Title's Theory for Classroom Assessment Practice (Title, 1994). It was developed to give guidance on the assessment practices in the classrooms. The theory is anchored on the following dimensions about assessment: (a) Interpretation and knowledge, beliefs, intents, and actions, and (b) assessment characteristics, embeddedness in practice, format and mode, scoring, evaluation, preparation and feedback.

In this study, three variables about FA were investigated; planning, application of Bloom's taxonomy, techniques of FA used by teachers and application FA feedback. Title's Theory for Classroom Assessment Practice was found to be relevant to this study for a number of reasons.

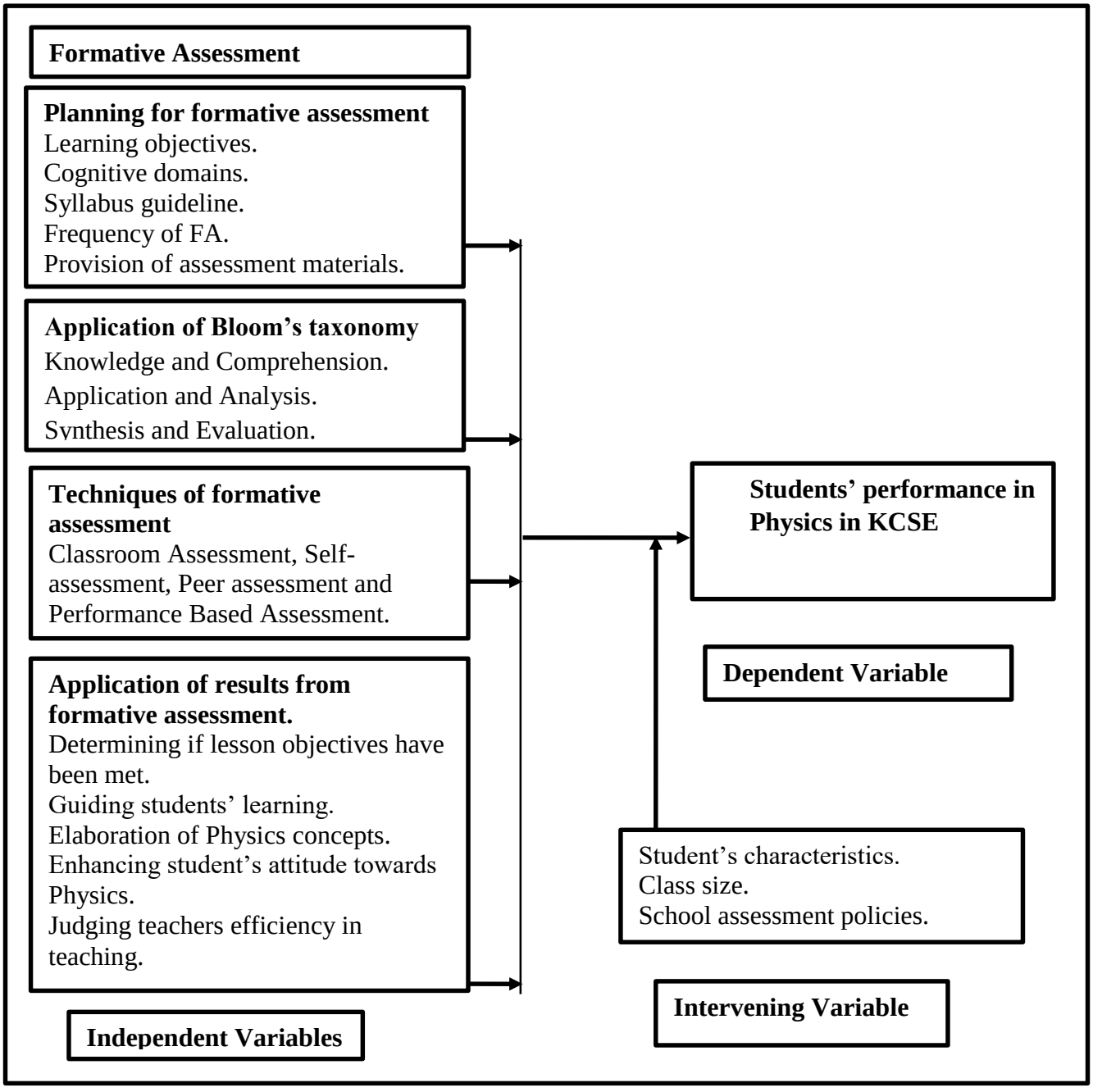
The theory emphasizes the preparation of assessment which entails a set of factors such as scheduling of FA in the lesson plan, consideration of learning objectives, testing of different areas

of cognitive domains, adherence to syllabus guidelines, the frequency of conducting FA and provision of materials to students to complete assessment tasks.

The theory also stresses the need to consider the format and the mode of assessment. This is relevant to this study especially in reinforcing the need to design learners' assessment tools such that knowledge, comprehension, application, analysis, synthesis and evaluation are all assessed in a balanced manner. In addition, by considering that the mode and the format of assessment, Title's Theory for Classroom Assessment Practice emphasizes the importance of employing different techniques of formative assessment such as classrooms assessment, self-assessment, peer assessment, and performance based assessment. Lastly, the theory is also anchored on assessment feedback. This is crucial because feedback from formative assessment tools are used to evaluate teaching and learning experiences for correction and improvement. In this case, results from the formative assessment become important in guiding teachers on the learning experiences to be carried out in line with the objectives of the curriculum.

1.12 Conceptual Framework

Figure 1.0: ***Conceptual Framework Showing the Relationship Between Independent Variables and the Depend Variable.***



Source: Researcher (2017).

In a structured education system, there is an educational objective that guides the teaching processes. In a bid to establish if the set objectives have been met, a formative assessment is conducted regularly and progressively. In the event that some of the objectives are not attained as indicated by the FA, Tyler's Theory of Evaluation in Education (1942) opines that corrective measures ought to be taken to rectify the anomaly. However, these flaws can only be detected and corrected if a good FA is conducted. In researchers' views, the independent variables are interrelated in such a way that the learning objectives guide teachers on how they can plan learners' assessment tools so that relevant learning domains are assessed in a balanced manner according to Bloom's taxonomy. The assessment technique to be used by the teacher is also informed by the learning objectives. After administering the assessment, learners results are used by teachers to make decision on how to correct or improve their understanding of certain learning areas in Physics. Collectively, these independent variables are expected to influence how students will perform in their summative assessment.

In the study, measures were taken in order to reduce the effects of intervening variables. For instance, learners were sampled from county schools, extra-county schools and day-schools to minimize the effect brought about by different students characteristics and class sizes. This was based on the fact that these categories of schools admit learners based on different entry behavior. Further, these categories of schools have a varying number of learners per class.

In order to reduce the effect of different formative assessment policies by different schools, the study opted to analyze the most recent end of term assessment tools which were considered to be relatively similar in terms of type of questions that are set and the number of questions in every examination paper.

1.13 Operational Definition of Terms

Application of Bloom's taxonomy in formative assessment tools: In this study, it refers to the frequency of utilization of various cognitive domains as per Bloom's taxonomy in FA tools. The cognitive domains were considered to be well balanced if the FA tools were found to test knowledge and comprehension between 20% to 30%, application and analysis at 40% to 50% while synthesis and evaluation to cover 30% to 40% of the set questions. An overall mean of above 4.0 measured using Likert scale was used to indicate if Bloom's taxonomy was satisfactorily applied when designing assessment tools in Physics.

Classroom Assessments: It is the type of formative assessment conducted during the course of the lesson or at the end of a lesson. In Physics, it a standard procedure to schedule it in the lesson plan.

Formative Assessment: It is a systematic and an ongoing process of collecting, analyzing and using educational information to monitor if progress is being made in improving students' understanding, acquisition of skills and competencies. In Physics, FA ought to be conducted after every lesson. It also entails planning for formative assessment, application of Bloom's taxonomy in designing assessment tools, selection of appropriate assessment techniques to the learning task and provision of feedback to students based on the results obtained.

Influence: It is the ability of formative assessment to bring an effect on students' performance in Physics.

Peer Assessment: It is an FA that gives room for students to evaluate their peers' learning by giving feedback to their fellow students about the value of their work through the guidance of their teacher.

Performance Based Assessments (PBA): In this study, the term is used to refer to laboratory or field experiments used by teachers to gauge students' mastery of practical skills in Physics.

Planning of Formative Assessment: It entails a set of factors such as scheduling of FA in the lesson plan, consideration of learning objectives, testing of different areas of cognitive domains, adherence to syllabus guidelines, the frequency of conducting FA and provision of materials to students to complete assessment tasks. Planning was considered to be properly done if combined score of 4.0 and above was obtained as measured using Likert Scale.

Self-Assessment: It is used in the study to refer to a type of FA in which its main purpose is to allow a student to judge his or her own academic progress by identifying strengths and weaknesses in their learning at personal level under the guidance of a teacher.

Students' Performance: It is the extent of students' performance in physic in KCSE. Performance indicators ranges between 1% to 99%. A student is considered to have performed well if he or she has scored 65% and above in Physics.

Techniques of Formative Assessment: They are styles or methods used to assess students during formative assessment. They include: classroom assessments, performance-based assessments, self-assessment and peer assessment. In this study, Teachers were considered to be appropriately using various formative assessment technique if a combined score of 4.0 and above was obtained as measured by the Likert Scale.

Use of Results from Formative Assessment: It is the application of results from student's formative assessment tools in gauging students' mastery of skills and helping them to make corrections and improvement in their learning. Application of results from FA were considered to be satisfactory if a combined score of 4.0 and above was be obtained as measured using Likert Scale.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of existing literature on formative assessment in secondary schools. Empirical studies concerning the practice of FA were discussed based on the study's four objectives; planning for formative assessment, application of Bloom's taxonomy in FA, techniques of FA and application of feedback from FA. Further, the chapter presents the summary of the reviewed literature and the existing gaps that the study sought to fill.

2.2 Planning for Formative Assessment

Planning for formative assessment involves a number of activities such as setting out of procedures and standards under which the assessment will be conducted and preparation of students for the assessment. Planning for FA is also scheduled in teachers' professional documents such as schemes of work and lesson plans.

During planning for FA, there are principles that ought to be adhered to such as protecting the safety and health of learners, following the set out procedures and being honest and fair in rating learners work (Nitko, 2004). Therefore, prior to giving out the tests, teachers are expected to communicate to the students the set-out procedures and conditions that will help to bar any external interference that may compromise the validity and credibility of the assessment.

Another important area of interest in the planning for formative assessment is the preparation of testing materials. Teachers administering assessments are required to avail some specific equipment to students so that they can complete the assessment tasks (Case, 2003). Some of the materials that ought to be provided are enough writing materials, calculators, mathematical tables,

apparatuses, watches for time keeping and formulae. Other extra materials that students may need should be stocked and be availed when needed (Case, 2003).

Planning for formative assessment also involves the preparation of students for assessment (Nitko, 2004). Nitko (2004) adds that for students to give their optimum output from assessments, teachers should provide them with information that they require such as when the assessment will be administered and the contents to be assessed. Schools can also prepare their students for assessment by teaching them test-skills such as how to write clear responses, giving answers neatly and paying attention to written and oral instruction (Oosterhof, 2001 and Nitko, 2004). In addition, for teachers to carry out a meaningful formative assessment, the aims of teaching must be made clear by making sure that there is a link between teaching concepts, the learning outcome, what is to be taught as well as what is to be assessed (Tanner and Jones, 2003).

In a research conducted by Wambugu (2009) on planning for Mathematics assessment, the study revealed that majority of the respondents (73%) plan for FA after teaching a particular topic. In this case, majority of teachers (63%) end up using learning content to plan for FA instead of using topic's objectives as should be. Further, the study showed that majority of teachers (53%) rarely use schemes of work to plan for formative assessment in mathematics.

In a similar research conducted by Njeru (2015) on the influence of continuous assessment tests on learners' performance in Mathematics, majority of the respondents (mean=4.9) agreed that FA is important in improving learners' performance in the subject.

In another investigation by Opula (2012), the study revealed that learners' poor performance in KCSE is influenced by the following factors: inadequate number of teachers, limited reference books and lack of laboratories. In addition, teachers failure to mark students' assignments due to

work overload and failure by learns to finish their assessment tasks were found to negatively affect learners' performance in KCSE.

From the literature reviewed in this section, the researcher sought to collect information on a number of aspects as a way of filling the gaps in the existing literature. For example, the study conducted by Wambugu (2009) on planning for FA did not investigate other aspects that ought to be considered such as: adherence to syllabus guidelines, assessing of learners after every lesson, informing learners the objective of an experimental assessment prior to the experiment, provision of assessment materials to learners and scheduling of FA in the lesson plan. This study investigated the mentioned variables.

Furthermore, the study by Njeru (2015) showed that majority of the respondents (mean=4.9) agreed that FA affects learners' performance in Mathematics. However, little is known about the extent to which FA influences learners performance in Physics. This study sought to provide this missing information.

Lastly, the influence of FA on learners' performance in KCSE was not investigated in the reviewed literature in this section. This research therefore focused on how FA influence learners performance, particularly in Physics.

2.3 Application of Bloom's Taxonomy in Formative Assessment

Designing formative assessment tools is a crucial undertaking since it facilitates the learning skills to be assessed. Identifying how to teach and assessing such skills are therefore very important roles played by teachers (Alison, 2010). At the center of construction of assessment tools is Bloom's Taxonomy of educational objectives (Bloom's, 1956, as cited in Allison, 2010). After realizing that 95% of the examined questions focused on the lower level cognitive skills, Bloom created

three dimensions of educational objectives: Cognitive, affective and psychomotor domains (Lord and Baviskar, 2007). On cognitive domains, the taxonomy has become useful in the education sector especially in the preparation of tests instruments in schools (Alison, 2010). In addition, the taxonomy can be used as a guide in promoting critical thinking among the students especially in practical subjects like Physics. It is, therefore, advisable to apply all levels of learning domains in assessing students in order to obtain a useful feedback from them. In the analysis of cognitive domain Alison (2010) focused on the following five aspects:

Knowledge. This is aimed at testing students' ability in memorizing and recalling of facts. Defining terms, naming parts of a diagram and stating of principles.

Comprehension. This is when students are assessed on their ability to interpret facts by putting them in their own words.

Application. Students are assessed on their ability to take up new ideas and apply them to another situation.

Analysis. The pupils are examined on their ability to break down knowledge into different parts and be able to show how they are related.

Synthesis. At this level one is needed to use given facts to come up with new sets of ideas or make predictions. Students are expected to combine knowledge from multiple subjects before they come up with conclusions.

Evaluation. It is the highest level of assessment in cognitive thinking. Students are expected to evaluate information and come to a conclusion such as discussing its advantages and disadvantages.

In order to effectively balance FA tool using Bloom's taxonomy, Sivaraman and Krishna (2015) argue that questions should be designed such that knowledge and comprehension covers 20%-30%, application and analysis 40% to 50% while synthesis and evaluation should cover between 30% and 40% of the set questions.

While analyzing the types of questions that teachers set from learners past test papers, Wambugu (2009) found that knowledge and comprehension were assessed in all the eight (100%) of the sampled papers. The study also establish that application was tested in six (75%) of the sampled papers. In addition, two (25%) of the past assessment tools tested synthesis while evaluation was tasted in only one (12.5%) of the past examination papers. Generally, the study revealed that in Mathematics, teachers in Kiambu County over assess the lower order thinking and under assess higher order thinking during FA.

In another related research by Kwaka (2003), the study revealed that in low performing schools, teachers of Mathematics assess learners more on comprehension (58.5%) and less on knowledge and application.

Although the reviewed literature focused on formative assessment, in the study conducted by Wambugu (2009), cognitive domains were not categorized into lower order thinking, intermediate order thinking and higher order thinking for clear analysis and reporting. Further, the study is silent about the frequency at which teachers assess learners on analysis. A similar trend is noted in the study by Kwaka (2003) where the frequency of assessing analysis, synthesis and evaluation were not investigated. Additionally, the two studies focused on FA in Mathematics subject only.

In order to give more information on FA, this study classified the cognitive domains into three categories of lower, intermediate and higher order thinking by studying all the six cognitive

domains. This was done with an aim of finding out if assessment tools were properly designed by teachers in such a way that knowledge and comprehension covered 20% to 30%, application and analysis 40% to 50% while synthesis and evaluation covered 30% to 40% of the set questions. The study also focused on the frequency of assessing various cognitive domain in Physics as opposed to Mathematics. Lastly, this researcher was interested in knowing the extent to which application of Bloom's taxonomy in FA tools influence students' performance in Physics by use of linear regression.

2.4 Techniques of Formative Assessments

Formative assessment is a very critical component in teaching and learning process because it helps teachers and students in decision making (Goodrum, Hackling, and Rennie, 2001). Therefore, for an effective teaching to take place, quality and appropriate formative assessment techniques should be used (Nenty, 2005).

During formative assessment, teachers should employ different assessment approaches to assess student understanding of what has been taught (Ajogbeje, 2012). This can be done by using assessment techniques such as classroom assessment, self-assessment, peer assessment and performance based assessment.

2.4.1 Classroom Assessment

Classroom assessments (CA) involve a systematic process of collecting information about what a student can do, what he knows and what he is planning to do (Reynolds, Livingstone, and Wilson, 2009). Teachers can use classroom assessment to empower and encourage students to learn. By using a variety of test tools, teachers can gather information that can be used to give positive feedback to students. Such information can also be used to examine student's individual needs and make improvements on delivery of instruction thereby helping students to learn effectively (Marriot and Lau, 2008). Further, McMillan (2008) found out that assessing students at a class room level is important because it is effective in making timely decisions. This means that teachers need to be in charge of classroom assessment by knowing the frequency of conducting it, choosing how to assess and knowing when to give feedback to students.

2.4.2 Self-Assessment

The main purpose of self-assessment is to allow students to judge their own work by identifying strengths and weaknesses in their learning (McMillan and Hearn, 2008). As such, self-assessment can be used by students to regulate themselves and check their progress at individual level (Andrade and Valtcheva, 2009). However, Ross (2006) argues that to make self-assessment effective, students and teachers should negotiate and agree on the criteria to be used by students to do the assessment and how they will receive the feedback. The importance of self-assessment is further supported by McDonald and Boud (2003) who argue that students who are trained on self-assessment are well prepared and out-perform those that do not receive the training. On the other hand, Andrade and Valtcheva (2009) ague that there is a positive relationship between self-assessment and students' writing skills, communication skills, level of engagement and learner freedom. Another very important advantage of self-assessment in FA is that it gives students an

opportunity to be less reliant on their teachers (Andrade and Valtcheva, 2009). As a result, student understanding of their own learning process is supported (Andrade and Valtecheva, 2009).

2.4.3 Peer Assessment

Peer assessment, just like self-assessment is another strategy that is used in FA. It gives room for students to evaluate their peers learning (Topping, 2005). Through peer assessment, learners can give feedback to their fellow students about the value of their work (Topping 2009). Peer assessment is also considered as a teaching strategy because it develops the skills of the assessor and the one to be assessed (Li, Liu, and Steckelberg, 2010). The use of peer-assessment can be very useful in classrooms with a very large teacher-student ratio. Although a single student feedback to his peers may not be as comprehensive as that of the teacher, it is suggested that peer assessment can boost learning (McLeod, Brown, McDaniels, and Sledge, 2009). In supporting this idea, Topping (2009) argues that if it is properly planned and conducted, peer assessment has the potential of improving the quality of learning to a level equivalent to that of the teacher's assessment. The process of delivering and receiving feedback from peers impact positively on meta-cognitive skills such as self-regulation. According to Topping (2005), peer-assessment can be made better when students are allowed to provide feedback rather than grading their peers because this is likely to make students uncomfortable. To make peer-assessment more effective, it should be used together with other types of assessments so that peer assessment is not the only assessment provided.

2.4.4 Performance Based Assessments

Performance based assessment, is also known as project-based assessment or simply project. It is used to gauge if students have mastered skills that can be applied in the real-world situation by asking students to create an end product. According to Palm (2008), the skills to be demonstrated

by the students are applicable outside the classroom setting. Some of the skills to be assessed are construction of a model, doing a scientific experiment and researching and giving a detailed report (Darling-Hammond and Pecheone, 2009; Wren, 2009). In Physics, students are assessed on practical concepts. This makes PBA a very important tool of assessment in the subject because it does more than testing by offering both the student and the teacher an opportunity to understand the challenges involved in the field of profession (Wiggins and McTighe, 2005). The common factor in all PBAs is that learners are asked to do a given task which resembles real world challenges (Wiggins and McTighe, 2005). If used together with other assessment techniques such as peer assessment and classroom-based assessment, PBAs can provide students with the why and how of a practical work which are important in assisting the teacher to know how best the students can learn (Falk, Ort, and Moirs, 2007; Shepard, 2009). PBA is also very useful as a formative assessment since its feedback is timely compared to a standardized assessment. While standardized assessment can take weeks or months to get results, PBA allows teachers to make changes and improvements in their teaching because PBA's responses are immediate (Darling-Hammond and Pecheone, 2009; Wood, Darling-Hammond, Neill, and Roschewski, 2007). In addition, PBA is student centered, making it a very important technique in examining higher order thinking (Wood, et al., 2007; Wren, 2009). In addition, PBA makes learners to be innovative and creative in their learning (Wood et al., 2007; Wiggins and McTighe, 2005). It also gives students an opportunity to demonstrate their understanding of the learned concepts (Darling-Hammond, 2009).

In a study to investigate various techniques used by teachers to assess learners in Mathematics Kwaka (2003), established that homework is the mostly used technique of evaluation (91.7%) while oral questions were fairly utilized (66.7) by teachers during FA. In addition, the study found that less (41.7%) frequently used techniques of FA was project work; which was mostly used

depending on the topic. Although the study indicated that a majority of teachers use classroom assessment, it was found that there was a weak correlation between classroom assessment and students' performance in Mathematics.

In another related research by Kemboi (2015), the study established that, majority (58%) of teachers of Mathematics sometimes utilize self-assessment. Similarly, majority (58%) of teachers sometime use peer-assessment. Further, majority of teachers (45%) seldom apply performance based assessment as a technique of assessing learners during formative assessment. A similar finding by Wabugu (2009), revealed that competency based assessment was not used at all by teachers of Mathematics.

Although the reviewed literature describes the utilization of classroom assessment, self-assessment, peer assessment and performance based assessment, the extent to which they influence learners' performance was not addressed. In addition, the reviewed literature focused on Mathematics as opposed to Physics. Therefore, this study aims at filling this gap in the existing literature.

2.5 Application of Results from Formative Assessment

Results from formative assessment is the information provided by a teacher or peers about one's understanding of concepts after subjecting a learner to assessment tools. Results from FA can also be termed as assessment feedback. Teachers can provide assessment feedback as a corrective information and peers as alternative strategy to challenging concepts. This therefore makes assessment feedback an important component that drives learning (Brown 2007).

According to Gibbs and Simpson (2004), feedback is meant to create understanding through elaboration, correction of mistakes, supporting of extra learning by suggesting more study work,

promotion of cognitive thinking and encouraging students to carry out more tasks on their own. In FA, feedback is important in helping students to critique their learning so that they can be in control of their studies. By doing this, FA becomes an important tool in empowering students to control and manage their own learning (Nichol, 2007). According Gibbs and Simpson (2005), feedback in FA should be designed to support students learning. Thus, the tone of the comments made in writings or words should motivates student. Comments such as "your work is poor" can be devastating to students. Instead, positive comments like, "your argument is fair, but you can strengthen it." should be made so that students are encouraged to improve their performance (Gibbs and Simpson, 2005). Comments sheets can also be utilized to give credit to students where they have performed well (Taylor, 2008). If used in this manner, students can place a lot of value on feedback especially when it is provided to them immediately when the task is still fresh in their minds. This will significantly support and strengthen their learning (Gibbs and Simpson, 2005). This suggestion is further supported by Njiru (2015), who conducted a study on influence of formative evaluation on learner performance in mathematics in secondary schools in Embu County, Kenya. The study established that quick feedback on FA inform students how well they are progressing which is beneficial to both students and teachers.

Further, Gibbs and Simpson (2005) emphasizes that assessment feedback should be frequent and specific to the task assigned so that students' learning is improved. Teachers too should explain to the students why they are given feedback and how they will benefit their learning by reflecting and acting on them (Scott, 2008).

Given that information concerning the usage of feedback from Physics assessment was unknown, more so in Elgeyo Marakwet County, conducting this study therefore allowed the researcher to

provide useful data and help to fill the gap in existing literature about how feedback from formative assessment is utilized.

In a study to establish how long teachers take to give assessment feedback to learners in Mathematics, Wambugu (2009), found that majority of teachers (54%) took two weeks to give feedback. The study also revealed that majority of teachers (53%) gave feedback generally to the whole class while a few (27%) of them gave the feedback to individual learners. A minority of teachers (20%) gave feedback in groups depending on performance of learners.

In another similar survey conducted by Gichuru (2014), the study showed that teachers who have not been trained on FA rarely use the information from learners' tasks to: grade students (mean 1.35), identify students' learning challenges (mean=1.17), report to parents (mean=1.09), assign learners other tracks (mean=1.13) and plan for future lessons (mean=1.39).

Similar, findings made by Kemboi (2015), showed that 37% of Mathematics teachers use assessment feedback to grade learners while 31% use it to give feedback to students. Additionally, 27% of teachers use FA information to identify students' learning needs whereas 18% of teachers use assessment information from students to plan for future lessons. Minority of teachers (6%) indicated that they use information gathered from learners' FA tools to report to parents.

From the reviewed literature, teachers views were only gathered. Learners' views about how teachers conduct FA in their classes were missing. Further, information about how teachers use results from FA tools from learners to: gauge if lesson objectives have been met, guide students to critique their own learning, gauge learners' mastery of practical skills in Physics, improve students' attitude towards Physics and judge their effectiveness in teaching was missing. Lastly, in the reviewed literature, how the use of results from learners' FA tool influences learners

performance in Physics remained unaddressed. Conducting this study helped to address these missing information in the existing literature.

2.6 Other Factors Influencing learners' Performance

Although the reviewed literature focuses on how the practice of FA influence learners performance in Physics, there are other studies that have been conducted to show how some variables influence students' performance in sciences. For example, Wanyama (2013) established that inadequate number of teachers and insufficient reading resources such as reference books and guides for teachers lower students' performance in the subject. In addition, negative attitude towards sciences by students, insufficient textbooks, poorly equipped laboratories and poor pedagogical approaches in science subjects were found by Muchwe (2014) as factors that contribute to students' poor performance. High poverty level was also found to contribute to poor performance of students in KCSE (Njagi and Amukowa, 2013). Other factors are students' absenteeism from school due to lack of school fees, poorly equipped schools in terms of physical facilities, insufficient instructional materials and admission of weak students from primary schools. In addition, Munene (2014) found out that low performance of students is influenced by factors such as negative attitude towards Physics and poor teaching methods.

However, these variables were not investigated in this study because of a number of reasons. For example, although it has been shown by Muchwe (2014) that poor attitude towards science subjects contributes to low performance of students, this did not apply to this study because Physics is an elective subject. Students who opt to enroll for Physics do so because they have a positive attitude towards it. As noted by Wanyama (2013), inadequate number of teachers contributes to low performance of students in KCSE in Narok North District. Elgeyo Marakwet County faces a similar challenge since the Teachers Service Commission (TSC) is the only institution that is

tasked with employment and distribution of teachers across the country. The low teacher to student ratio is therefore a challenge that is faced by all other regions in Kenya.

In addition, the MOE has been carrying out an in-service training for teachers of sciences and mathematics on the best teaching practices that are aligned to the needs of the 21st century (SMASSE, 2015). In this case, it was expected that Physics teachers have benefitted from SMASSE program by improving their teaching skills. Therefore, the contribution to dismal performance in KCSE by poor pedagogical skills in sciences as noted by Muchwe (2014) and Munene (2014) was not considered to play a major role towards the low performance in Physics in Elgeyo Marakwet County.

Since the year 2008, the government of Kenya has been subsidizing secondary school fees at Kshs 12,870 per student (ROK, 2005). According to the subsidization guideline, the Boards of Management (BOM) of secondary schools are required to purchase text books, exercise books, printing papers and laboratory chemicals and equipment. Given that the government introduced subsidization of school fees 12 years ago, factors such as problems in the payment of school fees, insufficient teaching resources, inadequate laboratory equipment and books as noted by Amukowa (2013), Wanyama (2013) and Muchwe (2014) have already been addressed or are in the process of being addressed by the government and were not therefore expected to play out as major variables leading to dismal performance of students in Physics in the location of study.

Given that FA practice is an integral part in the teaching and learning process, low performance in Physics therefore raised doubts about how FA is conducted. It is in light of this that one would wonder if the poor performance of students in Physics in Elgeyo Marakwet is influenced by the way FA is conducted by teachers in the region.

2.7 Summary of Literature Review

On planning of FA, factors such as: adherence to syllabus guidelines, assessing learners after every lesson, informing learners the objective of an experimental assessment prior to the experiment, provision of assessment materials to learners and scheduling of FA in the lesson plan were not investigated. Further, the influence of planning of FA on learners' performance in KCSE in Physics remained unknown. Cognitive domains were also not categorized into lower order thinking, intermediate order thinking and higher order thinking for clear analysis and reporting. Additionally, the frequency of assessing analysis, synthesis and evaluation were not investigated in one of the survey. The extent to which application of Bloom's taxonomy in FA tools influences students' performance in Physics was also unknown. Another gaps that were identified in the existing literature was the unknown extend to which the utilization of classroom assessment, self-assessment, peer assessment and performance based assessment influence learners' performance in Physics. Lastly, in the reviewed literature, learners' views about how teachers conduct FA in their classes are missing. In addition, information about how teachers use results from FA tools from learners to: gauge if lesson objectives have been met, guide students to critique their own learning, gauge learners' mastery of practical skills in Physics, improve students' attitude towards Physics and judge their effectiveness in teaching was missing. Lastly, how the use of results from FA tool influence learners performance in Physics remained unaddressed. Conducting this study, therefore, helped to address the missing information in the existing literature.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter presents the study design, research variables, study population, study location, target population, sample size and sampling techniques. It also describes research instruments and how their validity and reliability were ensured. Data collection procedure that was used will be discussed as well. In addition, the chapter will demonstrate how qualitative and quantitative data were analyzed and presented.

3.2 Research Design

The study used explanatory sequential mixed method design. The design was used because both the quantitative and qualitative data were collected and analyzed in two phases for purpose of gaining a general understanding of the research problem (Tashakkori and Teddlie 2003). In the first phase, learners performance in KCSE, quantitative data in Physics was analyzed in Elgeyo Marakwet County. Through the analysis, a trend of low performance was noted as illustrated in Table 1.0. In the second phase, qualitative data was collected to help in explaining the witnessed trend of low performance by investigating the practice of FA by Physics teacher.

3.3 Dependent and Independent Variables

The study focused on four independent variables and one dependent variable. The independent variables were planning of formative assessment, application of Bloom's taxonomy in FA tools, techniques of formative assessment and application of results from formative assessment. The dependent variable was students' performance in Physics in KCSE.

3.4 Location of the Study

The study was conducted in Elgeyo Marakwet County which is categorized as a semi-arid county. The county is divided into four sub-counties, Marakwet East, Marakwet West, Keiyo South and Keiyo North. The choice of Elgeyo Marakwet County was due to the fact that over the past, students' performance in Physics in KCSE has been consistently low compared to the national mean score as indicated in Table 1.0.

3.5 Target Population

A population of 126 Physics teachers and 13,101 students was targeted in the study from a population of 73 public secondary schools.

3.6 Sampling Techniques and Sample Size

3.6.1 Schools

In Elgeyo Marakwet County, there are four categories of schools: national schools, extra county school, county schools and day schools. This helped to ensure that there was fairness in data collection from all categories of schools. Out of a population of 73 public schools, 15 schools were sampled to represent 21% of the schools in the location of study. The only private school in the county was used during piloting of the research instruments. A sample size of 21% was considered enough since it helped to minimize biasness in sampling (Kombo and Tromp, 2006). Public schools were categorized into three strata: extra county schools, county schools and day schools. Proportionate sampling technique was used to select 21% of schools from each stratum. In each stratum, schools were arranged alphabetically where interval sampling was applied using proportional allocation method proposed by Bowley (1926). This formula was found relevant because it helped in ensuring that the total number of sampled schools from all the three strata added up to 21% of the total population.

$$n_h = n\frac{N_h}{N} \qquad \text{Such that:} \qquad \sum_{h=1}^{H} n_h = n.$$

Where N is the population size of the schools and H the three sub populations of extra county schools, county schools and day schools. The variable N_h is the size of each strata so that the summation of N_h from each strata gives the total population N. The variable *n* is the total sample size from each stratum. By using proportionate and interval sampling of schools from each strata, the researcher was able to sample teachers and students that were highly representative of the whole population.

3.6.2 Teachers

There were 126 Physics teachers in the location of study, out of these, 30 teachers were sampled to represent 24 % of the total population since a sample size of 10% and above should be considered enough (Mugenda and Mugenda, 2009). In the study, it was anticipated that some schools may have less than two Physics teacher which would have lowered the number of sampled teachers. In order to avoid this challenge, a sample size of 24% for teachers was considered. To obtain the sample of 30 teachers, two Physics teacher were sampled from each of the 15 sampled schools using simple random sampling.

3.6.3 Students

The researcher was interested in obtaining students' views on how FA is practised in their schools, 12 students were sampled from a population of 13,101 students representing 0.09 % of the total population. Sampling of 12 students for interview was informed by the fact that if the aim of a study is to understand a common perception from a relatively large and a homogeneous population, twelve interviews should be enough to avoid saturation effect (Guest, Bunce and Johnson, 2006).

To arrive at a sample size of 12 students, one school from each of the three strata was selected randomly. One student from each form was then select using simple random sampling technique. Further, the researcher collected copies of the most recent end of term question papers from the 12 interviewed students for document analysis.

3.6.4 Sample Size

The following table is a summary of the population, the sample and sample size in percentage.

Table 2.0: ***Sample Size***

Item	Population	Sample	% Sample
Schools	73	15	21
Teachers	126	30	24
Students	13,101	12	0.09

Source: Researcher (2017)

3.7 Research Instruments

Data for this study was collected using teachers' questionnaire, students' interview schedules and a document analysis sheet.

3.7.1 Teachers' Questionnaire

The researcher designed one questionnaire that was administered to Physics teachers. Orodho (2009) observes that questionnaires are appropriate tools to use when collecting data from a large group of respondents because they are easy to administer. Further, questionnaires give respondents the freedom to give their views freely without them being known. The questionnaire contained closed ended Likert items. It was used to seek views from teachers about: how they plan for

formative assessment, how they balance cognitive domain according to Bloom's taxonomy in designing FA tools, the techniques they use to assess students and how they use results from formative assessment. Closed ended questions provided precise responses for qualitative analysis. The teacher's questionnaire was administered by the researcher.

3.7.2 Students Interview Schedule

According to Letts (2003), interviews are meant to provide an in-depth information about a subject that is under study since the researcher and respondents are able to meet and talk in detail. A closed fixed response interview was used. This helped the researcher to obtain standard responses from the students about FA for ease of data collection and analysis (Boudah, 2011). During the interview, the researcher was interested in knowing if teachers help students to do corrections after marking their assessments in Physics, the frequency at which students are given practical exercises, if students are given individual assignments after every lesson in Physics and how often they are given group assignments. In addition, the researcher wanted to know if students are provided with all the needed apparatus to carry out assignments involving experiments and project work in Physics. Information from the students were compared to those provided by the teachers.

3.7.3 Document Analysis Sheet

The researcher collected information about how teachers balance the six cognitive domains of learning during FA from the most recent end of term question papers in Physics. By analyzing the collected data, the researcher gained a better understanding about how teachers assess their Physics students according to Bloom's taxonomy (Bowen, 2009). Information gathered using document analysis sheet were compared with those provided by teachers on how they balance cognitive domains in test items.

3.8 Piloting

According to Orodho (2009), testing of the research instruments helps to ensure that information obtained is consistent and accurate. The developed instruments were piloted in two secondary schools which were randomly selected from the location of study. The two schools were not sampled for the actual study. Four teachers and four students of Physics were sampled for piloting in each school. The validity and reliability of research instruments were determined as follows:

3.8.1 Validity of the Research Instruments

Content validity was used to ensure that items in the questionnaire and interview schedule provided valid information about FA. By focusing on content validity, the researcher was able to make corrections on items that did not elicit the required responses. An item that had a CVR of less than 0.6 was removed from the questionnaire. In total, 8 items were removed from the questionnaire during validation. To ensure for content validity, five subject matter experts (SMEs) on assessment trained by KNEC were used. To estimate for content validity, Lawshe's (1975) content validity ratio (CVR) formulation was applied as shown below.

$$\text{CVR} = \frac{ne - \frac{N}{2}}{\frac{N}{2}}$$

Where *n*e in the formula represents the number of experts who agreed on the relevance of particular item while N represents the total number of experts. A CVR was calculated for each item in teachers questionnaire and students interview schedule. Since five subject matter experts were used, an item was considered to be relevant only if it generated a CVR of 0.6 and above (Lawshe, 1975).

3.8.2 Reliability of the Research Instruments

Testing for the reliability of research instruments is important as it helps to enhance the accuracy of respondents' feedback (Tavakol and Dennick, 2011). To determine the reliability of the research questionnaire, the internal consistency method was used where the Cronbach's alpha coefficient was computed using the following expression.

$$\alpha = \frac{N \cdot \bar{c}}{\bar{v} + (N-1) \cdot \bar{c}}$$

Where, N represents the number of items, $\bar{c}$ is the average covariance between item pairs and $\bar{v}$ is the average variance. A coefficient of 0.8 and above was considered high enough to confirm that an instrument is reliable (Orodho, 2009). During the test for reliability, an alpha coefficient for every objective was computed using SPSS version 22.0. A coefficient of 0.841 for objective one and 0.842 for objective two. For objective three, an alpha coefficient of 0.862 was obtained while a coefficient of 0.939 was obtained for objective four. As a result, the instrument was considered reliable because the computed alpha coefficients were all above 0.8.

3.9 Data Collection Procedure

Given that the study was guided by the explanatory sequential design, data was collected in the following phases.

Phase one: The researcher obtained approval from the Dean of Graduate School, Kenyatta University and research permit from National Commission for Science, Technology and Innovation (NACOSTI).

Phase two: The researcher visited the sampled schools requesting the school principles for the study to be conducted in their schools.

Phase three: Quantitative data was collected, analyzed and interpreted to give a general picture of the research problem concerning poor performance of students in Physic in the location of study. The quantitative data analyzed were obtained from KNEC reports. From the analyzed data, a trend of poor performance in students' performance in Physics was noted.

Phase four: In order to explain the possible causes of the persistent low performance in Physics in Elgeyo Marakwet county, qualitative data was collected in this phase using questionnaires and interview schedule. This allowed for the collection of information about the independent variables which are: planning of formative assessment, application of Bloom's taxonomy in FA tools, techniques of formative assessment and application of results from formative assessment.

3.10 Data Analysis and Presentation

Responses from teachers for all the four objectives were generated using a five-point Likert Scale. Below are methods that were used to analyze and present data in each objective.

In objective one, the researcher was interested in finding out how the planning of formative assessment, an independent variable, influences the dependent variable which is the students' performance in Physics. To establish this, 11 items about planning of FA were posed to the respondents where each Likert item was analyzed independently using linear regression, frequencies, mean and standard deviation and presented using tables. The responses from the 11 Likert items were combined so as to generate a composite score using mean score and standard deviation. To establish if formative assessment is satisfactorily planned, a composite score of 4.0 and above was considered.

In objective two, application of Bloom's taxonomy in FA tools was the independent variable. The researcher was interested in knowing how the application of Bloom's taxonomy in formative assessment influences students' performance in Physics which is the dependent variable. To establish if there was balancing of questions in FA tools as per Bloom's taxonomy, teachers were asked to rate the frequency at which they test each of the six cognitive domains. The frequency, mean and standard deviation of each cognitive domain were presented in a table. The cognitive domains were considered to be well balanced if assessment tools were designed such that knowledge and comprehension covered 20% to 30%, application and analysis 40% to 50% while synthesis and evaluation to covered 30% to 40% of the set questions.

In objective three, the researcher was seeking answers on how the techniques of formative assessment, an independent variable, used by teachers influences students' performance in Physics, the independent variable. In relation to this, 14 Likert items were developed where each item was analyzed independently using frequencies, mean and standard deviation and presented using a table. The responses from the 14 items were statistically combined using standard deviation to generate a composite score. To know if the four techniques of FA were used up to the required standard, a combined score of 4.0 and above was considered in this study.

In objective four, the application of results from formative assessment was the independent variable. The study was interested in knowing how it influences the dependent variable which is students' performance in Physics. In total, 12 Likert items were developed. Each item was analyzed separately using frequencies, mean and standard deviation and presented using a table. A combined score was generated using standard deviation. In this study, application of results from FA was considered sufficient if a combined score of 4.0 and above was obtained.

Linear regression model was used because it helped to measure the level of influence that each independent variable had on learners performance. The following model was applied:

$$y= \alpha+\beta x+\varepsilon$$

Where y is the predicted value of the dependent variable, α is predicted value of the dependent variable if the independent variable is zero, β is the rate of change for each unit of change in x, which is the independent variable and ε represents other factors influencing the dependent variable for each objective. The students' performance in Physics was the dependent variable. On the other hand, planning of formative assessment, application of Bloom's taxonomy in FA tools, techniques of formative assessment and application of assessment feedback were the independent variables.

Qualitative data were collected from students using interview schedule. Their responses were analyzed thematically by identifying key concepts and themes. Students' responses were presented in narrative form supported by evidence from raw data.

Table 3.0 below summarizes the four research objective, the type of data collected, analysis technique, method of data presentation and data instrument used.

Table 3.0: ***Data Analysis and Presentation***

Research objective	Type of data	Analysis technique	Presentation	Data instruments
i. To determine how planning of formative assessment influences students' performance in Physics.	Qualitative and Quantitative	Frequencies, Standard Deviation, Mean and Simple regression	Tables	Questionnaire and Interview Schedule
ii. To find out how the application of Bloom's taxonomy in formative assessment tools influences students' performance in Physics.	Qualitative and Quantitative	Frequencies, Standard Deviation, Mean and Simple regression	Tables	Questionnaire Document Analysis Sheet and
iii. To determine how techniques of formative assessment used by teachers influences students' performance in Physics.	Qualitative and Quantitative	Frequencies, Standard Deviation, Mean and Simple regression	Tables	Questionnaire and Interview Schedule
iv. To find out how the application of results from formative assessment influences students' performance in Physics.	Qualitative and Quantitative	Frequencies, Mean Standard Deviation and Simple regression	Tables	Questionnaire and Interview Schedule.

3.11 Ethical, Logistical, Human Relations and Legal Issues

The researcher explained the objectives of the study to teachers who took part in the study. The respondents were informed that their performance in the study is voluntary and were free to decline or withdraw from it at any time they wished to do so. They were also assured that their responses will be treated with confidentiality. They were not required to write their names on the research instruments.

Proper channels of authority were adhered to while collecting data from teachers in the sampled schools.

Prior to the study, the researcher ensured that all the required permits were obtained. A proper research work plan and the research budget was put in place before the study commenced. Furthermore, the research instruments were packaged to ensure that data collection was orderly.

All sources that were used to support the study were acknowledged so as to avoid research plagiarism. Research fraud was prevented by ensuring that data used were true facts collected from the field.

CHAPTER FOUR

PRESENTATION OF FINDINGS, INTERPRETATION AND DISCUSSION

4.1 Introduction

The chapter presents research findings, interpretation and discussion of demographic information of the respondents and findings as per the following objectives: to determine how planning of formative assessment influences students' performance in Physics, to find out how the application of Bloom's taxonomy in formative assessment tools influence students' performance in Physics, to determine how techniques of formative assessment used by teachers influence students' performance in Physics and to find out how the use of results from formative assessment influence students' performance in Physics.

4.2 Demographic Information of the Respondents

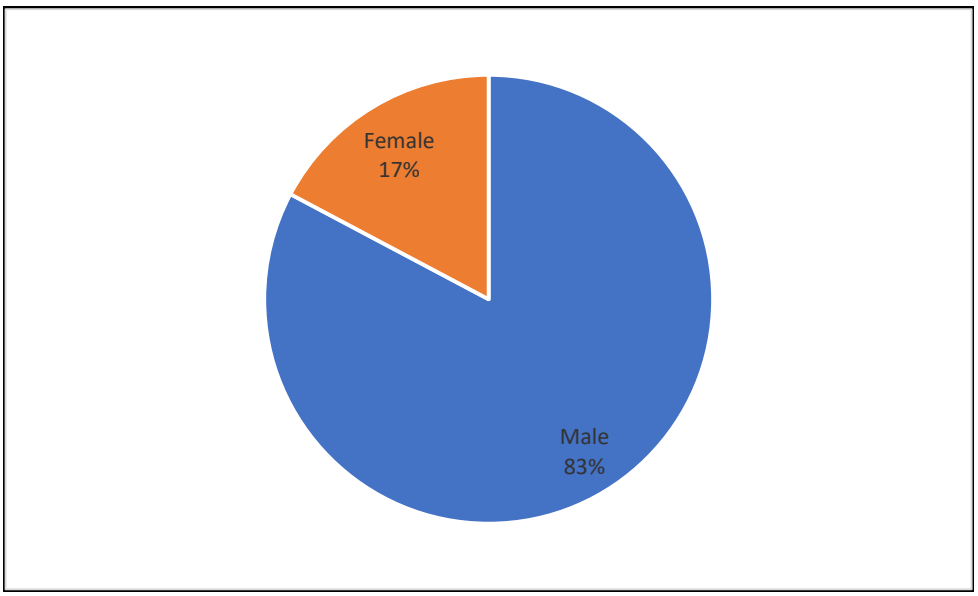
4.2.1 Response Rate

The target respondents were 30 Physics teachers and 12 Physics students. During data collection, 30 questionnaires were administered to 30 Physics teachers in selected schools. The researcher collected 29 dully filled questionnaires giving a response rate of 96.7% for teachers. During the interview, all the targeted 12 students were interviewed.

4.2.2 Gender of the Respondents

The study sought to find out the gender of Physics teachers which is presented in Figure 3 below.

Figure 2.0: ***Gender of Physics Teachers***

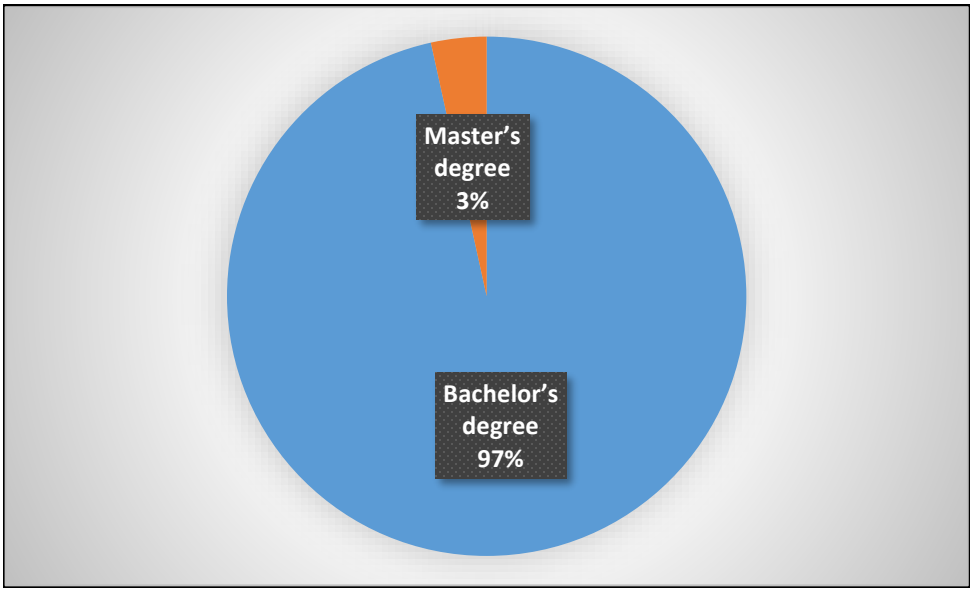


The data collected revealed that the majority of the Physics teachers were male 24(82.8%) and 5(17.2%) were female. This shows that the majority of Physics teacher in Elgeyo Marakwet County are male. The question on gender of Physics teachers was to establish if boys and girls get an opportunity to be taught by both male and female teachers given that in education, gender issues are regarded as important in influencing students' learning.

4.2.3. Highest Academic Qualification of Physics Teachers

The researcher sought information on the highest academic qualifications of Physics teachers. This was informed by the fact that teachers' academic qualification has an influence on students' academic achievement. The findings are summarized in figure 4 below.

Figure 3.0: ***Highest Academic Qualification of Physics Teachers***

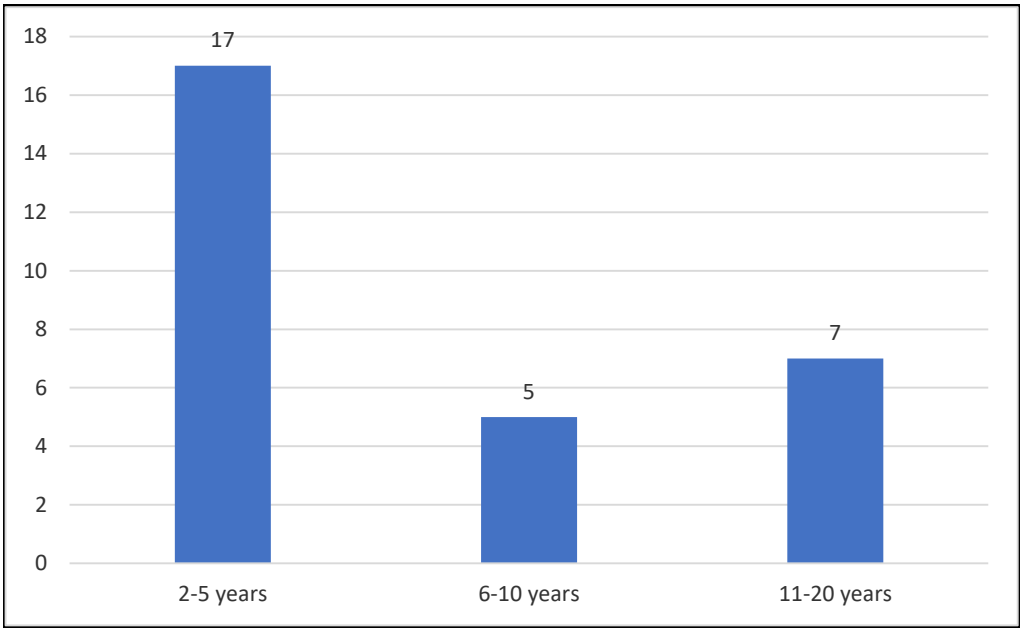


From the data gathered, it was established that most of the Physics teachers had a bachelor's degree 28(96.6%) while only a minority had master's degree. This shows that majority of Physics teachers in Elgeyo Marakwet County have the requisite knowledge and skills needed to deliver learning content to students of Physics. This is because diploma is the minimum qualification required for one to teach in secondary school in Kenya.

4.2.4. Experience of Physics Teachers in Years

Further, the researcher sought information on the experience of Physics teacher in years. This was informed by the fact that experience determines the effectiveness of a teacher (Cheryll and Rebecca, 2006). Figure 5 below shows the summary of the findings.

Figure 4.0: ***Experience of Physics Teachers in Years***



Data collected indicated that 17(58.6%) Physics teachers had an experience of between 2-5 years, 5(17.2%) had taught Physics for between 6-10 years and 7(24.1%) had taught Physics for between 11-20 years. This means that majority of teachers in Elgeyo Marakwet County are inexperienced, an aspect that is likely to affect their effectiveness in assessing learners in Physics.

4.3 Students' Performance in Physics from 2013 to 2017

The study sought to assess the students' KCSE performance in Physics from 2013 to 2017 from the sampled schools. This data was collected with a purposes of determining if they were influenced by how teachers conducted FA. Linear regression was used to determine the level of influence that each independent variable had on students' performance. The summary of the results are presented in table 4.0 below.

Table 4.0: ***Students Performance in Physics from 2013 to 2017in Elgeyo Marakwet County***

Year/ Grades		E	D- to D+	C- to C+	B- to B+	A- to A	Mean
2013	F	0	12	9	7	1	**3.90**
	%	0.00	41.40	31.00	24.10	3.4	
2014	F	0	8	13	8	0	**3.00**
	%	0.00	27.60	44.80	27.60	0.00	
2015	F	0	4	17	7	1	**3.17**
	%	0.00	13.80	58.60	24.10	3.40	
2016	F	0	4	19	6	0	**3.07**
	%	0.00	13.80	65.50	20.70	0.00	
2017	F	2	11	12	4	0	**2.63**
	%	6.9	37.90	41.40	13.80	0.00	

Source: Researcher (2018)

According to KNEC, the minimum grade in Physics is one (1) while the maximum grade is twelve (12). The study findings on Students' Performance in Physics from 2013 to 2017 indicated that the mean grade in Physics in 2013 was 3.90 (C- to C+), in 2014 the mean grade was 3.00 (C- to C+) and in 2015 the mean grade was 3.17 (C- to C+). Further, in 2016 the mean grade was 3.07 (C- to C+) and in 2017 the mean grade was 2.63 (D- to D+).

From the collected results, the highest KCSE mean grade in Physics in Elgeyo Marakwet County was in 2013 with a mean of 3.90 (C- to C+) and the lowest was in 2017 with a mean grade of 2.63 (C- to C+).

The national mean was 9.62 (B) in 2013 and 9.24 (B) 2014. In the year 2015, the national mean was 10.50 (B+) and 10.48(B+) in 2016. Lastly, the national mean for 2017 was 8.41(B-) (KNEC, 2018).

This implies that performance in Physics in Elgeyo Marakwet County between 2013 and 2017 was poor since it fell below grade C+ and was below the national mean for all the five years.

4.4 Analysis of Specific Objectives

4.4.1 To Find out How Planning for Formative Assessment Influences Students' Performance in Physics

The first objective of the study was to establish the influence of planning for formative assessment on student's performance in Physics in KCSE. The respondents in this study were Physics teachers from selected public secondary schools in Elgeyo Marakwet County.

In the study, a structured questionnaire was used to collect quantitative data using eleven items which were used to ask teachers if they: schedule formative assessment in their schemes of work and lesson plan, consider learning objectives when designing formative assessment tools, strictly adhere to syllabus guidelines when planning for formative assessment and assess Physics students after every lesson based on lesson plan.

Teachers were also asked if they: inform students the objective of an experimental assessment before they conduct it, give to students written procedures one day before an experiment, ensure that all apparatuses are available before conducting experimental assessment, provide each student with all the needed apparatus to complete assessment tasks during experiments, provide assessment's objectives to students in advance and lastly if they provide assessment procedures to students in advance.

Physics teachers were provided with five scale Likert questions rated; strongly disagree (SD) 1, disagree (D) 2, neutral (N) 3, agree (A) 4 and strongly agree (SA) 5. Each item was computed from the scale of measurement displayed in percentage and mean as presented in table 5.0 below.

Table 5.0: ***Teachers' Response on Planning for Formative Assessment***

Statement	SD		D		N		A		SA		M	SD
	F	%	F	%	F	%	F	%	F	%		
Scheduling FA in the schemes of work.	0	0.0	7	24.1	4	13.8	17	58.6	1	3.4	3.41	0.907
Scheduling FA in the lesson plan.	0	0.0	13	44.8	5	17.2	11	37.9	0	0.0	2.93	0.923
Learning objectives in FA tools.	0	0.0	12	41.4	3	10.3	11	37.9	3	10.3	3.17	1.104
Syllabus guidelines when planning for FA	0	0.0	14	48.3	4	13.8	11	37.9	0	0.0	2.90	0.939
FA based on lesson plan.	0	0.0	21	72.4	6	20.7	2	6.9	0	0.0	2.34	0.614
Objective of experimental assessment	6	20.7	12	41.4	5	17.2	0	0.0	0	0.0	2.79	0.774
Written procedures a day before experiment	4	13.8	16	55.2	5	17.2	1	3.4	3	10.3	2.41	1.119
All apparatuses for experimental.	0	0.0	16	55.2	4	13.8	7	24.1	2	6.9	2.83	1.037
Each student with all apparatus during experiments.	0	0.0	15	51.7	7	24.1	7	24.1	0	0.0	2.72	0.840
Assessment objectives in advance.	0	0.0	20	69.0	5	17.2	4	13.8	0	0.0	2.45	0.736
Assessment procedures in advance.	1	3.4	23	79.3	1	3.4	4	13.8	0	0.0	2.28	0.751
Grand Mean											**2.7**	

Source: Researcher (2018)

Majority of the respondents 17(58.6%) agreed that they schedule formative assessment in the scheme of work while 7(24.1%) disagreed (M=3.41, SD =0.907). The mean of 3.41 on average implies that Physics teacher were undecided about whether they schedule FA in their schemes of work.

Majority of the respondents 13(44.8%) disagreed with the statement that they schedule FA in their lesson plan compared to 11(37.9%) who agreed (M=2.93, SD = 0.923). A mean of 2.93 implies that Physics teachers disagree with the statement that they schedule FA in their lesson plans.

Similarly, 12(41.4%) of the respondents disagreed with the statement that they consider learning objectives when designing formative assessment tools while 11(37.9%) agreed and 3(10.3%) strongly agreed with the statement (M=3.17, SD=1.104). A mean of 3.17 means that the respondents were undecided if they consider learning objectives when they are designing formative assessment tools.

Most of the respondents 14(48.3%) disagreed with the statement that they strictly adhere to syllabus guidelines when planning formative assessment, 11(37.9%) agreed with this statement (M = 2.90, SD=0.939). A mean of 2.90 indicates that Physics teachers disagree with the fact that they strictly adhere to syllabus guidelines when planning FA.

On the statement that I assess Physics students after every lesson, 21(72.4%) disagreed while 2(6.9%) agreed to this statement (M = 2.34, SD = 0.614). A mean of 2.34 means that Physics teachers do not assess their students after every lesson.

Most respondents 12(41.4%) disagreed and 6(20.7%) strongly disagreed with the statement that I inform students the objective of the experimental assessment before conducting it (M = 2.79, SD = 0.774). A mean of 2.79 means that Physics teachers do not inform students the objective of the experimental assessment before conducting it.

The study also revealed that teachers do not give students written procedures a day before the experiment as indicated by most respondents 16(55.2%) who disagreed and 4(13.8%) who strongly

disagreed with the statement (M= 2.41, SD = 1.118). A mean of 2.41 indicates that Physics teachers disagree with the fact that they give students written procedures a day before the experiment is conducted.

Large proportion of the respondents 16(55.2%) disagreed with the statement that I ensure that all the apparatus are available before conducting an experimental assessment, while 7(24.1%) agreed and 2(6.9%) strongly agreed with the statements (M =2.83, SD = 1.037). A mean of 2.83 means that physics teachers do not ensure that all the apparatus are available to their students before conducting an experimental assessment.

Further, each student is not provided with the needed apparatus to complete assessment task during experiment as indicated by 15(51.7%) of the respondents who disagreed as opposed to 7(24.4%) who agreed with the statement (M = 2.72, SD =0.840). A mean of 2.72 means that Physics teachers do not provide each student with the needed apparatus to complete assessment task during experiment.

Similarly, students are not provided with assessment objectives in advance as shown 20(69.0%) of the respondents who disagreed as opposed to 4(13.8%) who agreed with the statement (M = 2.45, SD =.736). A mean of 2.45 indicates that Physics teachers disagree with the fact that they provide assessment objectives to students in advance.

On the statement that I provide experiment procedures to the students in advance, most respondents 23(79.3%) disagreed with the statement while 4(13.8%) agreed to this statement (M = 2.28, SD =.751). A mean of 2.28 indicates that Physics teachers do not provide experiment procedures to the students in advance.

From the data collected, the combined score for the planning for formative assessment was found to be M=2.74. This means that planning for formative assessment is not well conducted in Elgeyo Marakwet County as the combined score falls below 4.0. Yet according to the findings by Njeru (2012) it was reported that majority of the respondents (Mean=4.9) agreed that planning for FA is important as it influence learners' performance.

The response from students' interviews on how often they are given class assignments in Physics, one of the respondent indicated that they are assessed at the end of a sub topic. This can be confirmed by, respondent 004F1 who said, "Our Physics teacher gives us exams after every topic". However other students responded that they are not given class assessment at all. The respondent 011F4 had this to say, "Our teacher doesn't give us questions during Physics lesson".

These research findings agree with the study conducted by Wambugu (2009) in a number of ways. For example, the study showed that majority of teachers (73%) planned for FA after teaching a particular topic instead of assessing learner after every lesson. In the same study, it was also discovered that, majority of teachers (63%) use learning concept to plan for FA instead of using lesson's objectives. Lastly, Wambugu (2009) discovered that majority of teachers (53%) rarely plan for FA in their schemes of work.

In order to establish the degree to which the planning for formative assessment influences students' performance in Physics, a linear regression model, as shown below, was applied.

$$y= \alpha+\beta x+\varepsilon$$

Where y is the predicted value of the dependent variable which is the students' performance in Physics. The variable x is the planning for formative assessment which is the independent variable

and α is the predicted value of the dependent variable if the planning for formative assessment is zero. The coefficient β is the rate of change for each unit of change in x while ε represents other dependent variables.

A simple linear regression model was used to determine if there was a significant relationship between planning for FA, Table 5.0, and students' performance in Physics in KCSE as indicated in Table 4.0. The study findings are presented in table 6 below.

Table 6.0: ***Linear Regression Results on Planning for FA and Annual Physics Performance from 2013 to 2017***

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.598	0.068		0.304	0.764
	Planning for Formative Assessment.	1.411	0.662	0.458	2.133	0.044
Model Summary; R Square Value = 0.532, ANOVA (Goodness of Fit Test) = 0.000						
a. Dependent Variable: 2013						
1	(Constant)	1.281	0.861		-0.689	0.498
	Planning for Formative Assessment.	0.631	0.268	0.549	2.358	0.027
Model Summary; R Square Value = 0.621, ANOVA (Goodness of Fit Test) = 0.001						
a. Dependent Variable: 2014						
1	(Constant)	0.523	0.122		0.214	0.321
	Planning for Formative Assessment.	1.383	0.462	0.568	2.993	0.007
Model Summary; R Square Value = 0.711, ANOVA (Goodness of Fit Test) = 0.000						
a. Dependent Variable: 2015						
	(Constant)	0.621	0.012		0.231	0.015
	Planning for Formative Assessment.	1.832	0.616	0.652	2.974	0.022
Model Summary; R Square Value = 0.521, ANOVA (Goodness of Fit Test) = 0.000						
a. Dependent Variable: 2017						

Source: Researcher (2018)

The study findings from regression analysis indicated that in the year 2013, there was a significant relationship (p= 0.044) between planning for formative assessment and students' performance in Physics in KCSE. The model showed that performance in Physics changed by 1.411 for every unit change in planning for FA.

In the year 2014, the findings showed that there was a significant relationship (p=0.027) between planning for formative assessment and students' performance in Physics in KCSE where performance in Physics changed by 0.631 for every unit change in planning for FA.

Further, in 2015, the study findings indicated that there was a significant relationship (p=0.007) between planning for formative assessment and students' performance in Physics in KCSE. The regression model showed that performance in Physics changed by 1.383 for every unit change in planning for FA.

Lastly, in 2017, the study established that there was a significant relationship (p=0.022) between planning for formative assessment and students' performance in Physics in KCSE where performance changed by 1.832 for every unit change in planning for FA.

There was no significant relationship between planning for formative assessment and students' performance in Physics in the year 2016.

In order to obtain an overall linear regression of planning for FA against students' performance, Physics results from 2013 to 2017 were transformed to one for which a general linear regression was obtained as shown in Table 7.0 below.

Table 7.0: ***Overall Linear Regression on Planning for Formative Assessment and Physics Performance from 2013 to 2017***

Coefficients[a]					
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	12.505	3.419		3.658	0.001
	Planning for Formative Assessment.	0.842	1.260	0.128	.668	0.005
Model Summary; **R Square Value = 0.601**, ANOVA (Goodness of Fit Test) = 0.000						

Source: Researcher (2018)

Averagely, the study findings indicated that there was a significant relationship ($p<0.05$) between planning for formative assessment and students' performance in Physics in KCSE (Model Summary; R Square Value = 0.601, ANOVA (Goodness of Fit Test) = 0.000).

Therefore, y = 12.505 + 0.842 (Planning) + 3.419 (error)

This implies that planning for formative assessment influences performance in Physics by up to 84.2%. This underscores the importance of planning for formative assessment in enhancing students' performance in Physics.

4.4.2 To Find out How Application of Bloom's Taxonomy in Formative Assessment Tools Influence Students' Performance in Physics in KCSE

The second objective of the study was to establish how the application of Bloom's taxonomy in formative assessment tools influence students' performance in Physics in KCSE. The respondents in this study were Physics teachers from selected public secondary schools in Elgeyo Marakwet County. A structured questionnaire was used to collect qualitative data using six items. The study was interested in finding out how teachers balance the six cognitive domains of learning during FA namely; knowledge, comprehension, application, analysis, synthesis and evaluation. Physics

teachers were provided with five scale Likert questions rated; never 1, rarely 2, sometimes 3, very often 4 and always 5. Each item was computed from the scale of measurement displayed in frequency, percentage and mean as presented in Table 8.0 below.

Table 8.0: ***Response on the Use of Various Types of Cognitive Domains during Formative Assessment***

Statement	**Always**		**Very often**		**Sometimes**		**Rarely**		**Never**		**Mean**	**SD**
	F	%		%	F	%	F	%	F	%		
Knowledge	11	37.9	16	55.2	2	6.9	0	0	0	0	4.31	0.612
Comprehension	14	48.3	12	41.4	2	6.9	1	3.4	0	0	4.34	0.542
Application	7	24.1	7	24.1	2	6.9	13	44.8	0	0	3.28	0.241
Analysis	7	24.1	8	27.6	4	13.8	10	34.5	0	0	3.41	0.354
Synthesis	5	17.2	3	10.3	4	13.8	17	58.6	0	0	2.86	0.221
Evaluation	7	24.1	2	6.9	3	10.3	17	58.8	0	0	2.97	0.113
Grand Mean											**3.5**	

Source: Researcher (2018)

From the results, the study established that majority of teachers assess knowledge domains in their FA tools. This was evident by majority of the respondents 16(55.2%) who tests knowledge very often, 6(6.9%) responded that they sometimes assess learners on knowledge (M = 4.31, SD = 0.612). An average mean of 4.31 shows that a majority of teachers design students assessment tools in Physics where a large percentage of items assess students on knowledge.

Similarly, most respondents assess comprehension type of cognitive domain during formative assessments as shown by 14(48.3%) of the respondents who use the domain always as compared to 1(3.4%) who use it rarely (M = 4.34, SD = 0.542). A mean of 4.34 indicates that majority of teachers assess students on comprehension during FA.

The study established that most teachers rarely assess learners on application in their formative assessment tools as indicated by the majority of the respondents 13(44.8%) compared to 2(6.9%) who say that they sometimes test on application during FA (M=3.28, SD=0.241). An overall mean of 3.28 means that a majority of teachers do not assess learners on application when they design assessment tools.

From the study, it was evident that teachers rarely assess learners on analysis in their formative assessment tools as indicated by majority of the respondents 10(34.5%) who responded that they rarely assess learners on analysis compared to 8(27.6%) who indicated that they very often assess learners on analysis (M=3.41, SD=0.354). A mean of 3.41 means that a large percentage of teachers design assessment tools in Physics with insufficient questions assessing learners on analysis.

Likewise, synthesis domain was also found to be rarely assessed by teachers in the formative assessment tools in Physics as indicated by majority of the respondents 17(58.6%) who responded that they rarely test synthesis in FA compared to 3(10.3%) who responded that they very often assess learners on synthesis (M = 2.86, SD = 0.221). A mean of 2.86 shows that teachers assess learners using FA tools with inadequate items testing on synthesis.

The study also established that majority of teachers do not assess learners on evaluation. This was evident by majority of the respondents 17(58.8%) who indicated that they rarely assess students

on evaluation while few of the respondents 2(6.9%) indicated that they very often assess learners on evaluation (M = 2.97, SD = 0.113). An average mean of 2.97 shows that a majority of teachers do not design assessment tools that examine students evaluation skills in Physics.

In summary, the study findings indicated that knowledge and comprehension are the commonly assessed cognitive domain by Physics teacher. Further, the grand mean of 3.53 implies that Physics teachers do not design FA tools in Physics so that knowledge, comprehension, application, analysis, synthesis and evaluation are proportionally assessed in accordance to Bloom's taxonomy.

In order to gain a better understanding about how teachers assess Physics students according to Bloom's taxonomy, a document analysis sheet was used to collect data from students' assessment tools. The study findings are presented in Table 9.0 below.

Table 9.0: ***Document Analysis Results on Application of Bloom's Taxonomy***

Class/content area.	Knowledge and Comprehension (Lower order thinking)		Application and Analysis (Intermediate order thinking)		Synthesis and Evaluation (Higher order thinking)	
	Frequency	%	Frequency	%	Frequency	%
Form 1	94	66.7	44	31.2	3	2.1
Form 2	75	56.4	57	42.8	1	0.8
Form 3	57	42.2	77	57.0	1	0.8
Form 4	45	38.5	68	58.1	4	3.4
Average	**271**	**51.5%**	**246**	**46.8%**	**9**	**1.7%**

Source: Researcher (2018)

The results from the table indicated that knowledge and comprehension which are lower order thinking are assessed to about 51.5% while application and analysis which are intermediate order

thinking are assessed to about 46.8%. On the other hand, synthesis and evaluation which are higher order thinking are assessed to about 1.7% in Physics FA.

Generally, findings from learners' assessment tools and feedback from teachers showed a similar trend where it was established that higher order thinking was under assessed while lower order thinking was over assessed by teachers. It is therefore evident that preparation of FA tools by Physics teachers in Elgeyo Marakwet County do not meet the required standards because not all levels of cognitive domain are assessed proportionately.

Findings from this study are in agreement with a number of some studies. For instance, in a research conducted by Kwaka (2003), it was established that teachers of Mathematics assess learners more on comprehension (58.5%) and less on knowledge and application. In addition, in a survey conducted by Wambugu (2009), it was established that teachers assess learners more on the lower order thinking compared to higher order thinking. This was evident by the fact that in the study by Wambugu (2009), knowledge and comprehension were assessed in all the eight (100%) of the sampled papers. The study also establish that application was tested in six (75%) of the sampled papers. In addition, two (25%) of the past assessment tools tested synthesis while evaluation was tasted in only one (12.5%) of the past examination papers.

Lastly, findings from this study contradict the proposal by Sivaraman and Krishna (2015) who argue that in order to effectively balance FA tools using Bloom's taxonomy, questions should be designed in such a way that: knowledge and comprehension cover 20%-30%, application and analysis cover between 40% to 50% while synthesis and evaluation to cover between 30% to 40%.

In order to establish the extent to which application of Bloom's taxonomy in formative assessment influences students' performance in Physics, a linear regression model, as shown below, was applied.

$$y= \alpha+\beta x+\varepsilon$$

Where y is the predicted value of the dependent variable which is the students' performance in Physics. The variable x is the application of Bloom's taxonomy in FA which is the independent variable and α is the predicted value of the dependent variable if the application of Bloom's taxonomy in formative assessment is zero. The coefficient β is the rate of change for each unit of change in x while ε represents other dependent variables. Data in Table 8.0 on application of Bloom's taxonomy in FA was regressed with data in Table 4.0 which is the students' performance in Physics. The model summary is presented in Table 10.0 below.

Table 10.0: ***Linear Regression Results on Application of Bloom's Taxonomy in Formative Assessment from 2013 to 2017***

Coefficients[a]					
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.341	0.821		0.551	0.223
	Application of Bloom's Taxonomy in Formative Assessment.	0.721	0.112	0.625	2.358	0.000
Model Summary; R Square Value = 0.611, ANOVA (Goodness of Fit Test) = 0.000						
a. Dependent Variable: 2014						
1	(Constant)	0.523	0.241		0.321	0.254
	Application of Bloom's Taxonomy in Formative Assessment.	0.452	0.321	0.321	1.873	0.000
Model Summary; R Square Value = 0.611, ANOVA (Goodness of Fit Test) = 0.000						
a. Dependent Variable: 2015						
	(Constant)	0.621	0.011		0.332	0.015
	Application of Bloom's Taxonomy in Formative Assessment.	0.721	0.212	0.611	1.321	0.012
Model Summary; R Square Value = 0.524, ANOVA (Goodness of Fit Test) = 0.000						
a. Dependent Variable: 2017						

Source: Researcher (2018)

The study findings indicated that there was a significant relationship between application of Bloom's taxonomy in FA and students' performance in Physics in KCSE in 2014 (p = 0.000), where students' performance changed by 0.721 for every unit change in Bloom's taxonomy.

In the year 2015, there was also a significant relationship (p = 0.000) between application of Bloom's taxonomy and students' performance in Physics where, a unit change in Bloom's taxonomy caused students' performance to change by 0.452.

Lastly, in 2017 there was a significant relationship (p = 0.012) between application of Bloom's taxonomy and students performance, where a unit change in Bloom's taxonomy caused learners

performance in Physics to change by 0.721. The years 2013 and 2016 did not show any significant relationship between the application of Bloom's taxonomy in formative assessment and students' performance in Physics in KCSE.

In order to obtain an overall linear regression of application of Bloom's taxonomy in FA on students' performance, Physics results from 2013 to 2017 in Table 4.0 were transformed so as to obtain a general linear regression on the influence of application of Bloom's taxonomy on learners performance. The model summary is presented in Table 11.0 below.

Table 11.0: ***Overall Linear Regression on Application of Bloom's Taxonomy in Formative Assessment and Physics Performance from 2013 to 2017***

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	13.681	3.100		4.414	0.000
	Application of Bloom's Taxonomy in Formative Assessment.	0.306	0.864	0.068	.354	0.000
Model Summary; R Square Value = 0.680, ANOVA (Goodness of Fit Test) = 0.000						

Source: Researcher (2018)

Averagely, the study concluded that application of Bloom's taxonomy in formative assessment has a significant influence on students' performance in Physics in KCSE ($P<0.05$).

Therefore, **y** = 13.681 + 0.306 (Application of the Bloom's Taxonomy) + 3.419 (error)

This implies that application of the Bloom's taxonomy influences performance in Physics by up to 30.6%. This, therefore, shows the importance of implementing Bloom's taxonomy in enhancing students' performance in Physics.

4.4.3 To Find Out How Techniques Used in Formative Assessment Influence Students' Performance in Physics in KCSE

The third objective of the study was to determine how techniques of formative assessment used by teachers influence students' performance in Physics in KCSE. Physics teachers and Physics students were respondents. Students of Physics were subjected to an interview while Physics teachers were provided with questionnaires.

The questionnaires contained fourteen items which were used to ask teachers if they use: classroom assessment to find out if the students have understood lesson's objectives, classroom assessment to encourage students to learn, classroom assessment to gauge students' abilities in solving numerical problems in Physics, classroom assessment to enhance students understanding of the lessons' objectives and self-assessment to promote learner's freedom in solving problems in Physics.

The questionnaire was also used to ask teachers if the use: self-assessment to promote learner confidence in Physics, self-assessment to know the individual needs of a learner's, self-assessment to encourage individual students to take ownership of the learning process, peer assessment to enhance learning among the students, peer assessment to provide students with additional feedback through their peers, peer assessment to help students to internalize learning concepts better, experiments to enhance learner's application skills in Physics, experiments to gauge learner's evaluation skills in Physics and experiments to enhance learners' skills in report writing in Physics.

The questionnaire was rated; strongly disagree (SD) 1, disagree (D) 2, neutral (N) 3, agree (A) 4 and strongly agree (SA) 5. Each item was computed from the scale of measurement displayed in percentages and means as presented in Table 12.0.

Table 12.0: ***Teachers' Responses on Techniques Used in Formative Assessment***

Statement	SA		A		N		D		SD		Mean	SD
	F	%	F	%	F	%	F	%	F	%		
Using CA to find out if students have understood lesson's objectives.	3	10.3	22	75.9	2	6.9	2	6.9	0	0	3.90	0.112
Using CA to encourage students to learn.	2	6.9	20	69	2	6.9	5	17.2	0	0	3.66	0.241
Using CA to identify problem solving Skills	0	0	12	41.4	7	24.1	10	34.5	0	0	3.07	0.321
Using CA to enhance lessons' objectives.	2	6.9	7	24.1	3	10.3	17	58.6	0	0	2.79	0.213
Using SA to promote learner freedom in solving problems in Physics.	0	0	5	17.2	5	17.2	19	65.5	0	0	2.52	0.512
Using SA to promote learners' confidence in Physics.	0	0	4	13.8	7	24.1	18	62.1	0	0	2.52	0.321
Using SA to know learners' individual needs.	0	0	2	6.9	4	13.8	23	79.3	0	0	2.28	0.221
Using SA to encourage individual students.	0	0	5	17.2	4	13.8	20	69	0	0	2.48	0.124
Using PA to enhance students' learning.	2	6.9	4	13.8	3	10.3	20	69	0	0	2.59	0.421
Using PA to provide additional feedback.	0	0	5	17.2	3	10.3	21	72.4	0	0	2.45	0.241
Using PA to help students to internalize learning concepts better.	0	0	6	20.7	3	10.3	20	69	0	0	2.52	0.231
Using experiments to enhance learners application skills.	0	0	4	13.8	2	6.9	23	79.3	0	0	2.34	0.124
Using experiments to gauge evaluation skills.	0	0	4	13.8	5	17.2	20	69	0	0	2.45	0.005
Using experiments to enhance report writing.	1	3.4	1	3.4	3	10.3	17	58.6	7	24.1	2.03	0.413
Grand Mean											**2.5**	

Source: Researcher (2018)

From the table, it can be noted that majority of the respondents 22(75.9%) agreed that they use classroom assessment to find out if the students have understood lesson's objectives while 2(6.9%)

disagreed (M = 3.90, SD = 0.112). A mean of 3.90 implies that teachers do not use classroom assessment to gauge if learners have understood lesson's objectives.

Physics teachers also use classroom assessment to encourage students to learn, as indicated by most respondents 20(69.0%) who agreed compared to 5(17.2%) who disagreed with the statement (M=3.66, SD=0.241). Although the majority of respondents agreed that they use classroom assessment to encourage students to learn, a mean of 3.66 give a general impression that, that is not the case.

On the statement that I use classroom assessment to identify students' abilities in solving numerical problems in Physics, 10(34.5%) disagreed while 12(41.4%) agreed (M= 3.07, SD=0.321). A mean of 3.07 indicates that Physics teachers do not use classroom assessment to rank students' abilities in solving mathematical problems in Physics.

Most respondents 17(58.6) disagreed with the statement that they use classroom assessment to enhance students understanding of the lessons' objectives whereas 7(24.1%) agreed with the statement (M =2.79, SD = 0.213). With a response mean of 2.79 on this statement, it is evident that teachers do not use classroom assessment to enhance students understanding of the lessons' objectives.

Similarly, most respondents 19(65.5%) disagreed with the statement that they use self-assessment to promote learner freedom in solving problems in Physics, while 5(17.2%) agreed (M = 2.52, SD = 0.512). A mean of 2.52 indicates that Physics teachers do not use self-assessment to promote learner freedom in solving problems in Physics.

Majority of the respondents 18(62.1%) disagreed on statement that they use self-assessment to promote learner confidence in Physics compared to the minority 4(13.8%) who agreed with this statement (M=2.52, SD=0.321). A mean response of 2.52 implies that Physics teachers do not use self-assessment to promote learner confidence in Physics.

Further, on the statement that I use self-assessment to know the individual needs of a learner, 23(79.3%) of the respondents disagreed with this statement against the minority 2(6.9%) who agreed (M = 2.28, SD = 0.221). With a mean of 2.28, it means that Physics teachers do not utilize self-assessment in finding out the individual needs of a learner which ought to be the common practice.

Additionally, on the item that I use self-assessment to encourage individual students to take ownership of their learning process, the majority of the respondents 20(69.0%) disagreed compared to 5(17.2%) who agreed with the statement (M = 2.48, SD = 0.124). A mean of 2.48 shows that Physics teachers do not use self-assessment to encourage individual students to be in control of their learning process as needed.

Majority of the respondents 20(69.0%) disagreed with the statement that they use peer assessment to enhance learning among the students compared to 2(6.9%) of the respondents who strongly agreed with the statement (M =2.59, SD = 0.421). A mean of 2.59 implies that teachers do not use peer assessment to support learning among the students.

On the other hand, majority of the respondents 21(72.4%) also disagreed with the statement that they use peer assessment to provide students with additional feedback through their peers as opposed to 5(17.2%) who agreed with the statement (M =2.45, SD = 0.241). An overall mean of

2.45 on this statement indicates that Physics teachers do not use peer assessment to provide students with additional feedback through their fellow students.

Additionally, most respondents 20(69.0%) disagreed that they use peer assessment to help students to internalize learning concepts better compared to minority 6(20.7%) who agreed with the statement (M = 2.52, SD = 0.231). A mean of 2.52 shows that Physics teachers do not agree with the fact that they use peer assessment to help students to internalize learning concepts better.

Most respondents 23(79.3%) disagreed with the fact that they use experiments to enhance learners' application skills in Physics as opposed to 4(13.8%) of the respondents who agreed (M =2.34, SD = 0.124). With a mean of 2.34 on this statement, it is evident that Physics teachers do not utilize performance based assessment to enhance learners' application skills in Physics.

On the statement that I use experiments to gauge learner's evaluation skills in Physics, 20(69.0%) of the respondents disagreed compared to the minority of respondents 4(13.8%) who agreed (M=2.45, SD=0.005). A mean of 2.45 means that teachers disagree with the fact that they use performance based assessment to gauge learner's evaluation skills in Physics.

Lastly, 17(58.6%) of the respondents strongly disagreed that they use experiments to enhance learners' skills in report writing in Physics while 1(3.40%) strongly agreed with the statement (M=2.03, SD = 0.413). A mean of 2.03 means that Physics teachers do not use performance based assessment to support learners' skills in report writing in Physics.

A grand mean of 2.5 as shown in Table 12.0 is way below a mean of 4.0. It, therefore, implies that Physics teachers do not use classroom assessment, self-assessment, peer assessment and

performance based techniques of formative assessment to the expected level. This is further supported by learners' feedback during the interview.

The response from students' interview on the question of how often they are given classroom assessment in Physics, some of the respondents cited that they are not given class assessment as proven by respondent 007F1 who had this to say, "We are not given assessment after every lesson".

On the question of how often the students are given individual assignments in Physics, which is equivalent to self-assessment, some respondents said that they are not given individual assignment. Respondent 010F2 had this to say, "We are not given individual assessment at all". On the question of how often does your Physics teacher give you group assignments in Physics, which is equivalent to peer assessment, some of the respondents said that they are never given peer assessment as proven by respondent 007F3 who said, " We are not given group assignment at all".

Findings from this study are in agreement with some studies. For example, in a research by Kemboi (2015), the study established that, majority (58%) of teachers of Mathematics sometimes utilize self-assessment while majority (58%) of teachers sometime use peer-assessment. Further, majority of teachers (45%) seldom apply performance based assessment as a technique of assessing learners during formative assessment. Similarly, findings by Kwaka (2003), established that less (41.7%) number of teachers frequently use projects work to assess learners. Lastly, findings by Wabugu (2009), revealed that performance based assessment was not used at all by some teachers.

In order to establish the level to which the application of different techniques of formative assessment influence learners performance in Physics in KCSE, a linear regression model, as shown below, was applied.

$$y= \alpha+\beta x+\varepsilon$$

Where y is the predicted value of the dependent variable which is the students' performance in Physics in KCSE. The variable x is the techniques of formative assessment which is the independent variable and α is the predicted value of the dependent variable if the techniques of formative assessment is zero. The coefficient β is the rate of change for each unit of change in x while ε represents other dependent variables.

The study findings sought to determine regression analysis in order to find out the relationship between dependent and independent variable. The regression model indicated that there was no significant relationship between techniques of formative assessment and students' performance in Physics in KCSE in the years, 2013, 2014, 2015, 2016 and 2017, ($P>0.05$). Due to the lack of significance, linear regression equation was not generated.

4.4.4 To Find Out How the Use of Results from Formative Assessment Influence Students' Performance in Physics

The fourth objective was to find out how the use of results from formative assessment influence students' performance in Physics in KCSE. The respondents in this study were Physics teachers and Physics students from selected public secondary schools in Elgeyo Marakwet County. An interview schedule was used to collect qualitative data from students while a structured questionnaire was used to collect qualitative data from Physics teachers using twelve items which were used to ask teachers if they use results from formative assessment in Physics to: determine if lesson objectives have been attained, guide students to critique their own learning, gauge student's mastery of practical skills in Physics, elaborate to students concepts not well understood in Physics and improve students' attitude towards Physics,

Teachers were also asked if the use results from FA to: judge their effectiveness in teaching, determine students who are in need of individual attention, enhance teaching, encourage students to be in control of their learning, determine students readiness for the next topic, inform parents on the learning progress of their children and encourage students to take part in their learning process.

The questionnaire contained five scale Likert questions rated; strongly disagree (SD) 1, disagree (D) 2, neutral (N) 3, agree (A) 4 and strongly agree (SA) 5. The findings are displayed in percentage and mean as presented in Table 13.0

Table 13.0: ***How the Use of Results from Formative Assessment Influence Students' Performance in Physics***

Statements	**SA**		**A**		**N**		**D**		**SD**		**Mean**	**SD**
	F	%	F	%	F	%	F	%	F	%		
Using results from FA to determine if lesson objectives have been attained.	2	6.9	23	79.3	1	3.4	3	10.3	0	0	3.83	0.112
Using results from FA to guide students to critique their own learning.	2	6.9	20	69	3	10.3	4	13.8	0	0	3.69	0.241
Using results from FA to gauge practical skills	0	0	10	34.5	4	13.8	15	51.7	0	0	2.83	0.321
Using results from FA to elaborate concepts	1	3.4	11	37.9	2	6.9	15	51.7	0	0	2.93	0.241
Using results from FA to improve students' attitude	4	13.8	5	17.2	6	20.7	14	48.3	0	0	2.97	0.541
Using results from FA to judge effectiveness in teaching.	0	0	5	17.2	5	17.2	18	62.1	1	3.4	2.48	0.321
Using results from FA to determine students who need individual attention.	2	6.9	3	10.3	3	10.3	21	72.4	0	0	2.52	0.324
Using results from FA as part of teaching.	0	0	6	20.7	4	13.8	19	65.5	0	0	2.55	0.234
Using results from FA to encourage	0	0	2	6.9	4	13.8	23	79.3	0	0	2.55	0.278
Using results from FA to determine student's readiness for the next topic.	0	0	2	6.9	4	13.8	23	79.3	0	0	2.28	0.257
Using results from FA to inform parents	1	3.4	2	6.9	6	20.7	20	69	0	0	2.45	0.354
Using results from FA to encourage students in their learning.	0	0	4	13.8	3	10.3	22	75.9	0	0	2.38	0.289
Grand Means											**2.6**	

Source: Researcher (2018)

The study established that majority of the respondents 23(79.3%) agreed with the statement that they use results from FA to determine if lesson objectives have been attained compared to

3(10.3%) who disagreed (M = 3.83, SD =0.112). A mean of 3.83 implies that Physics teachers do not utilize results from FA to determine if lesson objectives have been attained.

Most respondents 20(69.0%) agreed that they use results from formative assessment to guide students to gauge their own learning as opposed to 4(13.8%) who disagreed (M=3.69, SD =0.241). With a mean of 3.69, it is evident that teachers do no use results from FA to guide students to critique their own learning.

However, most respondents 15(51.7%) disagreed with the statement that they use results from formative assessment to gauge student's mastery of practical skills in Physics while 10(34.5%) agreed (M= 2.83, SD=0.321). This means that teachers do not use results from FA to gauge student's mastery of practical skills in Physics as indicated by a mean of 2.83.

Majority of the respondents 15(51.7%) disagreed with the statement that they use results from formative assessment to elaborate to students concepts not well understood in Physics while 11(37.9%) agreed (M= 2.93, SD =0.241). A mean of 2.93 implies that results from FA are not used by teachers to elaborate to students concepts not well understood in Physics.

Similarly, 14(48.3%) of the respondents disagreed with the statement that they use results from formative assessment to improve students' attitude towards Physics compared to 4(13.8%) who strongly agreed to the statement (M= 2.97, SD = 0.541). With a mean of 2.97, it is evident that the use of results from FA in encouraging students' attitude towards Physics is not used to the required level.

Teachers disagreed with the statement that they use results from formative assessment to gauge their effectiveness in teaching as indicated by 18(62.1%) compared to 5(17.2%) who agreed (M=

2.48, SD = 0.321). A mean of 2.48 shows that teachers do not use results from FA to measure their effectiveness in teaching.

Further, 21(72.4%) of the respondents disagreed that they use results from formative assessment to determine students who need individual attention compared to minority 2(6.90%) who strongly agreed with the statement (M= 2.52, SD = 0.324). A mean of 2.52 indicates that teachers do not use results from FA to identify learners in need of individual attention.

Majority of the respondents 19(65.5%) disagreed that they use results from formative assessment to enhance teaching while 6(20.7%) agreed (M= 2.55, SD =0.234). A mean of 2.55 means that the use of results from FA to support teaching is not done to the expected standards.

Further, 23(79.3%) of the respondents disagreed with the statement that they use results from formative assessment to encourage students to take part in their learning process compared to the minority 2(6.90%) who agreed (M= 2.55, SD = 0.278). A mean of 2.55 implies that teachers do not use results from FA to encourage students to take part in their learning process as should be the norm.

Most respondents 23(79.3%) also disagreed with the statement that they use results from formative assessment to determine student's readiness for the next topic while the minority 2(6.90%) agreed to this statement (M= 2.28, SD =0.257). With a mean of 2.28, it is evident that teachers do not use results from FA to determine student's readiness for the next topic.

On the statement that I use results from formative assessment to inform parents on the learning progress of their children, 20(69.0%) of the respondents disagreed compared to 1(3.4%) who

strongly agreed (M= 2.45, SD =0.354). A mean of 2.45 indicates that Physics teachers do not use results from FA to inform parents on the learning progress of their children.

Lastly, 22(75.9%) of the respondents disagreed with the statement that they use results from formative assessment to encourage students in their learning as opposed to 4(13.8%) who agreed (M=2.38, SD=0.289). With a mean of 2.38, it shows that Physics teachers do not use results from FA to encourage students in their learning in Physics.

From the study, the combined score for all the items on the use of results from FA and its influence on students' performance in Physics in KCSE was found to be M=2.6. This implies that results from FA are not used to the expected level in Elgeyo Marakwet County since the grand mean falls below 4.0.

On the question of how teachers mark assignments given to students in Physics, majority of respondents said that Physics teachers read out the answers so that students can mark their own work. This can be confirmed by respondent 001F1 who said, "Teachers read answers for us to mark our own work". Also, other respondents pointed out that teachers ask them to exchange exercise books to be marked by their fellow students as proven by respondent 007F3 who said, "Teachers tell us to exchange exercise books to be marked by our desk mates". Yet according to Brown (2007), results from FA ought to assist teachers to provide feedback to learners for corrective measures. Failure by teachers to mark students' FA tasks means that teachers will miss an opportunity to identify areas of weakness in students' learning.

Findings from this study are in agreement with some studies. For instance, in survey conducted by Gichuru (2014), the study showed that teachers rarely use the information from learners' tasks to:

identify students' learning challenges (mean=1.17), report to parents (mean=1.09), assign learners other tasks (mean=1.13) and plan for future lessons (mean=1.39).

Similar, in a study by Kemboi (2015), it was reported that a small number (31%) of Mathematics teachers use information from FA to give feedback to students. Additionally, 27% of teachers use information from FA to identify student's learning needs whereas 18% of teachers use assessment information from students to plan for future lessons. Lastly, minority of teachers (6%) indicated that they use information gathered from learners' FA tools to report to parents.

The study, also, sought to establish the level to which the use of results from formative assessment influences students' performance in Physics in KCSE. A linear regression model, as shown below, was applied.

$$y= \alpha+\beta x+\varepsilon$$

Where y is the predicted value of the dependent variable which is the students' performance in Physics in KCSE. The variable x is the use of results from formative assessment which is the independent variable and α is the predicted value of the dependent variable if the use of results from formative assessment is zero. The coefficient β is the rate of change for each unit of change in x while ε represents other dependent variables. The regression model indicated that there was no significant relationship between use of results from formative assessment and students' performance in Physics in KCSE for the years 2013, 2014, 2015, 2016 and 2017 since ($P>0.05$). Because of the lack of significance, linear regression equation was not computed.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary, conclusions and recommendations. The purpose of this research was to collect information in order to establish if the practice of FA by teachers has an influence on students' performance in Kenya Certificate of Secondary Physics Examination in public secondary schools in Elgeyo Marakwet County. The aim was to establish if there are flaws originating from how teachers conduct FA and how they can be resolved so that students' performance in Physics can be improved. This chapter is organized according to the study's four objectives which were:

v. To determine if planning of formative assessment influence student's performance in Physics.

vi. To find out if the application of Bloom's taxonomy in formative assessment tools influence students' performance in Physics.

vii. To determine if techniques of formative assessment used by teachers influence students' performance in Physics.

viii. To find out if the use of results from formative assessment influence students' performance in Physics.

5.2 Summary

During the study, the following findings were made:

5.2.1 Influence of Planning of Formative Assessment on Students' Performance in Physics in KCSE

The study established that teachers in Elgeyo Marakwet do not plan for formative assessment in Physics to the required standard. As a result of this, the study found that planning for formative assessments has a significant influence on students' performance in Physics in KCSE in public secondary schools in Elgeyo Marakwet county.

5.2.2 Influence of Application of Bloom's Taxonomy in Formative Assessment on Students' Performance in Physics in KCSE

In the study, it was discovered that teachers do not design formative assessment tools in Physics so that all the cognitive domains are proportionally assessed in accordance with Bloom's taxonomy. It was found that lower order thinking was over assessed while higher order thinking was under assessed. Due to this, the study established that application of Bloom's taxonomy has a significant influence on learners' performance in Physics in KCSE in public secondary schools in Elgeyo Marakwet county.

5.2.3 Influence of Techniques Used in Formative Assessment on Students' Performance in Physics in KCSE

Results from the study indicated that teachers in Elgeyo Marakwet County do not utilize various techniques of formative assessment to the required level. However, the study established that this did not have a significant influence on students' performance in Physics in KCSE.

5.2.4 Influence of the Use of Results from Formative Assessment on Students' Performance in Physics in KCSE

The study found that teachers in Elgeyo Marakwet County do not apply results from formative assessment satisfactorily. However, the study did not find this to have a significant influence on students' performance in Physics in KCSE.

5.3 Conclusions

This study resulted in four conclusions which are specifically addressed based on the research objectives.

Firstly, based on findings that teachers in Elgeyo Marakwet county do not plan for formative assessment in Physics to the required standard and that this has a significant influence on students' performance in KCSE in Physics in public secondary schools, the study concluded that it is necessary to plan for formative assessment so that learners performance in Physics can be improved.

Secondly, the study showed that teachers in Elgeyo Marakwet County do not design formative assessment tools in accordance with Bloom's taxonomy. As a result, findings showed that this had a significant influence on learners' performance in Physics in KCSE in public secondary schools. Therefore, the study concluded that balancing of cognitive domain in line with Bloom's taxonomy should be prioritized when designing FA assessment tools because it influence learners' performance in Physics.

Thirdly, although linear regression did not show that techniques of formative assessment used by teachers in Elgeyo Marakwet County have a significant influence on learners' performance in Physics in KCSE, there were evidence from the study that teachers do not use all the assessment

techniques satisfactorily. Based on this, this study concluded that Physics teachers should utilize various techniques to assess learners especially on classroom assessment and performance based assessment in order to improve efficiency of teaching and learning.

Lastly, in spite of the fact that application of results from formative assessment did not have a significant influence on students' performance in Physics in KCSE in Elgeyo Marakwet County, the study established that teachers do not apply results from formative assessment adequately. The study, therefore, concluded that there is need for teachers to effectively use results from formative assessment so that learning of Physics can be improved.

5.4 Recommendations

The study made the following recommendations which are specifically described as per the research objectives.

5.4.1 Planning for Formative Assessment

Based on the findings that inadequate planning of formative assessment by Physics teacher in Elgeyo Marakwet County has an influence on students' performance in KCSE in public secondary schools, the study made the following recommendations:

i. Teachers should be retrained on how to plan for formative assessment especially in their lesson plans and schemes of work.
ii. There should be constant supervision of teachers to ensure that they adhere to the best practice of planning for formative assessment for effective evaluation of students learning.

5.4.2 Application of Bloom's Taxonomy in Formative Assessment

In relation to the study's discovery that failure by teachers in Elgeyo Marakwet County to balance cognitive domains in FA tools has an influence on learners' performance in Physics, the study made the following recommendations:

i. Teachers should be inducted on the use of table of specification so that all the cognitive domains are balanced fairly when designing formative assessment tools in Physics.
ii. It should be mandatory for every Physics teacher to be trained by KNEC on the best practices of FA. More importantly, stress should be put on training teachers to test more on analysis, synthesis and evaluation since physics is a practical subject.

5.4.3 Techniques of Formative Assessment

Concerning the findings that teachers in Elgeyo Marakwet County do not use all the assessment techniques satisfactorily in Physics, the study made the following recommendations:

i. Courses on FA in Physics should be included in SMASE modules during teacher training programs which are offered annually to teachers of STEM across the country. This will help in improving teachers' assessment skills.
ii. The KICD should design guidelines on specific techniques of assessment to be used for every concept taught in Physics. This will help in guiding teachers to utilize various assessment methods in secondary schools.

5.4.4 Application of Results from Formative Assessment

In relation to the findings that Physics teachers in Elgeyo Marakwet County do not apply results from formative assessment to the required standards, the study made the following recommendations:

i. Workload, number of lessons and class size, for Physics teachers should be reduced so that they can dedicate adequate time for giving assessment feedback to each learner through face-to-face consultation.

ii. Learners should be encouraged to submit self-assessment sheet according to the assigned tasks. This will help to account for teacher's involvement in student's formative assessment.

5.5 Suggestions for Further Research

In line with the research findings, the following suggestions for further research were made:

i. A similar research be carried out in other counties posting poor performance in Physics within the country to establish if there is a consistency of the outcome that shows the influence of FA on students' performance in Physics.

ii. A further study should be conducted to ascertain why physics teacher over assess the lower order thinking and under assess higher order thinking of cognitive domain.

iii. A comparative study on public schools and private schools in a different county on the influence of FA on students' performance in Physics should be done.

REFERENCES

Adipo, D. (2007). An investigation into poor performance in Physics in national examinations. Nairobi: Khan University.

Aina J, K., & Olanipekun S. S., (2015). A Review of Teachers' Qualifications and Its Implication on Students' Academic Achievement in Nigerian Schools. *International Journal of Educational Research and Information Science. 2* (2), 10-15.

Ajogbeje, O. J. (2012). Effect of formative testing on students' achievement in junior secondary school mathematics. *European Scientific Journal, 8*(8), 94-105.

Alison, C. (2010). *Bloom's Taxonomy and its Use in Classroom Assessment*. Retrieved October 16, 2016 from://www.researchgate.net/publication/283328372_ Bloom%27s_Taxonomy_ and_ its_Use_in_Classroom_Assessment.

Ampofo, S. Y., Bizimana B., Ndayambaje I., Karongo, V, V., Lyn, L., & Orodho, J. A. (2015). Social and Spill-Over Benefits As Motivating Factors To Investment In Formal Education In Africa: A Reflection Around Ghanaian, Kenyan And Rwandan Contexts. *Journal of Education and Practice, 6*(11), 134-147.

Anderson, L. W., & Krathwohl, D. (2001). *Taxonomy for learning, teaching, and assessing: A revision of Bloom's Taxonomy of Educational Objectives.* New York: Longman.

Andrade, H., & Valtcheva, A. (2009). Promoting Learning and Achievement through Self-Assessment. *Theory into Practice, 48*(1), 12-19.

Barchfeld-Venet, P. (2005). Formative assessment: The basics. *Alliance Access, 9*(1), 2–3.

Barnes, J., & Kaplinsky, R. (2000). Globalization and the Death of the Local Firm? The Automobile Components Sector in South Africa. *Regional Studies, 34*(9).

Bell, B., & Cowie, B. (2001). Formative assessment and science education. Dordretch: Kluwer Academic Press.

Black, A. (2001). Globalization and restructuring in the South African automotive industry. *Journal of International Development, 13*(6), 779-796.

Black, P., & Wiliam, D. (2003). In praise of educational research: Formative assessment. *British Educational Research Journal, 29*(5), 623-637.

Bloom, B. (1964). *Taxonomy of educational objectives: The classification of educational goals, by a committee of college and university examiners:* New York; Longmans, Green.

Boudah, J. D (2011). *Conducting research, guide to completing a major research.* Thousand oaks, CA: Sage.

Brookhart, S. M. (2011). Grading and learning: Practices that support student achievement. Bloomington. Solution Tree.

Case, B. J. (2003). *Accommodations on Stanford 10 for students with disabilities*. San Antonio: Pearson Inc.

Case, B. J. (2003). *It's about time.* San Antonio: Pearson Inc.

Chappuis, S., & Chappuis, J. (2008). The best value in formative assessment: *Educational Leadership*, *65*(4), 14-19.

Chikumba, N. F. S. (2012). *Relationship between Formative and Summative Assessment in Open Distance Learning: University of South Africa: School of Engineering Case Study.* Johannesburg: University of South Africa. Retrieved September 14, 2016 from http: // uir .unisa.ac.za/bitstream/handle/10500/9500/fungura_n_ODL031_2012.pdf? Sequence=1.

Creswell, J. W., & Plano Clark, V. (2007). *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage.

Cross Sectoral Assessment Working Party (2011). *Teachers' Guide to Assessment*. Retrieved December 14, 2016 from http://sophiemoncrieffportfoliogdtl. weebly. com/ uploads 1/2/1/8 /12 182951/teachers_guide_to_ assessmentweb.pdf.

Darling-Hammond, L., & Pecheone, R. (2009). *Reframing accountability: Using assessments to focus learning on higher-order skills*. Washington, DC: Alliance for Excellent Education.

Derek, O., Amy, C., & Farooq, U. (2015). Universal Sustainable Development Goals. Stake Holders Forum.

Earl, L. (2003). *Assessment as learning: Using classroom assessment to maximize student learning*. California: Corwin Press, Inc.

Falk, B., Ort, S. W., & Moirs, K. (2007). Keeping the focus on the child: Supporting and reporting on teaching and learning with a classroom-based assessment system. *Educational Assessment, 12*(1), 1-2.

Gay, R. L. (2003): Educational Research: Competencies for Analysis and Application. Columbus. Charles E. and Merrill.

Gibbs, G., & Simpson, C. (2005). Conditions under which assessment supports students' learning. *Learning and Teaching in Higher Education, 1,* 3-31.

Gichuru, F. (2014). *Classroom assessment practices in Kenyan secondary schools: teacher perspective* [masters dissertation]. University of Nairobi, Nairobi, Kenya.

GOK. (2007). Kenya Vision 2030. *A Globally Competitive and Prosperous Kenya, October 2007*. Nairobi: Government of Kenya.

Goodrum, D., Hackling, M., & Rennie, L. (2001). *The status and quality of teaching and learning of science in Australian schools.* Canberra: Department of Education, Training and Youth Affairs.

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods, 18* 59-82.

Hayward, L., & Hedge, N. (2005). Travelling towards change in assessment: policy, practice and research in education. *Assessment in Education, 12*(1), 55-75. http://www.mmrwsjr.com/assessment.htm

Ilker, E. Sulaiman, A. M., & Rukayya, S. A. (2016). Comparison of Convenience Sampling and TPurposive Sampling. *American Journal of Theoretical and Applied Statistics.* Vol. 5, No. 1, 2016, pp. 1-4.

JISC (2010). *Effective Assessment in a Digital Age: A guide to technology-enhanced assessment and feedback*. Bristol: University of Bristol. Retrieved December 14, 2016 from http://www.jisc.ac.uk/media/ documents/ programmes/eLearning/digiassass_eada.pdf.

Kaplan, L., & Owings, W. (2001). Enhancing teacher and teaching quality: Recommendations for principals. *NASSP Bulletin*, *85*(628), 64-73.

Kemboi, E. K (2015). *Classroom assessment practices by mathematics teachers in secondary schools of Kenya* [master's dissertation]. University of Nairobi, Nairobi, Kenya.

KIE, (2002). Secondary Syllabus Volume II. Kenya Institute of Education.

Kirton, A., Hallam, S., Peffers, J., Robertson, P., & Stobart, G. (2007). Revolution, evolution or a trojan horse? Piloting assessment for learning in some Scottish primary schools. *British Educational Research Journal*, 33(4), 605-627.

KNEC, (2016). *Kenya national examination council report 2015*. Nairobi: Kenya National Examination Council.

KNEC, (2018). *Kenya national examination council report 2018*. Nairobi: Kenya National Examination Council.

Kombo, D. K., & Tromp, D. L. A. (2006). *Proposal and thesis writing. An introduction*. Nairobi: Pauline Publication Africa.

Kothari, R. (2004). *Research methodology*. New Delhi: New Age International Publisher.

Kwaka, D. M. (2003). *Influence of teachers' assessment practice in enhancing performance in mathematics among secondary school students in Mombasa District, Kenya* [masters dissertation]. Kenyatta University, Nairobi, Kenya.

Lawshe, C. H. (1975). A quantitative approach to content validity. *Personnel Psychology, 28*, 563-575.

Leahy, S., Lyon, C., Thompson, M., & Wiliam, D. (2005). Classroom assessment-minute by minute, day by day, *Educational Leadership, 63*(3), 18-24.

Letts, L. (2003). Occupational therapy and participatory research: A partnership worth pursuing. *American Journal of Occupational Therapy, 57*, 77-87.

Lewy, A. (1977). *Handbook of curriculum evaluation*. London: UNESCO.

Li, L., Liu, X., & Steckelberg, A. L. (2010). Assessor or assessee: How student learning improves by giving and receiving peer feedback. *British Journal of Educational Technology, 41*(3), 525-536.

Littledyke, M. (2008). Science education for environmental awareness: approaches to integrating cognitive and affective domains. *Environmental Education Research, 14*(1), 1-17.

Looney, J. W. (2011). "Integrating Formative and Summative Assessment: Progress toward a Seamless System?" *OECD Education Working Papers*, No. 58, OECD Publishing. Retrieved December 10, 2016 from http://dx .doi.org/10.1787/5kghx3kbl734-en.

Marriott, P., & Lau, A. (2008). The use of on-line summative assessment in an undergraduate financial accounting course. *Journal of Accounting Education 26*, 73-90.

McDonald, B., & Boud, D. (2003). The impact of self-assessment on achievement: the effects of self-assessment training on in external examinations. *Assessment in Education, 10*(2), 209-220.

McLeod, S., Brown, G., McDaniels, P., & Sledge, L. (2009). Improving writing with a PAL: Harnessing the power of peer assisted learning with the reader's assessment rubrics. *International Journal of Teaching and Learning in Higher Education, 20*(3), 488-502.

McManus, S. (2008). *Attributes of effective formative assessment*. Greenwich: Information Age Publishing.

McMillan, J. H. (2001). *Assessment essentials concepts for teachers and administrators*. Thousand Oaks: Corwin Publishing Company.

McMillan, J. H. (2008). *Assessment essentials for student-based education*. Thousand Oaks: Crown Press.

McMillan, J. H., & Hearn, J. (2008). Student Self-Assessment: The Key to Stronger Student Motivation and Higher Achievement. *Educational Horizons, 87*(1), 40-49.

McMillan, J. H., Myran, S., & Workman, D. (2002). Elementary teachers' classroom assessment and grading practices. *Journal of Educational Research,* 95, (4).

Minishi, O., Muni, E., Mutai, P., Munyeke, F., & Omolo, H. (2004). *Secondary Physics students book one*. Nairobi: Kenya Literature Bureau.

Ministry of Education. (2002). *Secondary education syllabus volume two*. Nairobi: Kenya Institute of Education.

Ministry of Education. (2012). Sessional Paper No 2 of 2015: Reforming education and Training Sector in Kenya. Ministry of Education.

MoHEST. (2008). TIVET Strategic Plan 2008-2012. Nairobi: MoHEST.

Moskal, B. M. (2003). Recommendations for developing classroom performance assessments *and scoring rubrics. Practical Assessment, Research and Evaluation, 8*(14).

Muchwe, K. J. (2014). Factors contributing to poor of science subjects: a case of secondary schools in Kawe Division, Kinondoni Municipality, Tanzania (Master's thesis, Open University of Tanzania, Dar es Salaam, Tanzania. Retrieved December 2, 2016 from http: //repository.out.ac.tz/598/1/JAMES_MUCHWE_KING%E2%80%9DARU Final_Thesis.pdf.

Mugenda, O. M., & Mugenda, A. G. (1999). *Research methods. Qualitative and Quantitative approaches*. Nairobi: African Center for Technology Studies.

Mumasi, W. (2013). School based factors influencing students' at Kenya Certificate of Secondary Education in Narok – North District, Kenya. Retrieved 8, December 2016 from http://erepository.uonbi.ac.ke:8080/xmlui/handle/11295/56296.

Munene, S. K. (2014). *Factors affecting enrolment and in Physics among secondary school students in Gatundu District, Kenya* (Master's thesis, Kenyatta University, Nairobi, Kenya). Retrieved December 2, 2016 from http://irlibrary.ku .ac.ke/bit stream/handle/123456789/11155/ Factors%2 0affecting% 20enrolment

%20and%20%20in%20Physics%20among%20secondary%20school%20students%20in%20Gatundu%20district,%20Kenya..pdf?sequence=1andisAllowed=y.

Namatende-Sakwa, L., & Longman, C. (2012). *Government policy on science education in Uganda: a glass-ceiling for women's access to higher education*. Retrieved September 20, 2017 from http:https://www.google.com/search?q=government+policy+on+science+education +in+Uganda%3a+a+glassceiling+for+women%e2%80%99s+access+ to+ higher +education+pdfandie=utf-8andoe=utf-8andclient=firefox-b

Ndayambaje, I, Ampofo, S. Y., Bizimana, B., Otieno, M. A., Ogeta, N. O., & Orodho, J. A. (2015). Challenges of social and spill-over benefits as motivating factors to investment in formal education in selected countries of Ghana, Kenya and Rwanda. *Journal of Humanities and Social Science*, *20*(4), 29-38.

Nenty, H. J. (2005). Assessment as a partner in primary and secondary school teaching in African schools. *Journal of Botswana Educational Research Association*, *13*(2), 33-47.

Nicol, D. (2007). Principles of good assessment and feedback: Theory and practice. *Proceedings of the REAP International Online Conference on Assessment Design for Learner Responsibility*. Retrieved October 20, 2016 from http://www.reap.ac.uk/reap/public/ papers/Principles _of_ good _assessment_and_feedback.pdf.

Nicol, D. (2007). Principles of good assessment and feedback: Theory and practice. *REAP International Online Conference on Assessment Design for Learner Responsibility*, 29th – 31st May, 2007.

Nicol, D. (2010). From monologue to dialogue: improving written feedback processes in mass higher education. *Assessment and Evaluation in Higher Education,* 35(5), 501–517.

Nitko, A. J. (2004). *Educational assessments of students*. Englewood Cliffs: Prentice Hall.

Njagi, K., & Amukowa, W. (2013). Analysis of factors that lead to poor in Kenya certificate of secondary examination in Embu District in Kenya. *Journal of Social Sciences, 3*(1), 98.

Njiru, B. (2015). *Influence of formative evaluation on learner performance in mathematics in secondary schools in Embu County, Kenya*. Nairobi. University of Nairobi.

Okonkwo, C. A. (2011). Adapting on demand examination system in national Open University of Nigeria end of semester examination. *Turkish Online Journal of Distance Education, 12*(4), 167-178.

Oosterhof, A. (2001). *Classroom applications of educational measurement.* Upper Saddle River: Merrill Prentice Hall.

Orodho, J. (2009). Elements of education and social science research methods. Maseno: Kanezja Publishers.

Orodho, J. (2013). Progress Towards Attainment of Education for All (EFA) Among Nomadic Pastoralists: Do Home-Based Variables Make a Difference in Kenya? *Research on Humanities and Social Sciences*. Pages 54-67. Www.Iiste.Org

Orodho, J. (2014). Policies on free primary and secondary education in East Africa: Are Kenya and Tanzania on course to attain Education for All by 2015? *Journal of Humanities and Social Sciences*. www.iosrjournals.org.

Palm, T. (2008). *Assessment and authentic assessment*: A conceptual analysis of the literature. *Practical Assessment, Research and Evaluation, 13*(4).

Pastor, V. (2011). Best practices in academic assessment in higher education: A case in formative and shared assessment. *Journal of Technology and Science Education, 1*(2), 25-39.

Popham, W. J. (2011). *Classroom assessments: What teachers need to know*. Boston: Person.

Pravica, M. (2005). The importance of Physics. Breakthroughs drive economy, quality of life. Retrieved January 5, 2016 from http://www.reviewjournal.com/ivrjhome/2005/mar06-sun 2005/opinion/682710.html.

Race, P. Brown, S., & Smith, B. (2005). Tips on assessment. London: Routledge.

Republic of Kenya, (2005): Seasonal Paper No. 1 2005.

Reynolds, C. R., Livingston, R. B., & Willson, V. (2009). *Measurement and assessment in education*. Ohio: Pearson.

Ross, J. (2006). The Reliability, Validity, and Utility of Self-Assessment. *Practical Assessment, Research and Evaluation, 11*, 1-13. Retrieved February 16, 2017 from http://pareonline.net/pdf/v11n10.pdf.

Scott, S. (2008). Improving Student satisfaction with Feedback: Report on a Project Undertaken in the Faculties of Arts and Social Sciences and of Law at UNSW. Unpublished.

Shepard, L. A. (2009). Commentary: Evaluating the Validity of Formative and Interim Assessment. *Educational Measurement: Issues and Practice, 28*(3), 32-37.

Sihanya, B. (2008). *The impact of IMF policies on education, health and women's rights in Kenya*. Nairobi: ACTIONAID, Kenya.

Simkins, S.D., Davis-Kean, P.E., & Eccles, J. S. (2006). Maths and Science Motivation: A Longitudinal Examination of Links between Choice and Beliefs. *Developmental psychology*, *42(*1), 70.

Simpson, E. J. (1972). *The classification of educational objectives: Psychomotor domain*. Urbana University: Illinois Press.

Sivaraman, S., & Krishna. D. (2015). Bloom's Taxonomy-Application in Exam Papers Assessment. *International Journal of Multidisciplinary Sciences and Engineering, 6,* (9).

SMASSE, (2005). SMASSE Cycle Four Training Manuals. Unpublished.

SMASSE, (2015) SMASSE Cycle Four Training Manuals. Unpublished.

South Africa Info, (2008). South Africa's Automotive Industry. Retrieved February 16, 2017 http:/ /www.southafrica .info/business/economy/sectors/automotive-overview.htm.

Stiggins, R. (2002). *Assessment in crisis*: The absence of assessment for learning. *Phi Delta Kappan*, *83*(10), 758-765.

Swearingen, R. (2002). A Primer: Diagnostic, Formative and Summative Assessment.

Tanner, H., & Jones, S. (2003). *Marking and assessment*. New York: BiddIes ltd.

Taylor, P. (2008). *How to give quality feedback: Learning through dialogue.* Faculty of Business and Economics. Macquarie University.

Title, C. K. (1994). Toward an educational psychology of assessment for teaching and learning theories, contexts, and validation arguments. Educational Psychology 29, 149-162.

Topping, K. J. (2005). *Trends in peer learning. Educational Psychology, 25*(6), 631-645.

Topping, K. J. (2009). *Peer assessment. Theory into Practice,* 48(1), 20-27.

Tyler, R. W. (1966). The Objectives and Plans for a National Assessment of Educational Progress. *Journal of Educational Measurement, 3, 1–*4.

UNESCO. (2009). Employability in Asia and the Pacific. UIS, Montreal: UNESCO.

United Republic of Tanzania (2010). Creation of employment, poverty reduction and improving human wellbeing. Retrieved September 20, 2017 from http://www. International. gc.ca /development-developpement/assets/pdfs/countries-pays/national-strategy-for-growth-and-reduction-of-poverty-tanzania.pdf

Wachira, J. (2013). *Factors influencing survival rate of female students' enrolment in Physics subject in public secondary schools in Kirinyaga Central District, Kenya*. Master's thesis,

University of Nairobi, Nairobi, Kenya. Retrieved February 2, 2019 from http: //erepository.uonbi.ac.ke.

Wambugu, D. (2009*). Assessment of formative evaluation in teaching and learning secondary mathematics: a case of Thika West* [masters dissertation]. Kenyatta University, Nairobi, Kenya.

Wanyama, M. (2013). *School based factors influencing students' at Kenya certificate of secondary education in Narok North District, Kenya* (Master's thesis, University of Nairobi, Nairobi, Kenya). Retrieved December 2, 2016 from http: //erepository.uonbi.ac.ke.

Wass, V., Van der Vluten, C., Shatzer, J., & Jones, R. (2001). Assessment of clinical competence. Toronto: University of Toronto Bookstore Custom Publishing.

Wigfield, A. (1994). Expectancy-Value Model of Achievement and Motivation. A Developmental Perspective. *Psychology Review*, 6, 49-78

Wiggins, G. P., & McTighe, J. (2005). *Understanding by design.* Alexandria, VA: ASCD.

Wiliam, D. (2011). *Embedded formative assessment*. Bloomington: Solution Tree Press.

William, D. (2008). *Improving learning in science with formative assessment.* Institute of Education: University of London.

Wilson, R. (2000). *Towards an integrated model of assessment in practice*. Paper presented at the annual conference of the Canadian Educational Researchers Association: Edmonton.

Wood, G. H., Darling-Hammond, L., Neill, M., & Roschewski, P. (2007). *Refocusing accountability: Using local assessments to enhance teaching and learning for higher order skills.* Retrieved October 10, 2016 from http://www.google.com/search?q=Wood+G+H%2C+refocusing+accountability+pdf%btn =%client=ms.html.

Wren, D. G. (2009). *Assessment: A key component of balanced assessment system*. Virginia Beach: Virginia Beach City Public Schools, Department of Research, Evaluation, and Assessment.

Zingu, E. (2005). Physics *for development:* Catching up is hard to do. IAEA Bulletin 47/1.

Zucker, S. (2004). *Administration practices for standardized assessments*. Retrieved October 16, 2016 from http://images.pearsonassessments.com/images/tmrs/tmrs_rg/ Administration.

APPENDICES

APPENDIX A: QUESTIONNAIRE FOR PHYSICS TEACHERS

The researcher is a student at Kenyatta University carrying out a study on "**Influence of formative assessment on students' performance in Kenya certificate of secondary education in physics: Case of Elgeyo Marakwet County, Kenya".** The researcher is in the process of completing his studies leading to the degree of Master of Education in Educational Research, Evaluation and Assessment. As part of the requirements for the award of this degree, he is required to carry out a research such as the one mentioned above and present his findings to the school's board of examiners.

Your views will be treated with utmost confidentiality and will not be divulged to other persons.

You are kindly requested to complete this questionnaire as honestly as possible. Do not write your name in the questionnaire.

Part A: General Information.

Indicate your gender.

Male [ ]. Female. [ ].

Indicate your highest professional qualification:

Diploma [ ]. Degree [ ]. Masters [ ]. Specify if others [ ].

For how long have you taught Physics?

Less than 2 [ ], 2 – 5 [ ], 6 – 10 [ ], 11 - 20 [ ], Over 20 [ ] years.

Part B: Planning of Formative Assessment.

In this section, the study is interested in your views about how you plan for formative assessment in Physics in your school. Read each statement keenly and tick the appropriate response.

5 = Strongly Agree, 4 = Agree, 3= Neutral, 2 = Disagree, 1 = Strongly Disagree

No	Item	5	4	3	2	1
1	I schedule formative assessment in the schemes of work.					
2	I schedule formative assessment in the lesson plan.					
3	I consider learning objectives when designing formative assessment tools.					
4	I strictly adhere to syllabus guidelines when planning for formative assessment.					
5	I assess my Physics students after every lesson based on lesson plan.					
6	I inform students the objective of an experimental assessment before they conduct it.					
7	I give to students written procedures a day before an experiment					
8	I ensure that all apparatuses are available before conducting experimental assessment.					
9	I provide each student with all the needed apparatus to complete assessment tasks during experiments.					
10	I provide assessment's objectives to students in advance.					
11	I provide assessment procedures to students in advance.					

Part C: Application of Bloom's Taxonomy in Formative Assessment.

The following are learning aspects that are assessed in cognitive domain in Physics. Terms that are used to construct questions in each type of learning are indicated in brackets.

Please rate your frequency of assessing each aspect by ticking the appropriate response.

5 = Always, 4 = Very Often, 3= Sometimes, 2 = Rarely, 1 = Never

Item	Type of cognitive domain	Always	Very often	Sometimes	Rarely	Never
1	Knowledge (define, list, name, state, identify, label).					

Item	Type of cognitive domain	Always	Very often	Sometimes	Rarely	Never
2	Comprehensions (classify, explain, illustrate, convert, describe, and distinguish).					

Item	Type of cognitive domain	Always	Very often	Sometimes	Rarely	Never
3	Application (construct, show, solve, apply, arrange, calculate, demonstrate).					

Item	Type of cognitive domain	Always	Very often	Sometimes	Rarely	Never
4	Analysis (Analyze, determine, estimate, differentiate).					

Item	Type of cognitive domain	Always	Very often	Sometimes	Rarely	Never
5	Synthesis (Compose, design, propose, formulate, compile, modify).					

Item	Type of cognitive domain	Always	Very often	Sometimes	Rarely	Never
6	Evaluation (Evaluate, compare, justify, conclude, assess)					

Part D: Techniques used in Formative Assessment.

In this section, the study seeks to find out how you apply different techniques of formative assessment during teaching and learning of Physics. Read each statement keenly and tick the appropriate response.

5 = Strongly Agree, 4 = Agree, 3= Neutral, 2 = Disagree, 1 = Strongly Disagree.

No	Item	5	4	3	2	1
1	I use classroom assessment to find out if the students have understood lesson's objectives.					
2	I use classroom assessment to encourage students to learn.					
3	I use classroom assessment to identify students' abilities in solving numerical problems in Physics.					
4	I use classroom assessment to enhance students' understanding of the lessons' objectives.					
5	I use self-assessment to promote learner freedom in solving problems in Physics.					
6	I use self-assessment to promote learner confidence in Physics.					
7	I use self-assessment to know the individual needs of a learner.					
8	I use self-assessment to encourage individual students to take ownership of the learning process.					
9	I use peer assessment to enhance learning among the students.					
10	I use peer assessment to provide students with additional feedback through their peers.					
11	I use peer assessment to help students to internalize learning concepts better.					
12	I use experiments to enhance learner's application skills in Physics.					
13	I use experiments to gauge learner's evaluation skills in Physics.					
14	I use experiments to enhance learners' skills in report writing in Physics.					

Part E: Use of Results from Formative Assessment.

In this section, the study seeks your views on how you utilize learners' results from formative assessment in Physics. Read each statement keenly and tick the appropriate response.

5 = Strongly Agree, 4 = Agree, 3= Neutral, 2 = Disagree, 1 = Strongly Disagree.

No	Item	5	4	3	2	1
1	I use results from formative assessment to determine if lesson objectives have been attained.					
2	I use results from formative assessment to guide students to critique their own learning.					
3	I use results from formative assessment to gauge student's mastery of practical skills in Physics.					
4	I use results from formative assessment to elaborate to students' concepts not well understood in Physics.					
5	I use results from formative assessment to improve students' attitude towards Physics.					
6	I use results from formative assessment to judge my effectiveness in teaching.					
7	I use results from formative assessment to determine students in need of individual attention.					
8	I use results from formative assessment to enhance teaching.					
9	I use results from formative assessment to encourage students to take part in their learning process.					
10	I use results from formative assessment to determine student's readiness for the next topic.					
11	I use results from formative assessment to inform parents on the learning progress of their children.					
12	I use results from formative assessment to encourage students to be in control of their learning.					

Part F: Students' Performance in Physics from 2013 to 2017.

In this section, the study seeks information about KCSE Physics results in your school from the year 2013 to 2017. Please, indicate the mean score of Physics in your school as per the indicated year.

Year	KCSE mean score
2013	
2014	
2015	
2016	
2017	

APPENDIX B: DOCUMENT ANALYSIS SHEET FOR COGNITIVE DOMAINS TESTED IN PHYSICS

Item/content area.	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Form 1						
Form 2						
Form 3						
Form 4						

APPENDIX C: STUDENTS' INTERVIEW SCHEDULE ON FORMATIVE ASSESSMENT

How often are you given class assignments in physic?

After every lesson. ☐

After finishing a subtopic ☐

After finishing a topic ☐

We are not given class assignment at all ☐

How are you provided with apparatuses during practical tests in Physics?

All the needed apparatuses are provided ☐

Some apparatus provided are improvised ☐

Sometimes, not all apparatus are provided ☐

Some apparatus provided are old and do not work ☐

How often are you given individual assignments in Physics?

During every lesson. ☐

After every subtopic ☐

After every topic ☐

We are not given individual assignment at all ☐

How often does you Physics teacher give you group assignments?

During every lesson. ☐

After every subtopic ☐

After every topic ☐

We are not given group assignment at all ☐

How are the questions set in end of term examination in Physics related to what you were taught in class?

All the set questions are related to what we are taught in class. ☐

Some questions are not related to what we are taught in class. ☐

How does your teacher mark assignments given to you in Physics?

Marks them by himself ☐

Reads answers for us to mark ☐

Writes answers to us on the board ☐

Tells us to exchange exercise books to be marked by our desk mate. ☐

APPENDIX D: INTRODUCTORY LETTER

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 020-8704150

Our Ref: E55/CE/27941/13

DATE: 4th September, 2018

Director General,
National Commission for Science, Technology
and Innovation
P.O. Box 30623-00100
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR MR. CHUMO JOHN KIPLIMO – REG. NO. E55/CE/27941/13

I write to introduce Mr. Chumo John Kiplimo who is a Postgraduate Student of this University. He is registered for M.Ed. degree programme in the **Department of Educ. Management, Policy & Curriculum Studies.**

Mr. Chumo intends to conduct research for a M.Ed. thesis Proposal entitled, **"Influence of Formative Assessment on Students' Kenya Certificate of Secondary Education Performance in Physics in Public Secondary Schools in Elgeyo Marakwet County, Kenya."**

Any assistance given will be highly appreciated.

Yours faithfully,

OFFICE OF DEAN
-4 SEP 2018
GRADUATE SCHOOL

PROF. PAUL OKEMO
DEAN, GRADUATE SCHOOL

EM/cww

APPENDIX E: NACOSTI RESEARCH AUTHORIZATION

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/18/27873/25306**

Date: **2nd October, 2018**

John Kiplimo Chumo
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Influence of formative assessment on students' Kenya Certificate of Secondary Education performance in physics in public secondary schools in Elgeyo Marakwet County, Kenya"*** I am pleased to inform you that you have been authorized to undertake research in **Elgeyo Marakwet County** for the period ending **2nd October, 2019.**

You are advised to report to **the County Commissioner and the County Director of Education, Elgeyo Marakwet County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Elgeyo Marakwet County.

The County Director of Education
Elgeyo Marakwet County.

APPENDIX F: RESEARCH PERMIT

THIS IS TO CERTIFY THAT:
MR. JOHN KIPLIMO CHUMO
of KENYATTA UNIVERSITY, 0-30100
Eldoret,has been permitted to conduct
research in *Elgeyo-Marakwet County*

Permit No : NACOSTI/P/18/27873/25306
Date Of Issue : 2nd October,2018
Fee Recieved :Ksh 1000

on the topic: *INFLUENCE OF FORMATIVE ASSESSMENT ON STUDENTS' KENYA CERTIFICATE OF SECONDARY EDUCATION PERFORMANCE IN PHYSICS IN PUBLIC SECONDARY SCHOOLS IN ELGEYO MARAKWET COUNTY, KENYA*

for the period ending:
2nd October,2019

.....
Applicant's Signature

.....
Director General
National Commission for Science, Technology & Innovation

THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013

The Grant of Research Licenses is guided by the Science, Technology and Innovation (Research Licensing) Regulations, 2014.

CONDITIONS

1. The License is valid for the proposed research, location and specified period.
2. The License and any rights thereunder are non-transferable.
3. The Licensee shall inform the County Governor before commencement of the research.
4. Excavation, filming and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
5. The License does not give authority to transfer research materials.
6. NACOSTI may monitor and evaluate the licensed research project.
7. The Licensee shall submit one hard copy and upload a soft copy of their final report within one year of completion of the research.
8. NACOSTI reserves the right to modify the conditions of the License including cancellation without prior notice.

National Commission for Science, Technology and Innovation
P.O. Box 30623 - 00100, Nairobi, Kenya
TEL: 020 400 7000, 0713 788787, 0735 404245
Email: dg@nacosti.go.ke, registry@nacosti.go.ke
Website: www.nacosti.go.ke

REPUBLIC OF KENYA

NACOSTI

National Commission for Science, Technology and Innovation

RESEARCH LICENSE

Serial No.A 20834

CONDITIONS: see back page

APPENDIX G: COUNTY COMMISSIONER RESEARCH AUTHORITY

OFFICE OF THE PRESIDENT
MINISTRY OF INTERIOR & COORDINATION OF NATIONAL GOVERNMENT

Telegrams:
Telephone: (053) 42007
Fax : (053) 42289
E-mail: ccelgeyomarakwet@yahoo.com
ccelgeyomarakwet@gmail.com
When replying please quote

COUNTY COMMISSIONER'S OFFICE,
ELGEYO-MARAKWET COUNTY,
P.O. BOX 200-30700
ITEN

PUB. CC. 24/2 VOL.II/93
Ref. .....

22nd October, 2018
Date .....

TO WHOM IT MAY CONCERN

RE: RESEARCH AUTHORIZATION
JOHN KIPLIMO CHUMO

This is to confirm that the above named has been authorized to carry out a research on ***"Influence of formative assessment on students' Kenya Certificate of Secondary Education performance in Physics in public secondary schools in Elgeyo Marakwet County, Kenya".*** The research will be undertaken for the period ending **2nd October, 2019.**

Please accord him necessary assistance.

COUNTY COMMISSIONER
ELGEYO MARAKWET COUNTY

K. O. MIFWONI
FOR: COUNTY COMMISSIONER
ELGEYO MARAKWET

c.c. All Deputy County Commissioners
Elgeyo Marakwet County

KOM/njk

APPENDIX H: COUNTY DIRECTOR OF EDUCATION RESEARCH AUTHORIZATION

REPUBLIC OF KENYA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
STATE DEPARTMENT OF EARLY LEARNING AND BASIC EDUCATION

TELEGRAM:.....
TELEPHONE NO: 0534142207
WHEN REPYLING PLEASE QUOTE OUR REFERENCE
EMAIL: *cdeelgeyomarakwet@gmail.com*

COUNTY DIRECTOR OF EDUCATION,
ELGEYO MARAKWET COUNTY,
P.O. BOX 214-30700,
ITEN.

DATE:22ND OCTOBER,2018

REF No: CDE/EMC/R/26/VOL.II/ (75)

John Kiplimo Chumo
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: FORMAL RESEARCH AUTHORIZATION-
JOHN KIPLIMO CHUMO –REG. NO. E55/CE/27941/13

Following the authorization by the National Commission for Science, Technology and Innovation **(NACOSTI)** to carry out research in **Elgeyo Marakwet County** Vide Authority letter **Ref. No. NACOSTI/P/18/27873/25306** dated **2nd October, 2018** you are hereby formally granted authority by this office to proceed with your study on "***Influence of formative assessment on student' Kenya Certificate of Secondary Education performance in Physics in public secondary schools in Elgeyo Marakwet county*** " for a period ending **2nd October, 2019.**

Please accord him necessary assistance.

FOR: COUNTY DIRECTOR OF EDUCATION
ELGEYO MARAKWET
P. O. Box 214 - 30700
ITEN

Joel O. Oyola
For: County Director of Education
ELGEYO MARAKWET.

Copy to:
1. The Director General/CEO -NACOSTI
2. All SCDEs Elgeyo Marakwet County

APPENDIX I: RESEARCH WORK PLAN

Period Activity	**April 2018**	**June 2018**	**Sep 2018**	**Oct 2018**	**June 2019**	**July/Aug 2019**
Writing of Proposal and corrections by Supervisors						
Presentation/defense of Proposal at Department Level						
Data collection						
Thesis writing						
Submission of thesis to supervisors for value addition						
Submission of final copy for defense at Graduate School.						

APPENDIX J: RESEARCH BUDGET

ACTIVITIES	**PARTICULARS**	**AMOUNT (Kshs)**
Development of proposal	Stationery	2,000
	Printing cost	5,000
	Binding	1,000
	Traveling cost	15,000
	Meals	4,000
Data collection and analysis	Typing and printing of 30 questionnaires	1,000
	Traveling	8,000
	Data Analysis	10,000
Thesis	Typing and Printing of Draft	4,000
	Typing and printing of the final draft	4,000
	Traveling and meals	20,000
Miscellaneous		5,000
Total		**78,000**