EFFECT OF STUDENT SELF-ASSESSMENT ON ACADEMIC PERFORMANCE

BY

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A RESEARCH PROJECT REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR MASTER OF EDUCATION IN MEASUREMENT AND EVALUATION DEGREE IN THE DEPARTMENT OF PSYCHOLOGY, SCHOOL OF EDUCATION, UNIVERSITY OF NAIROBI.

2020

DECLARATION

I declare that this research project report is my original work and has not been presented for the award of an academic degree in any university.

SIGNATURE……... **DATE…….**

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E58/78929/2015

SUPERVISOR'S DECLARATION

I confirm that this research project report has been presented for examination with my approval as the University of Nairobi supervisor

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DEDICATION

I dedicate this work to Almighty God, to my wife Peullet Onyango, mom Elizabeth Oloo and brother Daniel Oloo for the supporting me during the studies

ACKNOWLEDGEMENTS

I hereby express my utmost gratitude to all people who supported me professionally in making this project a success. I would like to thank my supervisor, Dr. Karen T. Odhiambo who has guided me throughout the process. My sincere recognition goes to NACOSTI for the permission to carry out the study.

ABSTRACT

There is a paradigm shift in thinking which requires authentic learning that has led to focus on formative assessment. This has caused a challenge to educators. Educational experts have recommended for the integration of student self-assessment in learning process to address this challenge. Self-assessment is a process where learners reflect on the worth of their work, compare their work to the standards, identify gaps and revise appropriately. The purpose of this study was to determine the effect of student self-assessment on academic performance in secondary schools and if it ensures quality education. This was studied considering mathematics. The objectives of this study were: a) to determine the classroom assessment practices that arise while teaching mathematics; b) to determine the effectiveness of student self-assessment in improving performance in mathematics; c) to determine the perception of teachers and students towards student self-assessment as a tool for formative assessment, and d) to determine the attitude of students towards mathematics since attitude towards mathematics is an attribute that affects mathematics performance. This study adopted a quasi-experimental, pretest-posttest, nonequivalent control group design for students, survey design for teachers and students. The study was carried out in secondary schools in Homa Bay County. The study population consisted of secondary school learners' context, while the sample consisted of 60-form three learners. The instruments were determined as validated having been used in previous thesis studies after getting permission to use. The findings were that, the major classroom assessment practices in use were discourse, own production and observation. Self-assessment and other alternative assessment strategies were rarely used. Student' self-assessment strategy was not effective in improving academic performance in mathematics. Teachers held mixed perceptions towards self-assessment strategy with the behavioral feelings being the major reasons for integrating the strategy while the control feelings formed the major reasons for not implementing the strategy. Majority of the students applauded self-assessment strategy. Most of the students had positive attitude towards mathematics. The study concluded that the integration of student self-assessment promoted better performance in mathematics to the extent desirable. The study recommends that there is need for a policy in education on the integration of the alternative assessment strategies in the classrooms as formative assessment methods to enhance more meaningful learning especially student self-assessment. A connection exists between attitude, learning, performance, and practical use of mathematics competencies. This study recommends that such a connection be identified at the early stages in a child's mathematics education.

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ACRONYMS

ANCOVA:	Analysis of Co-Variance
ANNOVA:	Analysis of Variance
CDS:	Compact Disks
KICD:	Kenya Institute of Curriculum Development
KNEC:	Kenya National Examination Council
NACOSTI:	National Commission for Science, Technology and Innovation
SPSS:	Statistical Package for the Social Sciences.
USA:	United States of America
USB:	Universal Serial Bus

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CHAPTER ONE

INTRODUCTION

1.1 Background

Andrade (2010) defines self-assessment as the process where learners make a reflection on the worth of their work, compare the nature of their work explicitly to the expected standards, make judgment on how well their work resembles the criteria and finally make revisions appropriately. Self-assessment is an aspect of formative assessment. According to policies of formative assessment, student self-assessment is useful for raising academic performance (Black & Wiliam, 2006). There is evidence that suggests that self-assessment contribute positively to learning outcomes, but its effects are highly variable, with many threats to its validity (Brown & Harris, 2013). Nonetheless, student self-assessment is strongly advocated for as an important classroom practice (Leahy, Lyon, Thompson, & Wiliam, 2005). Different terminologies in describing the self-assessment process have been globally used for example self-reflection, self-evaluation and self-monitoring.

A pivotal rationale for self-assessment is to avail feedback useful in deepening learners' mastery and improvement in their achievement. Research carried out by Butler & Winne (1995) and Crooks (1988) shows that feedback enhances achievement and learning when provided effectively. The limited nature of feedback in the classrooms is caused by the fact that many of the teachers lack adequate time to address each student's work. Luckily, there is a demonstration from research by Andrade, Du, & Wang (2008) that learners can be effective source of feedback through the process of self-assessment especially where the information in the feedback is on the processes and the learning goals.

Self-assessment is founded on the scholarship of self-regulated learning. Pintrich and Zusho (2002) define self-regulated learning as a process where students control all the components of their behavior, motivation and cognition during the process of learning. Practically self-regulated learners perform the following roles: set-up the learning goals, identify effective learning strategies, manage the learning resources, monitor own progress towards the goals, react to the external feedback constructively and ensure achievement of the goals (Zimmerman, 1989). Zimmerman (1989) describes learning in this context as a task that learners undertake for themselves in a bold manner instead of handling it as a secretive one happening to them in response to teaching. According to Zimmerman (2000), self-regulated learning consists of three stages: the forethought stage which takes place before the onset of learning, the performance stage which is the learning stage and lastly the self-reflection stage which occur after learning. Zimmerman argues that the stage of self-reflection is where students create self-judgments and make perspectives on the causes of their level of performance.

The following are the three types of self-assessment identified by Brown and Harris (2013) in K-12: Self-grading or marking, self-ratings and rubric-based or criteria-based assessments. In self-rating, students judge aspects of their work qualitatively or quantitatively through the use of a rating system. Self-marking or grading on the other hand according to Todd (2002) can be undertaken using a rubric, scoring guide or model answer. The third type of self-assessment according to Brown and Harris (2013) is the use of rubrics to verify the worth of any work written or performed by an individual. According to Taras (2010), all of the three types may be similar to the model of 'self-marking' of higher education. The difference between the three is that some may use a grade or a mark while some types may just describe the worth of the student's work.

According to Andrade & Valtcheva (2009), self-assessment can enable students to set realistic goals, pinpoint gaps in own skills, trail own advancement, identify areas which need more attention during learning and revise their work. Self-assessment of the achievement creates a positive self-reaction which boosts self-confidence. Self-assessment in the context of self-regulated learning engages cognitive processes like memory, attention, perception as well as higher reasoning. Research by Johnson and Gelfand (2013) suggest that self-assessment prepares students for life-long learning, enables the students have the ability to critique self and also that of reflecting on their performance in a manner to know whether they are meeting the requirements or not. Boud (1989) believes that self-assessment enables learners to create new ways of becoming more critical and perspective about their learning. Self-assessment promotes the development of metacognitive skills among learners.

According to Cooper (2006), self-assessment makes students to possess more skills that can enable them to adjust in their learning to better the value of their output. Black & William (1998); Chappuis, & Stiggins (2002) are of the opinion that this kind of assessment impact positively for the low achievers hence reducing the achievement gaps. According to Brookhart, Andolina, Zuza, & Furman (2004), it increases problem-solving ability of students. According to Beaman (1998), it creates autonomy and independence, increases responsibility (Dochy et al, 1999) and enhances self-efficacy (Bangert et al, 1991). Self-assessment also enables teachers develop better classroom assessment practices which are engaging to the students and this enhances learning.

As the world shifts towards a sustainable development paradigm which is leading us to authenticity, the nature of learning must also change in line with authenticity. Authentic learning focuses on the 21st Century skills like critical thinking, adaptive skills, innovativeness and problem-solving (Mueller, 2005). The outcome of this paradigm shift is life-long (sustainable) learning. This nature of learning therefore demands for an 'alternative' assessment (Dysthe, 2002): a kind of assessment that mirrors far transfer of knowledge rather than the near transfer of knowledge. Forms of alternative assessment are meant to communicate feedback to the learners and teachers on the process and the progress of learning, enhance independence, autonomy, innovativeness and motivation among the learners. Self-assessment is one of the 'alternative' assessments strategies and is the concern for this study.

Self-assessment has had a complex and long past that has been sustained by few people. As Boud (1995) puts it, student self-assessment has been shown to be an effective way of enhancing student learning since its early use in 1930s in the US where the standard model was used. In this model students were required to assess their work using agreed standards and criteria, provide the differences between weaker and stronger aspects of their work and assign a grade or not. In 1970s and 1980s, there were divisions between students and their teachers occasioned by changing discourses of student autonomy and independence. The emphasis in this era according to Boud (1995) was on the ability of students to work and develop with no assistance from teachers and instead seek for peers for any external assistance. The period of 1980 and 1990 witnessed refreshed enthusiasm to involve students in assessment especially in higher education. For example, in Australia and UK, Boud (1995) did extensive work on supporting self-assessment where he documented various case-histories of varied academic and content settings demonstrating the

flexibility of self-assessment. Taras (2014) on the other hand reported an influx in the use of self-assessment in higher education institutions in England between 2000 and 2014.

Brown and Harris (2013) for K-12 and Taras (2014) for higher education argue that even though there has been development of self-assessment over a long time and also an increased excitement for it, its usage is never the same. Brown and Harris (2013) cited a research done by Hunter, Mayenga & Gambell (2006) among high school teachers in Canada which found that only 23% of the sampled teachers noted to have not used self-assessment, those who had minimal use were 58%. The model used is the standard model of self-marking. In Finland according to Lasonen (1995), about 50% of 346 sampled students in upper secondary disclosed to have engaged in self-assessment. The information above does indicate the trend of the use of self-assessment but does not show the frequency of its use. The fact that more than 58% of secondary school teachers admitted to be utilizing student self –assessment minimally is encouraging. Nevertheless, if 23% of the teachers sampled admitted never to be using it more so in this era of renewed thinking, good practice and innovations, it raises an alarm. The situation is worse in Africa and Kenya where education systems are still undergoing problems related to quality and equity. The study comes at an opportune time when knowledge is needed to help fast track regulated learning in the era of Sustainable Development, that leads to lifelong learning.

1.2 Statement of the Problem

The literature shows that teachers do not apply student self-assessment (Taras & Davies, 2013) or when they do, they are not skilled. Similarly, when they apply self-assessment, they do not believe in it and apply it because it is mandated more so in subjects like mathematics. Black and William

(1998) cited a study carried out by Daws and Singh (1996) which reported that among the UK science teachers they sampled only 33.3% engaged their learners in self-assessment. Similarly, Dignath and Buttner (2008) found that very few studies recognized pedagogical approaches that can effectively prompt secondary students become negotiators of instruction and the impact of the approaches on educatonal performance. This study intended to determine the effect of student self-assessment as a self-regulated learning strategy on academic performance in mathematics in secondary schools. This intervention intended to address some gaps cited within the literature by Zimmerman (2011) that requires educators to improve their classrooms activities in order to promote self-regulated learning.

1.3 Purpose of the study

The purpose of this study was to determine the effect of student self-assessment on academic performance in mathematics in secondary school.

1.4 Objectives

The objectives of the study were:

i. To determine the classroom assessment practices that arise while teaching mathematics.
ii. To determine the effectiveness of student self-assessment strategy in improving performance in mathematics.
iii. To determine the perception of teachers and students towards student self-assessment.
iv. To determine the attitude of students towards mathematics.

1.5 Research Questions

This study intended to find answers to the following questions:

i. What classroom assessment practices arise while teaching mathematics?

ii. How effective is student self-assessment strategy in improving performance in mathematics?

iii. What is the perception of teachers and students towards student self-assessment?

iv. What is the attitude of students towards mathematics?

1.6 Significance of the Study

The outcome of the study will result in Education planners and designers of curriculum use the information from this study to enrich the curriculum and realise better strategic actions for educational programs. The outcome will further enrich classroom practices regarding self-assessment. Additionally, the information from this study will be useful in enriching the literature that surrounds fruitful instructional approaches fostering self-regulated learning in the classrooms.

1.7 Justification of the Study

There is not enough research carried out on student self-assessment more so in secondary schools across languages, cultures and continents (Taras, 2015). The information from this study will enrich the academic community by providing more informed knowledge on the use, experiences and discourses on student self-assessment. This research will add to the existing literature and enrich global thinking and understanding of practices and discussions on self-assessment.

1.8 Terminologies

Assessment: The process of gathering and collecting data to inform about learning

Self-assessment: This is a process where students make a reflection over the worth of their effort, balance explicitly to the criteria expressed, make judgment on the degree their effort resembles the standard and finally correct appropriately.

Formative assessment: The process where information is gathered and collected to monitor learning and give feedback to enhance learning and teaching.

Summative assessment: The process where there is gathering and collection of information about what has been learnt with respect to set benchmarks and standards mainly for purposes of credentialing, selection and placement.

Teaching: Conscious arrangements of experience(s) with the aim of helping learners attain some desirable changes in their behaviors.

Learning: This refers to the process which results in a permanent change in an individual's behavior through experience, practice and interaction.

Self-regulated learning: A process where one controls and evaluates own behavior and learning.

Academic performance: The scores or grades that a student attains in a test.

CHAPTER TWO

LITERATURE REVIEW

2.1 Related Studies

This section of the chapter will highlight and summarize the findings of four studies on the effect of self-assessment and performance in mathematics.

A study was done by Daniel James Hotard (2010) on the effect of self-assessment on performance in mathematics. The purpose of the research was to find out the impact of teaching student self-assessment on their learning of mathematics. The study objective was to determine the effect of student self-assessment on short-term learning gains in mathematics. He reported that in all cases, no significant difference was found.

In 2012, Warner Z.B and his colleagues did a study on the effect of student self-assessment in performance in mathematics. The purpose of the study was to create a self-assessment process for students in the 7^{th} grade in mathematics and test its effectiveness in improving achievement. The objectives for this study were to: determine the feasibility of self-assessment among the 7^{th} grade students in mathematics, determine the transferability of rubric-referenced self-assessment process from writing to mathematics and to determine the size and direction of the effect of self-assessment on performance. They reported that the treatment group achieved averagely a higher score cumulatively and on three items compared to the control group. They suggested for a study with a large sample.

Laura Dvornick Clift (2015) carried out a study on student self-assessment with goal setting and academic achievement in mathematics. The purpose of this research was to implement the self-regulation theory through quantifying the impact of student self-assessment with goal setting on performance and motivation. The objectives of the study were to: determine any significant statistical difference in the academic performance and motivation in the posttest mean scores in mathematics between the 4th grade experimental and the control groups while the pretest is controlled, find out if there is any a statistically significant difference linking the performance posttest mean score of 4th grade pupils of mathematics who took part in self-assessment with goal setting and those who did not and finally to determine if there is a significant statistical difference linking the motivation posttest mean scores of 4th grade pupils of mathematics who took part in self-assessment with goal setting and those who did not as the pretest was controlled. The study reported that the application of self-assessment with goal setting as an approach of teaching results in greater degree of motivation and performance.

A relatively more recent study in the same area was carried out by Kathryn Price in 2016 in USA to investigate the effects of student self-assessment on academic performance in mathematics among 3rd grade classroom students. The study was to determine whether or not self-assessment and self-directed learning impacted on student performance for students in a third-grade mathematics classroom. The objective was to determine the effect of self-assessment and self-directed learning on academic performance. She found out that the intervention had a significant effect on student performance.

2.1.1 Summary of outcomes from the studies

The studies reviewed above focus on the effect of student self-assessment on the academic achievement. Three of the four reviewed studies report significant statistical difference favoring the experimental group against the control group with only one of them by Hotard (2010) reporting no significant difference between those students trained on self-assessment and the control group. These studies report mostly that those in the experimental group perform better than those in the control group. Below is the general trend from the studies:

- Hotard (2010) reported that student' self-assessment has no effect on learning of mathematics
- Warner Z.B et al (2012) found out that self-assessment strategy led to an improvement in academic performance
- Clift (2015) reported that self-assessment approach with goal-setting results in greater degree of motivation and educational performance.
- Price (2016) found out that self-assessment has a significant effect on student's performance.

2.2. Related Literature

2.2.1. Concept of self-assessment

Student self-assessment is an evaluation of a student's own work products and processes in classroom settings. According to Andrade (2010), self-assessment is a process where learners make a reflection on the worth of their work, compare the nature of their work explicitly to the expected standards, make judgment on how well their work resembles the criteria and finally make revisions appropriately. Self-assessment is type of authentic assessment. Authentic assessment

according to Mueller (2005) is a type of assessment where learners are required to demonstrate the application of knowledge and skills in actual situations. Authentic assessment is also an aspect of formative assessment. Different terminologies in describing the self-assessment process have been globally used for example self-reflection, self-evaluation and self-monitoring.

The main reason for self-assessment is to provide response crucial in deepening learners' mastery and improvement in their achievement. Research carried out by Butler & Winne (1995) and Crooks (1988) shows that feedback enhances achievement and learning when provided effectively. Boud (1989) believes that self-assessment enables learners to create new ways of becoming more critical and perspective about their learning. Self-assessment promotes the development of metacognitive skills among learners. According to Cooper (2006), self-assessment makes students to possess more skills that can enable them to adjust in their learning to better the value of their output.

According to Brookhart, Andolina, Zuza, & Furman (2004), it increases problem-solving ability of students, creates autonomy and independence (Beaman, 1998), increases responsibility (Dochy et al, 1999) and enhances self-efficacy (Bangert et al, 1991). Self-assessment also enables teachers develop better classroom assessment practices which are engaging to the students and this enhances learning.

2.2.2 Types of self-assessment

According to Brown & Harris (2013), there are three types or processes of student self-assessment for the K-12 compulsory sector. These includes: self-rating, criteria- or rubric-based assessments and self-estimates of performance. The three types are explained as follows:

a) In self-rating, learners are required to determine quantitative and qualitative features of their work with the help of a system for rating. Clarke, Timperley, & Hattie, (2003) suggest that in classroom setting, checklists can be useful in reminding learners about crucial features and processes of the tasks. Clarke's (2005) adds that learners should provide ratings of the worth of their works as well as the feedback statements for advancement to mimic the feedback tutors might give.

b) Todd (2002) describes self-marking or self-grading of a person's own work as a process which can be carried out through the use of a rubric or a marking guide or model answer. Students can put a mark or score, grade or a rank order in order to estimate his/her level of performance in the work.

c) The third one is the use of a rubric to verify the qualitative attributes of a learner's performed or written work. These rubrics can have indicators of score or not (e.g., A; Level 3; Excellence) but should organize the measures of standard in incremental series for the usage of the student to best fit the different attributes of their work. Andrade &Valtcheva (2009) believe that rubrics are important especially when leaners judge portfolios and assess their writing

The three types are discussed in detail so as to discover the differences and similarities in the procedures. In self-rating, a system of rating is used which stresses on quantity or quality of work. A question that may arise is the difference and similarity between it and self-marking which utilizes a rubric, marking guide or a checklist. Both self-rating and self-marking uses an answer system or a calque. Self-rating looks at the quantitative or qualitative aspects while self-marking on the other hand awards a grade or a mark. The third type of self-assessment uses rubrics, but so is self-marking. Both the first and the third examine the qualitative aspects of one's work.

Additionally, all these processes need reflection. According to Taras (2010), all of the three types can be equated to the model of self-marking of Higher Education. The only difference perhaps could be that some of the types utilize words to describe the worth, while some types may also need a grade or mark.

According to Brown & Harris (2013), practices of self-assessment may also persuade learners to incorporate advice or observations from the learner to her or himself on ways to improve. Taras (2015) is of the view that it could be more precise to perceive the three types of self-assessment as self-marking which can be categorized into three sub-types of self-marking.

2.2.3 Classroom application of student self-assessment

There are three levels or models of implementing self-assessment; stronger, median and weaker. This categorization according to Taras (2010), is in terms of the level of students' access to decision making as well as power in the process of assessment in comparison to the teacher. Carlile and Jordan (2005) argue that as the self-assessment strategies under discussion herein change from the weaker to the stronger model, the strategies change from behaviorists to constructivists' views on learning.

a) The weaker model of self-assessment according to Taras (2010) involves students judging the quantity or quality of their work through the use of a system of rating. A rubric or checklist can preferably be useful here. In this model the students are given the sheets having the standards to enable marking, in the marking sheets there is a hierarchical organization of content and categorized according to concepts, structure and arguments. In the next step the learners understand how the teacher interprets the sheet and use such interpretations to check own work and make corrections and assign a grade appropriately. The students then actively

participate critiquing and interpreting their work. Finally, the learners perform same process of assessment as their teachers. This model or level of self-assessment is perceived to be of benefit as it's simple to carry out, it's engaging to the students in both the product and process of assessment, it also results into an increase in trust between the students and their teachers as the students feel welcomed to be assessors.

b) The median model is a relatively greater level of self-marking. According to Cowan (2006), this is the standard model. Here the learners pass judgment using the criteria. They then comment on their weak and strong areas and place a grade to own work before they submit to their teachers. Teachers then mark the students' work as usual and add comments alongside those of the students' comments on the self-assessment and the work. The marked work is finally given back to learners. This model is advantageous in the sense that the students are more engaged and this ensures in-depth understanding the process of assessment.

c) According to Taras (2015), the stronger model entails self-assessment integrated with peer/teacher feedback. This is the greatest level of "self-marking" (Taras, 2015). Students in this model self-assess their work using the marking sheets given by their teachers which have the standards and criteria. The teacher then gives the feedback based on the criteria with no placing of a score or grade. The learners then receive feedback from the peers and use the teacher's feedback and that from the peers to carry out revision, score and finally resubmit. The advantage of this model is that learners carry out the self-assessment with no pressure of attaching a grade. In addition, the students combine both the peer feedback and that of the teacher to inform their learning.

2.2.4 Self-assessment strategies and tools

The following techniques and procedures have been used by teachers successfully in the classrooms.

a) Student progress cards

According to Oscarsson (1984), student progress cards have been used as instruments of self-assessment in different educational contexts globally. Student progress cards describe collection of short-lived functioning goals and assemble them at once in graded chunks at different degree of complexity. Teachers and students can altogether take part in this process. The learner can mark within the student column each task that he/she is capable of undertaking effectively. The instructor later may mark in his/her column the task once the learner has exhibited understanding.

b) Checklists, Questionnaires and rating scales

Another common strategy in the context of self-assessment is the usage of checklists, questionnaires and rating scales (Oscarsson, 1984). These strategies have existed in use as methods through which students assess their general degree of competency. Coombe (1992), argues that much work has been carried out on these strategies by using statements showing ability. Students can be supplied with a table showing the column of ability or competency and that of the score (rate). In this case they rate themselves using the scale provided based on how they perceive their ability levels.

c) Learner Diaries and Dialog Journals

According to Dickinson (1987), learner diaries and dialog journals have been suggested as one approach of organizing self-assessment for students. In this context, learners write about what they have learnt, their level of mastery of the content according to their perception, and their intended action plans with the acquired skills.

d) Videotapes

In the current era of technology, audiovisual may not be able to compete the video recording. Videos are useful in so many different ways in order to enhance self-assessment in classroom context. For instance, students can videotape one another during an oral presentation and later each can self-assess his/her performance. The importance of the use of video in self-assessing is that students are able to assess both their language skills, communicative skills and even the body language skills (paralinguistic skills).

e) Portfolios

A portfolio is student's work over a given period of time grouped together that demonstrate his/her performance, the progress and efforts in an area or more (Leon Paulson et al, 1991). A portfolio can be used to show academic growth of a student over time, to provide information on student's progress to the parents during such conferences or for judging the performance of the district-wide goals.

2.2.5 Classroom assessment practices that arise while teaching mathematics

Classroom assessment encompasses a wide collection of tasks ranging from creating achievement standards and paper-pencil tests, to scoring, explanation of scores, conveying of test outcomes and applying the tests outcomes in making decisions. According to Stiggins (1992), when performance tests and paper-pencil tests are used there is need for teachers to be cognizant of the merits and demerits of different testing strategies and select suitable ones to assess learners. Teachers do grapple to better their assessment methods and create decisions, since the entire exercise is portrayed by conflicts around teachers‘ convictions on assessments and their underlying

advantages in addition to other exterior constrains that must be put into consideration in the process (McMillan, 2003).

Classroom assessments consists of a broad scope of perspectives for the continuing judgment of learner performance and advancement, which include structured quizzes; homework; assignments; worksheets; and unofficial assessment of student contribution, input and behavior. Classroom assessment practices differ in almost a similar way as the methods for teaching students (McMillan, 2004). Assessment methods can either be traditional or alterative. Traditional methods of assessment consists of assessments of learning (summative) which evaluate the learner at the end of a topic or a given period of study. Objective tests have been traditionally used by teachers to estimate certain expertise through the use of quizzes. Additionally, assessment practices can be categorized as either alternative or traditional depending on the authenticity and difficulty of the piece of work and the duration of the assessment (Gronlund, 2006).

Assessments practices like matching items, true-false and multiple choice which are traditional in nature tend to be lower in authenticity and difficulty of the assessed work but require a shorter duration to conduct and score (Gronlund, 2006). Portfolios, observations and other performance-oriented ones which are alternative in nature are both greater in terms of difficulty of the work assessed and authenticity and also need a longer duration of time in using and scoring compared to the traditional assessments (Gronlund, 2006).

Both traditional assessment (e.g. matching types, multiple choice tests, standardized tests and achievement tests) and the alternative assessment methods (e.g. student self-assessment, projects,

peer-assessment, portfolio assessment and group assessment) have been used in assessing learning in mathematics. The table below shows some assessment types and the level of assessment where they are most likely to occur in the learning of mathematics.

Table 2.1: Assessment techniques

ASSESSMENT TECHNIQUE		
Format	**Purpose**	**Level**
Performance Tasks	Require learners to make or take an action related to a problem, issue, or mathematical concept	Formative and summative
Investigative Projects	Require students to explore a problem or concern stated either by the teacher or the students	Summative
Portfolios	Assist students in the process of developing and reflecting on a purposeful collection of student generated data	Formative and Summative
Interviews	Assess individual and group performance before, during, and after a mathematics experience	Formative
Paper and Pencil Tests	Multiple choice, short answer, essay, constructed response, written reports, Assess students' acquisition of knowledge and concepts	Formative
Embedded Assessments	Assess an aspect of student learning in the context of the learning experience	Formative

From Angelo & Cross (1993). *Classroom Assessment Techniques*: A Handbook for College Teachers. San Francisco: Jessey-Bass Eberly Center for Teaching Excellence, summer 2000 There has been a change in the thinking over the classroom assessments practices which lean towards alternative ones over the traditional ones. According to Shepard (2000), the thinking is that alternative assessments inherently motivate the students more than the traditional ones. Lin (2006)

is of the view that any method used in assessing children's learning of mathematics ought to mirror realistic goals to enable the results of the assessment become useful in making proper educational resolves (Romagnano, 2001) and assist teachers point out strategies of enhancing learning and teaching of mathematics (NCTM, 1989).

The table below describes some of the alternative assessment practices for mathematics and the skills they develop.

Table 2.2: Alternative Assessment Techniques and the skills they develop

Assessment method	**Meaning and skills developed**
Student self-assessment	Self-assessment obliges students more actively and formally to evaluate themselves and may develop self-awareness and better understanding of learning outcomes
Projects	These may develop a greater range of knowledge, for example organizational, research and IT skills.
Peer-assessment	By overseeing and evaluating other students' work, the process of peer assessment develops heightened awareness of what is expected of students in their learning
Portfolios	This possess significant ability for advancing and showing moveable expertise as a proceeding task in the entire student learning.
Group assessment	It develops interpersonal skills and may also develop oral skills and research skills (if combined, for example, with a project).

Source: The Handbook for Economics Lecturers Dr Nigel Miller, University of York (Edited by John Houston and David Whigham, Glasgow Caledonian University).

One of the concerns of this study was on the classroom assessment practices that are in use by teachers while teaching mathematics in secondary schools. These classroom assessment practices include both alternative and traditional methods.

2.2.6 Self-Assessment and performance in mathematics

Self- assessment is evident to have the ability to enable learners to converse and have rational mathematical thinking. Brookhart, Andolina, Zuza, and Furman (2004) in their study discovered that involving third grade learners' in own assessment led to an improvement in the performance in mathematics as well as reduced the performance gap. Ross, Hogaboam-Gray, and Rolheiser (2002) on the other hand reported fruitful outcome of self-assessment on solutions to word problems of mathematics among 5^{th} and 6th graders.

Stallings and Tascione (1996), dealing with older students of mathematics discovered that the self-assessment process was engaging to students as they evaluate own progress, help to develop their conversation capacities, and enhance their mathematics discourse. Other studies also show convincing impact of self-assessment on achievement of learners in mathematics, both in formative and summative assessments. For instance, Fontana and Fernandes (1994) discovered improvement in achievement among Portuguese students aged between 8 and 14 when the mixed treatment included self-assessment. Black et al. (2004) in their study on assessment for learning practices in science and mathematics classes among pupils aged between eleven and fifteen years in England discovered a firm, constructive connection between assessment for learning (self-assessment included) and achievement. The authors deduce that the developing self-assessment by

the learner could make a crucial attribute of any initiative of formative assessment. One of the objectives of this study was to determine the effect of self-assessment in improving performance in mathematics.

2.2.7. General perception of teachers and students towards student self-assessment

From the literature the use of self-assessment is never the same globally. This can be attributed to the fact that teachers and student hold different beliefs or perceptions concerning the strategy. Hunter et al. (2006) for instance, used a self-report survey tool to study classroom assessment of a collection of teachers of English from Canadian secondary schools. They found out that not more than 20% of the sampled teachers (n=4148) used student self-assessment frequently and about 85% of them either used little or did not use the strategy in the classrooms. This justify the need to determine the perceptions or reasons for using and for not using student self-assessment.

Different reasons have been given in the literature for the lack of use of student self-assessment in the classrooms. According to Brown and Harris (2013), lack of knowledge of evaluation among students pose a great challenge as this affect the accuracy of self-assessment. Panadero et al. (2014) on the other hand are of the view that the school or the national policies on assessment may influence teachers not to use student self-assessment. In addition, these authors believe that unfavorable attitudes of teachers towards self-assessment is one of the reasons for its absence in use.

According to Ross, J (2006), the following are the reasons why some teachers use student self-assessment in their classrooms. Some teachers assert that engaging students in the assessing own work, more so providing them with avenues to provide to the basis for judging the work, improves learner commitment in assessment tasks. Secondly, some teachers argue that self-assessment leads to different assessment strategies which is crucial to maintain learner's attention and interest. Some other teachers hold an argument that self-assessment is cost-effective compared to other techniques.

The reasons given by the teachers for their assessment decisions enhances understanding why self-assessment is implemented and why at times it is not implemented. These reasons may only provide superficial explanation of choices made by a teacher. On the other hand, beliefs may possess greater effect on assessment decisions. Ginsborg (2006) argues that in as much as reasons stem from beliefs, the two are different in that reasons tend to describe why there is belief on something while reasons are suppositions on the truth about something.

Since beliefs are not easily evident, it could be not easy to report on teachers' beliefs. According to Ajzen's (1991) theory of planned behavior, three types of beliefs manifest: control, normative, and behavioral. Control beliefs are one's conceptions about aspects that hinder or enhance their capacity to do a given work. A teacher for instance, may communicate a control belief that he/she does not believe to have adequate time for understanding and implementing student self-assessment effectively. Normative beliefs on the other hand are one's conceived supposition from others in performing a given action or behavior. For instance, teachers may convey a normative perception and belief that students don't always take student self-assessment seriously. Lastly

behavioral beliefs are one's perceptions of the possibility of a given action or trait resulting into a specific outcome. For instance, a teacher may hold a behavioral belief that through implementing student self-assessment in the classroom, students would attain a result of in-depth thinking.

Similarly, students' perception towards the use of self-assessment affect its implementation in the classrooms. According to Jafapur (1991), some studies reported that teacher and students' ratings have low agreements. Sullivan & Hall (1997) on the other hand argue that self-assessment strategy is more challenging to students of lower ability compared those of higher ability since it calls for exhaustive questioning. This study therefore sought to determine the perceptions of students and teachers towards student self-assessment.

2.2.8 Implication of attitude of students towards mathematics

Attitude is a propensity to behave in a given way faced with a given issue (Oppenheim, 1966). In the perspective of learning, attitude is the feeling a person exhibits towards anything or anyone and is at times seen in one's behavior (Wasiche, 2006). The attitudes students exhibit depends on their experiences within the environment of learning. Attitudes can also be formed or enhanced by the interactions within the learning environment. According to Heider (1946), one can have a negative or positive attitude towards something or anyone but this depends on a person's liking or disliking.

Sources of these attitudes may be related to one's environment of learning. Twoli (1986) contends that a correlation exists between the attitudes that students form towards the learning of mathematics and the science subjects and their attainments in previous tests at similar levels. When

a student performs dismally repeatedly, he/she may acquire negative attitudes towards the discipline and this might affect the learning and so performance in the subject in the future years of learning. Another perspective is the notion that female and male students do perform differently in mathematics and so may exhibit different perceptions towards mathematics. According to HMI Survey (1977), girls averagely achieve low marks compared to boys in the end course tests. This may imply that girls develop different attitudes compared to the boys as they interact in the school learning environment. Costello (1991) did a study among 11-16-year old students found that learners exhibited dissimilar perceptions about mathematics. A fraction of the female students perceives mathematics as a subject meant for the boys.

The interaction of learners in schools may lead to development of different attitudes towards mathematics. According to Costello (1991), students can influence one another's attitudes towards mathematics. The learning environment created by the teacher also affect the nature of the attitudes of the students towards a subject. Stanic (1995) said while citing Fennema (1976) that more male students enjoy learning mathematics than their female counterparts. Stanic (1995) argues that teachers can create an enabling environment to enable all the students in both genders to persist in learning mathematics. The attitudes that students develop affect their learning of mathematics. In summary, the learning environment, students' experiences and the interaction between the students within the environment influences the attitudes the students exhibit towards mathematics. All these ultimately affect the performance in mathematics. This study intended to determine the attitudes that arise among form three students towards mathematics and some of the reasons for the attitudes.

2.2.9 Self-assessment and self-regulated learning

Self-regulated learning according to Pintrich (2000) is a process where students lay down learning targets and make attempts for monitoring, regulating, and controlling their thinking, behavior and motivation to reach the goals. According to Andrade (2010), self- assessment and self-regulated learning have a common role of giving the students feedback which is self-generated about their learning and their approaches to learning so as to widen their knowledge and enhance their achievement.

A clear demonstration of the common attributes between self-assessment and self-regulation can be observed when Zimmerman's (2000) model of self-regulated learning which is often cited as compared with the self-assessment process illustrated by Andrade and Valtcheva (2009). The Zimmerman's model has three major phases which work cyclically. The first phase is the forethought where students identify and set goals and plan how to attain them. The second is the volitional control or performance phase which takes place as students learn and entails using self-monitoring and the strategies of learning. Finally, the third phase is of self-reflection where students make reflections and judge own work.

The phases of self-regulation of learning are observed to considerably overlap with the stages of self-assessment which includes pronouncing targets or expectations which corresponds to the self-regulated learning 'forethought phase'. The second stage of self-assessment of own work with respect to the targets or expectations, which entails self-monitoring of achievement and self-reflection. The third stage is revision so as to bridge any void between the expectations and the work, which is a way of reflecting.

In so many ways, the theories of formative self-assessment and those of self-regulated learning employ dissimilar terminologies to describe similar skills and processes. One observable distinction between the two areas of research is the basis of the feedback. In a simple way according to Andrade (2010), self-regulated learning tries to include the management of the process of learning whereas self-assessment deals mostly with the end results of learning. The fact that the two share a common goal of availing feedback that enhances learning depicts that practice and research in either of the fields can advise the other. For instance, it is arguable that consistent self-assessment can cause improved self-regulated learning.

2.3 Theoretical Framework

There are various theories that explain how learning takes place. They include (a) the behaviorists' theories of learning, (b) the socio-cultural, and situated and activity theories of learning and (c) the cognitive and constructivist theories of learning.

2.3.1 Behaviorists' theories of learning

These theories came into being strongly in the 1930s and are widely connected to the work of Thorndike, I. Pavlov, B.F. Skinner and James Watson. The learning environment according to these theories is the main factor in learning. Learning is perceived to be a conditioned reaction to exterior motivation. Awards and punishments or the holding back of the awards, are stronger methods of making or putting out behavior. Compliments may form a fraction of such a reward process. These theories do not believe in the existence of intelligence, mind and ego as important in explaining the process of learning but only focus on observable behavior which according to

them is sufficient. Performance in this context is perceived in terms of remembering of realities and accumulation of skills in a specific area.

The role of teaching is to guide learners to react positively to teaching faster and accurately. In terms of planning the syllabus, the compounded concepts are taught after the simple ones. Feedback is normally conveyed in terms of praises while mistakes are rectified so as to create links between stimulus and response. Assessment in this context is carried out to determine the progress using concealed tests with items developed from continuous levels in specific hierarchy of skills. Achievement is normally perceived as accurate (true) or inaccurate (false) deficient achievement is mitigated through undertaking more exercises on the inaccurate items.

2.3.2 The socio-cultural, situated and activity theories of learning

William James, John Dewey, George Herbert Mead, Levy Vygotsky and Jerome Brunner are among those who developed these theories. Others include Barbara Rogoff, Jean Lave and Etiene Wenger. These theories are based on the idea that learning is situated in the social environment. According to these theories, learning takes place as a result of interaction between the individual and the social environment. This means that thinking is carried out by actions which change the situation and the situation changes the thinking i.e. thinking and situation constantly interact. These theories perceive learning as a negotiated exercise where educational artefacts like language, equipment and books possess a crucial role. Learning is also perceived to be a "social and collaborative" process where students develop their thinking together.

Salomon (1993) argues that in these theories, learning entails participation and the content learnt is not from a learner but mutual within the social clique. Here the cumulative knowledge of the organization, community or group is importantly prioritized in comparison to the cumulative knowledge of individuals. These theories stress on the engaged participation of the learners in appropriate ways like perceiving the world in a given way and acting. Knowledge is not abstracted from context but perceived with respect to the context. Knowledge is extracted from practice.

The place of the teacher is to build conditions where learners can be excited into act and think in authentic activities above their competency levels but within their zones of proximal development. The learners according to the theories should be active participants in the creation of problems and solutions. Teachers and students should jointly solve the problems and develop skills and understanding. Learning is deduced from agile engagement in actual tasks. Biggs and Tang (1997) argues that judgment on learning needs to be holistic in order to be consistent with socio-cultural or situated approach. They add that if the main goal of learning is to build learning identities then students' own assessments should be central.

2.3.3 Cognitive and constructivist theories of learning

This study was guided by the cognitive and constructivists' theories of learning. The cognitive and constructivists' theories of learning were developed by Noam Chomsky, Herbert Simon and Jerome Bruner. The theories are based on what takes place in an individual's mind. The following are some of the tenets of these theories:

- Knowledge is not innate, neither is it passively acquired but actively acquired
- Learning takes place as an individual learner actively engages with the environment.

- All kinds of knowledge is constructed as the environment of the learner influences how and what he/she think.
- Knowledge is personal. Learners have distinctive views about the nature of the world.

According to these theories, learning requires active engagement of the learner and is determined by the processes in peoples' heads. Interest is in the mind as a function of the brain. Learning depends on how people construct meaning and make sense of the world through organizing structures, concepts and principles in mental models (schemas). Prior knowledge is crucial factor according to these theories in determining the capacity of a student to learn. Emphasis during learning is understanding and removing misunderstanding. These theories foster problem-solving as a crucial skill in knowledge construction. Achievement is framed in terms of understanding with respect to conceptual structures and competence in processing strategies. Self-regulation and monitoring are also fostered as learning aspects.

The teacher's place is to assist 'beginners' obtain 'skillful' interpretation of abstract frameworks and having master plans to answer problems by figurative handling easily. Since prior learning is important in influencing new learning, formative assessment is crucial in pedagogy as it's necessary to elicit students' mental models (through classroom discussions and concept mappings) so as to support their comprehension of knowledge frameworks and avail them with contexts for far transfer of knowledge.

Assessment and teaching are combined in order to close the spaces between current understanding and the new one sought. According to Shepard (2001), as students self-monitor their thinking and learning, they create knowledge and this lies at the center of this theory. This means that students make meaning partly by self-assessing before learning and even after learning. Learners evaluate, organize and internalize during learning and self-assessment is part of this process. According to these theories, students must link new skills, knowledge and understanding to what they have used and stored. Self-assessment enhances ability of students to create these links themselves, present a technique that enhances meaningful learning and the outcome of this is significant learner inspiration and conviction.

2.4 Conceptual Framework

This framework is founded on self-assessment strategies as a component of self-regulated learning process that support the learning and teaching of mathematics. The independent variables are components of self-assessment strategy which include: practices on self-assessment (the usage of portfolios, checklists, video tapes and progress cards) during instruction, techniques of using self-assessment (self-marking, self-rating and rubric or criteria-based) and perception of students and teachers towards self-assessment and finally the attitude of students towards mathematics. When effectively implemented, self-assessment strategy imparts self-regulatory skills into the learners. The outcome of this is better performance in mathematics, improved discourse, high scores in mathematics and an independent learner.

However in order to achieve these learning outcome the teacher's qualification and experience, the learning facilities available and gender of the learner influences the process. These factors are the intervening variables which influences the attainment of the dependent variables by the independent variables. The figure 2.1 below illustrates the conceptual framework of the study.

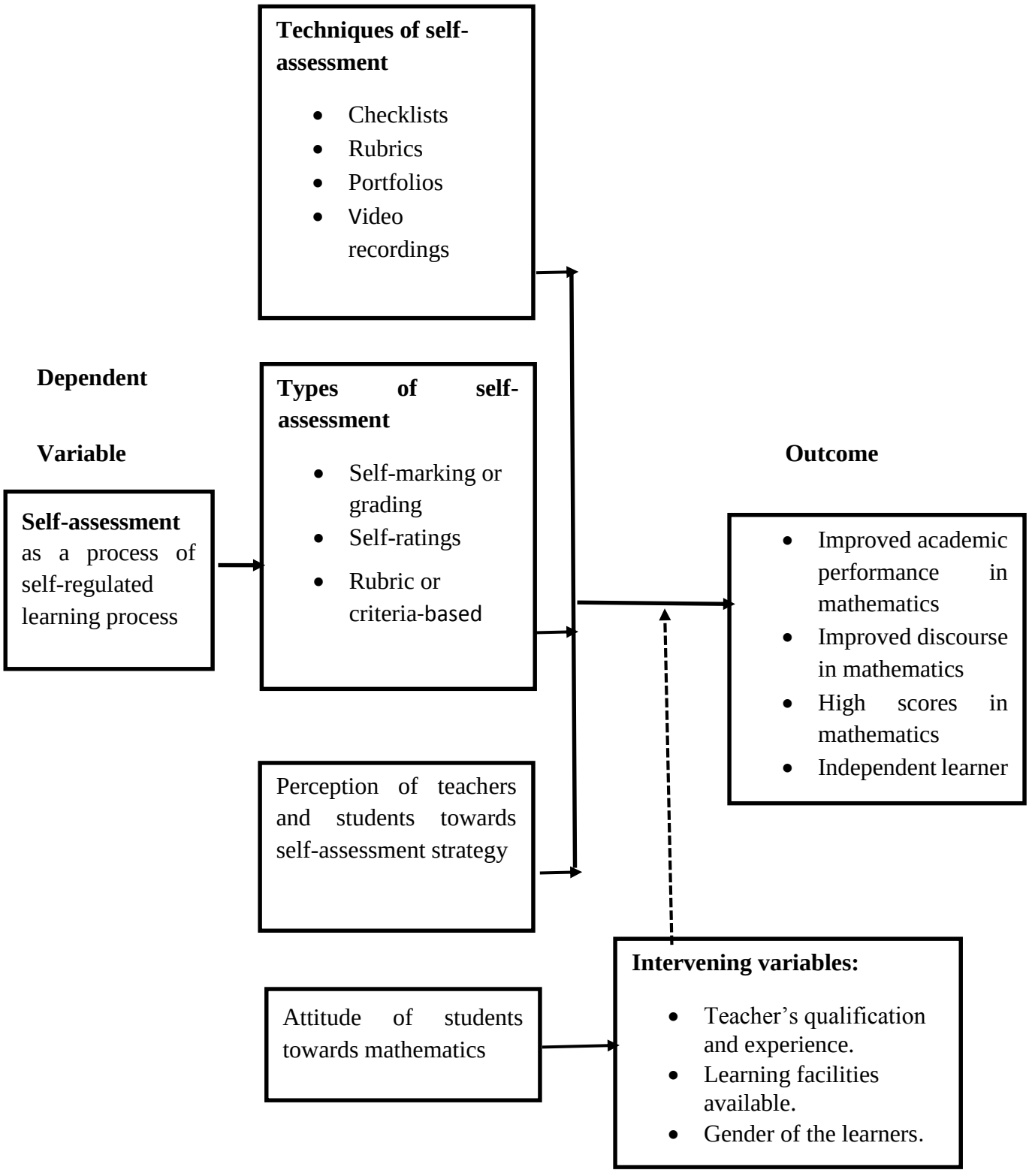

Figure 2.1: Conceptual Framework

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Design

This study used a quasi-experimental, pretest-posttest, nonequivalent control group design for students, survey design for teachers and students to determine the effect of student self-assessment strategies on academic performance. Quasi-experimental according to Cook & Campbell (1979), is a design where there is manipulation of the independent variable and non-random assigning of participants to orders of conditions or conditions. Survey research design on the other hand according to Visser, P. S.et al (2000) is that which involves data collection from a sample taken from a population that is well-defined using a questionnaire. Schneider et al. (2007) recommended a quasi-experimental design, arguing that it's most appropriate when the purpose of the inquiry is to establish the influence of a given teaching approach on learning.

3.2 Population of the Study

For this study the population consisted of all the secondary schools within Rachuonyo-East sub-county. This is because the information was collected from the students and teachers in secondary schools within the sub-county. The target population was 2052 respondents, 1950 of which were form three students and teachers of mathematics totaling to 102. There are 49 secondary schools within the sub-county with each school having between one and six trained teachers of mathematics. The table below shows the summary of the data.

Table 3.1: Population of the Study

Categories	Target population
Form three students	1950
Teachers of mathematics	102
Total	**2052**

3.3 Sample of the Study

The sample for this study consisted of 15 mathematics teachers and 60 form three secondary school students all from Rachuonyo-East Sub-county.

3.4 Sampling Procedure

The researcher selected 15 from 49 secondary schools using purposive sampling (30.61%) to form the sample. From each of the 15 selected schools the researcher purposively selected one form three teacher of mathematics to take part in the survey. For schools with only one teacher, he/she was selected for the survey while for a school with more than one, the most senior was selected for the survey. In a similar way 60 form three students were also selected purposively to take part in the quasi-experiment. The researcher chose the purposive sampling so as to accommodate both gender in both cases of students and teachers and secondly the researcher intended to have two groups with relatively same academic ability so as to measure the effect of the intervention on performance. The quasi-experiment was carried out in one school. The table summarizes the sample.

Table 3.2: Study sample

Categories	Target population	Sampling procedure	Sample size	Percentage (%)
Schools	49	Purposive	15	30.61
Students	1950	Purposive	60	3.08
Teachers	102	Purposive	15	14.71
Total	**2101**		**90**	**4.28**

Source: Researcher 2020

3.5 Data Collection Instruments

The table below shows the summary of the data collected against the objectives and the instruments in each case.

Table 3.3: Summary of data collection instruments

Objective	Information required	Data collection instrument
1. Determine the classroom assessment practices that arise while teaching mathematics.	Classroom assessment practices that arise while teaching mathematics	Mathematics teacher Questionnaire (Interview schedule)
2. Determine the effectiveness of student self-assessment strategy in improving performance in mathematics	Effectiveness of student self-assessment strategy in improving performance in mathematics.	Students Pre-/Post-assessment. (Experiment schedule)
3. Determine the perception of teachers and students towards student self-assessment strategy.	Perception of teachers and students towards student self-assessment strategy.	Teachers and Students Questionnaire (Interview schedule)
4. Determine the attitude of students towards mathematics	Attitude of students towards mathematics	Students. Questionnaire (Interview schedule)

3.6 Data Collection Procedures

Data for this study was collected depending on the objectives. The data collection process entailed many visits to the school where the experiment was conducted and visits to the schools where the sampled teachers were.

Table 3.4: Data Collection Procedures

Day/ Visit	Purpose of visit	Outcome
1	• Seek permission from the school administration to conduct the experiment • Self-introduction of the researcher to the teachers and the students and explanation of the purpose of the engagement. • Request students to participate in the study. • Agree with the students on the date of the pre-treatment test	• Permission was granted by the school administration. • The researcher introduced himself to the teachers and the students. The purpose of the engagement clarified. • Students accepted to participate in the study. • An agreement reached on the date of the pre-test.
2	• Conduct a pre-test among the form three students • Score the test items • Create the two groups: experimental and the control. • Organize the students into the groups ready for instruction	• A pre-test was carried out • The test items were scored • The experimental and control groups were formulated • The students were organized into their groups ready for instruction
3-21	• Teaching the two groups the two topics: System of Linear Equations and Linear Inequalities.	• The experimental group taught using the ordinary strategies with the integration of self-assessment strategies using the weaker model of self-marking. • The control group taught the two topics using the ordinary strategies
22	• To conduct a post-treatment test and score • Give back the scripts for both the pre and post treatments tests. • Give feedback to the students based on the experiment	• Post-treatment test administered and scored • Students received back their scripts for the two tests • Feedback on the experiment was given to the students.

23	• Conduct a survey using a questionnaire designed for the students	• A survey conducted using a questionnaire designed for the students • Data collected from the sampled students.
24-30	• Conduct survey using a questionnaire designed for teachers of mathematics from the sampled schools.	• Survey was conducted. Data was collected from the teachers of mathematics from the sampled schools.

3.7 Data Analysis Procedure

Table 3.5: Data Analysis Procedure

Objective	Data collection instrument	Data Analysis Procedure
Determine the classroom assessment practices that arise while teaching mathematics.	Mathematics teacher Questionnaire (Interview schedule)	Descriptive statistics were employed to analyze the responses. Measures of central tendencies were used to analyze the data.
Determine the effectiveness of student self-assessment strategy in improving performance in mathematics	Students Pre-/Post-assessment. (Experiment schedule)	The mean improvement indices for the two groups were computed. A two-sample t-test was employed to compare the two means.
Determine the perception of teachers and students towards student self-assessment strategy.	Teachers and Students Questionnaire (Interview schedule)	Descriptive statistics was employed to analyze the responses. Measures of central tendency were used in data analysis.
Determine the attitude of students towards mathematics	Students. Questionnaire (Interview schedule)	Descriptive statistics was used to analyze the responses. Measures of central tendency were used in data analysis.

3.8. Data Collection Process VIA the Self-assessment Process

A pre & post-test was used in the design. The pre-assessment was based on the two units: System of linear equations (Form one Unit 17 from K.I.C.D) and Linear inequalities (Form two Unit 16 from K.I.C.D). The first topic to be handled was the System of Linear Equations followed by

Linear Inequalities. For the control set both the class work and homework assignments were given and checked for completion by the teacher. The teacher checked the class assignments for correctness. The teacher answered any question from the students originating from the formative assignments. The learners did to score their work or rectified their errors.

The experimental group was guided through the self-assessment strategy by the use of rubrics using the guide by Taras M. (2010). The weaker model of self- marking was used. The rubrics to be used were created to reflect those used to score students' work by the Kenya National Examination Council (K.N.E.C). For short assignments the teacher wrote the solutions on the board for students. The students in this group had to complete all the assignments as their counterparts in the control group. Additionally, the students in this set were provided with self-scoring sheets at the start of each topic of study having all the activities and the assignments they will be doing. From all these topics the following skills were expected to be acquired by the students: solving linear equations by graphical method, solving linear equations by elimination and substitution, graphing linear inequalities and solving linear inequalities.

On the day for each assignment, the problems were solved and the rubrics projected on the board. Students scored their work guided by the projected rubrics. The students recorded their scores on the self-scoring sheets. Emphasis was made by the teacher on the need for the learners to revise the areas where they performed dismally. The students were also informed by the teacher that the assignments would be verified for completion and the scores of students would not affect their grades but used to guide and enhance self-monitoring.

A post-assessment was administered about one week after the treatments to the two sets. The pre-assessment was used as the post-assessment. The researcher scored the items from all the students in the two sets and recorded their marks. The mean improvement indices were computed from both sets for analysis.

3.9 Validity and Reliability

The researcher adopted already published instruments which are suitable to address the research questions effectively. These instruments had been designed and applied in unpublished thesis but consent sought and permission granted for adoption. Thus, the instruments had undergone through instrument development psychometric processes ensuring their validity and reliability.

3.10 Ethical Consideration of the Study

This study recognized research principles and ethics to ensure effective collection of data from participants. Permission was sought by the researcher from the National Council for Science, Technology and Innovation, The Ministry of Education and the Principals of all the sampled schools in the study.

3.10.1 Privacy and confidentiality

The researcher assured the respondents that none of any personal data collected would be shared with any third party. In addition, the researcher assured the respondents and ensure that none of their recognition information would be disclosed. Any other data collected from the respondents that is private would be kept private.

3.10.2 Storage of research data

The researcher sought for efficient and effective storage facilities to ensure safe custody of the data. These included acquisition of CDs, DVDs and USB disks for storing e-data and proper filling for the hard copies.

3.10.3 Consent of respondents

The researcher explained to the respondents the purpose, nature of the study and the data required of them and the procedure for collecting data. The researcher sought for consent from the respondents before collecting any data.

CHAPTER FOUR

RESULTS OF THE STUDY

4.0 Introduction

This chapter presented the study findings which were arranged guided by the objectives. The following were the objectives:

i. To determine the classroom assessment practices that arise while teaching mathematics.

ii. To determine the effectiveness of student self-assessment strategy in improving performance in mathematics.

iii. To determine the perception of teachers and students towards student self-assessment.

iv. To determine the attitude of students towards mathematics.

4.1 Background Information

4.1.1 Students background information

Table 4.1: Students background information

VARIABLE	CHARACTER	COUNT (N)
Gender	Male	38
	Female	22
Age	17-20 years	46
	20-24 years	14
Class	Form three	60
Marital status	Married	0
	Not married	60

From table 4.1 above, male students were 38 (63.3%) while the girls were 22 (36.67%). 46 of the students (76.6%) were aged between 17-20 years while 14 of them (23.33%) were between 20-24 years of age. All of them were in form three and all were not married.

4.1.2 Response rate: Teachers background information

Table 4.2: Teacher's background information

VARIABLE	CHARACTER	COUNT (NUMBER)
Gender	Male	8
	Female	4
Age	25-29 years	4
	30-39 years	6
	40- 49 years	1
	Above 50 years	1
Academic qualification	B.Ed.	9
	M.Ed.	3
Teaching experience	2 Years	1
	3 Years	3
	5Years	2
	6 Years	4
	More than 6 Years	2
Subjects taught	Mathematics	12
Lessons per week	Below 12	1
	12-19	3
	20-29	7
	30 or more	1

Table 4.2 indicates that majority of the teachers by gender were male (8) compared to the females (4). The table also indicates that nearly a third of the teachers were aged between 25 and 29 years; half of them between 30 and 39 years of age and the remaining falling between 40 - 49 years and above 50 years old or more. No teacher whose age is below 25 years participated in the study. The findings showed that the majority of teachers who teach form three mathematics hold Bachelor of Education degree (75%) while a quarter are the master's degree holders. Majority of the teachers had 5 years of teaching experience or more. Most of the teachers had more than 12 lessons per week.

4.2 The Results of the Study

4.2.1 Objective 1: Classroom assessment practices that arise while teaching mathematics.

A survey was conducted where teachers filled questionnaires on the classroom practices they employ while teaching mathematics. The table 4.3 below shows the study findings on the classroom assessment practices that arise while teaching mathematics.

Table 4.3: Classroom assessment practices that arise while teaching mathematics

Assessment practice	Never (%)	Seldom (%)	Sometimes (%)	Often (%)	Always (%)
Discourse	0.0	0.0	25.0	50.0	25.0
Observation	0.0	25.0	25.0	33.3	16.7
Own production	0.0	0.0	41.7	25.0	33.3
Projects	41.7	33.3	8.3	8.3	8.3
Peer assessment	0.0	33.3	50.0	16.7	0.0
Portfolio	16.7	50.0	25.0	0.0	8.3
Student self-assessment	8.3	25.0	41.7	16.7	8.3

Table 4.3 indicates that alternative forms of assessment were sometimes used: self-assessment (41.7%) and peer-assessment (50%). Only 16.7% of the sampled teachers often used student self-assessment while 8.3% always used the strategy within the classroom. Other alternative forms like portfolio assessment were not often used (0%). Generally, the alternative assessment types were not always used by majority of the teachers in their classrooms. Most often used assessment types include discourse (50%), observation (33.3%) and own production which 41.7% of the teachers sometimes employ in their classes.

4.2.2 Objective 2: Effectiveness of student self-assessment in improving achievement in mathematics

A quasi-experiment was conducted to determine the effectiveness of student self-assessment strategy in improving performance in mathematics. The mean improvement indices of their scores, sample sizes and standard deviation for students in both the control and the experimental groups for the two study units were computed. The table 4.4 below illustrates the findings.

Table 4.4: Improvement indices for the two groups

	STUDENTS GROUP	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
IMPROVEMENT INDEX	EXPERIMENTAL	30	9.4457	15.27819	2.78940
	CONTROL	30	5.5557	8.84462	1.61480

From table 4.4 above, the experimental group mean and standard deviation were higher than those of the control group. Improvement indices per gender was also computed to compare the two sets. The result of this is tabulated in the table 4.5 below. From the table, girls (9.53%) in the experimental group showed a greater improvement more than the boys (6.77%). From the control group the boys (8.33%) improved more than the girls (2.08%). This implies that the intervention was more effective to the girls than the boys. Generally, the improvement index of the experimental group was slightly more than that of the control group. The table below highlights the improvement indices of the students in terms of gender.

Table 4.5: Improvement index per gender

Group	**Gender**	**Pre-test mean (%)**	**Post-test mean (%)**	**Mean improvement index (%)**
Experimental	M	41.67	48.44	6.77
	F	29.17	38.69	9.53
Control	M	35.12	43.45	8.33
	F	35.42	37.50	2.08

However, to determine whether the difference in the mean improvement scores was statistically significant, an independent t-test was employed (Peck et al., 2009, p.609) to compare the mean improvement scores of the students from the two groups in the test. From the t-test, the data in the table 4.6 below was obtained.

Table 4.6: An independent t-test analysis of means of students' improvement scores for Experimental and Control groups.

	T	Df	Sig. (2 tailed)	Mean difference	Std. Error difference	95% confidence interval of the difference	
						Lower	Upper
Improvement index	1.207	58	0.232	3.89000	3.22310	-2.56173	10.34173
	1.207	46.475	0.234	3.89000	3.22310	-2.59597	10.37597

This generated a p-value of 0.232. Since the p-value is greater than the alpha i.e. (0.232> 0.05), the null hypothesis is accepted. This implies that there is no significant statistical difference between the mean improvement indices of the control and the experimental groups. The difference in the mean of the groups could be due to chance.

4.2.3 Objective 3: Perception of teachers and students towards self-assessment

4.2.3.1: Perceptions of teachers towards student self-assessment.

Reasons for using or not using self-assessment.

Studies show that teachers use self-assessment because it changes the efforts of the teachers from scoring to moderating and organizing assessment activities (Boud and Falchikov, 1989). Studies also reveal that teachers do not use self-assessment because learners do not possess evaluative knowledge hence may affect the accuracy of the assessment (Brown and Harris, 2013)

The analysis below was based on the number of classes used for the research.

Table 4.7: Reasons for using or not using student self-assessment

Consolidated Response : Reasons for using or not using self-assessment	**Frequency**	**Percentage (%)**
Leads to *retention* of learnt concepts	1	7.14
Dishonesty in awarding themselves marks	1	7.14
Engages the learner more in learning	1	7.14
Learners learns at their own pace	1	7.14
Time constraint in application of self-assessment	1	7.14
Students are impatient and need close supervision	2	14.28
It's time consuming	3	21.43
Creates *ownership* to their learning	1	7.14
Helps build *confidence* to their learning in mathematics	2	14.28
Motivates learning	1	7.14
Total	**14**	**100%**

Teachers' views seem to cut across various aspects of student self-assessment. For example, retention, engagement by students, pace, time element in terms of time consuming as well as building confidence and ownership. More teachers tend to state that time consuming element is a confounding factor. Other factors that came out strongly are issue of confidence in self-assessment and the aspect of learner impatient in applying self-assessment.

Effect of content area of teaching on the assessment decision

Studies reveal that the content area being taught affect the choice of an assessment method. For example, according to Airasian (1994), items of the test should reflect the instruction and objectives of the course to guarantee content validity and this influences the choice of an

assessment method to be used. The table 4.8 below shows the findings from the teachers on the ways the assessment decision is affected by the content of instruction.

Table 4.8: Effect on assessment decision by content area of teaching

Consolidated Response : Effect on assessment	**Frequency**	**Percentage (%)**
Provide *opportunities* for self-assessment process	1	12.50
Not able to deliver the *content* adequately	2	25.00
Content taught influences *attitude* towards self-assessment	1	12.50
No effect on assessment decision	1	12.50
Content affect self-assessment	1	12.50
It helps have all learners on board	1	12.50
Self-assessment application depends on the content to teach	1	12.50
Total	**8**	**100%**

Teachers seem to hold varied views concerning the effect of the content of teaching on the assessment decision. For example, majority of them are of the view that self-assessment may not enable them deliver the content adequately. Others hold that the content provides opportunity for implementing self-assessment process, the content influences the attitude towards self-assessment, the content taught has no effect on the assessment decision while some also hold the view that content affect self-assessment process.

Influence of school, district or state administration on the assessment decisions

Different administrations have got a role in decision making on the assessment process. This begins from the teacher, school, district and even state levels. McMillan (2003) is of the view

that accountability factors from the state, district and the school level influences the assessment decisions made by teachers. The table below illustrates the study findings on the influence of school, district or state administration on the assessment decisions.

Table 4.9: Influence of school, district or state administration on the assessment decisions

Consolidated Response : Influence of administration	**Frequency**	**Percentage (%)**
Self-assessment works when resources are availed	6	46.15
Decision made at times conflict with the administration	2	15.38
Training leads to success of self-assessment	2	15.38
Policy does affect the quality of assessment decision	3	23.08
Total	**13**	100%

Majority of the teachers hold the view that the administration influences the assessment decisions made at class level. For example 46.15% of the teachers believe that assessment works best when resources are availed, 23.08% of the views is that policy from the administration does affect the quality of assessment decisions. The other views are that training leads to success of self-assessment and assessment decisions made at times conflict with the administration.

Effect of learner's development stage on assessment

Learner's developmental stage could play a role in the assessment processes in the classrooms. From the literature, McMillan (2003) believes that the assessment decisions teachers make in the classroom is greatly affected by classroom realities for example heterogeneity which include the learner's stage of development, attendance among others. The table 4.10 below highlights the findings of this study on the effect of developmental age on assessment decisions.

Table 4.10: Effect of learner's development stage on assessment

Consolidated Response : Effect of developmental stage	Frequency	Percentage (%)
Younger secondary school students tend to follow instructions and so carry out self-assessment effectively	3	25.00
Older secondary school students tend to defy instructions from the teachers hence may not implement self-assessment effectively	2	16.67
Student's developmental age does not affect the assessment decision	2	16.67
Younger secondary school students tend not to follow instructions hence may not effectively carry out self-assessment	2	16.67
Student's stage of development dictate the method and level of assessment	2	16.67
Older secondary school students are responsible and so effective in carrying out self-assessment.	1	8.33
Total	**12**	**100%**

Teachers hold conflicting views on the effect of student's development stage on assessment decisions. Majority of the views is that younger students tend to follow instructions from their teachers hence can effectively implement self-assessment. 16.67% of the views are that older students at times tend to defy instructions from their teachers and so may affect the assessment process, student's development stage does not affect the assessment process, younger students tend not to follow instructions effectively from their teachers and older students are responsible and so effective in carrying out self-assessment.

Society and assessment decision

Parents and the community hold a role in the assessment decisions made. According to McMillan (2003), the decisions teachers make in the classroom is affected by the expectations of the parents and the community surrounding the school. The table below summarizes the findings of this study on the effect of the society on the assessment decisions.

Table 4.11: Society and assessment decision

Consolidated Response : Influence of society	**Frequency**	**Percentage (%)**
The society expects frequent assessments	2	18.18
The society provides resources for learning and assessment	2	18.18
The society does not affect	5	45.45
Provide opportunities for self-assessment	1	09.09
Motivates the learning process	1	09.09
Total	**11**	**100%**

Teachers hold divergent views on the role of the society on the assessment decisions. For example, majority hold that the society does not affect the assessment decisions made, 18.18% of the views is that the society expects frequent assessments, the society provide resources for learning and assessment while 9.09% of the views is that the society motivates the learning process.

Teacher beliefs on self-assessment

Experience with self-assessment

Research evidence suggests that student self-assessment does contribute positively to learning outcomes, but its effects are highly variable, with many threats to its validity (Brown & Harris, 2013). The table below highlights the experiences of teachers on the use of student self-assessment.

Table 4.12: Experiences on the use of student self-assessment

Consolidated Response : Experience	**Frequency**	**Percentage (%)**
Hectic	1	8.33
Enhances more learning	3	25.00
Disadvantages slow learners	2	16.67
Challenging to students	1	8.33
Slows down content coverage	1	8.33
Time consuming	1	8.33
A good practice	1	8.33
It's student centered	2	16.67
Total	**12**	**100%**

Most views of the teachers (25%) are that it enhances more learning. 16.67% of the views are that student self-assessment is student centered while another 16.67% of the teachers hold the view that it disadvantages slow learners. Minority of the views is that the strategy is challenging to students, hectic, slows down content coverage, time consuming while others also believe it is student centered.

Expectation if student self-assessment is used in classrooms

According to the literature, student self-assessment would reduce the achievement gap by impacting positively on the low achievers (Black & William, 1998). Cooper (2006), on the other

hand believes self-assessment would make students to possess more skills that can enable them to adjust in their learning to better the value of their output. Below are the findings on what teachers expect if the strategy is implemented in classrooms.

Table 4.13: Expectations if self-assessment is used in classrooms

Consolidated Response : Expectation	**Frequency**	**Percentage (%)**
Impart into learners self-regulated learning skills	1	8.33
Faster attainment of objectives	1	8.33
Enhances more learning	3	25.00
More time wastage	2	16.67
Increased learner motivation	3	25.00
Weaker students disadvantaged	2	16.67
Total	**12**	

From the table above, teachers hold mixed views with a majority expecting more learning (25%) and increased learner motivation (25%). Other views are that weaker students would be disadvantaged (16.67%) and more time would be wasted (16.67%). The other views are that learners would acquire self-regulated learning skills (8.33%) and the learning objectives would be attained faster (8.33%).

Advantages of student self-assessment

From the literature, student's self-assessment enables learners to think critically about own learning (Brown and Harris, 2013).According to Sadler (1989), student self-assessment enables the learner be independent and be able to monitor own progress. According to Beaman (1998), it creates autonomy and independence and increases responsibility (Dochy et al, 1999). The following were the responses from the teachers.

Table 4.14: Advantages of student self-assessment

Advantages	**Frequency**	**Percentage (%)**
Improves learner's *self-esteem*	1	7.69
Directs learning	2	15.38
Speeds up content coverage	3	23.08
Improves performance	5	38.46
Increases *motivation*	1	7.69
Increases *students' confidence*	1	7.69
Total	**13**	**100%**

Majority of the teachers hold the view that self-assessment improves academic performance (38.46%). Other views include, speeds up content coverage (23.08%), directs learning (15.38%), improves learners' self-esteem (7.69%), increases motivation (7.69%) and increases student's confidence (7.69%).

Disadvantages of self-assessment practices

The literature shows that the validity of student self-assessment may be at stake as the student's rating may differ compared to the teachers' ratings (Brown and Harris, 2013). Bullock (2011) argues that this kind of assessment consumes more time compared to other assessments. The table below summarizes the finding from this study.

Table 4.15: Disadvantages of student self-assessment

Consolidated Response : Disadvantages	Frequency	Percentage (%)
Consumes more time	3	27.27
Disadvantages low achievers	2	18.18
Not measurable	3	27.27
Victimization among students	1	9.09
Demanding	1	9.09
Requires a lot of resources	1	9.09
Total	**11**	**100%**

Majority of the teachers (27.27%) are of the view that it consumes more time and the assessment is not measurable (27.27%). Others believe that it disadvantages low achievers (18.18%), there is victimization among learners (9.09%), it is demanding (9.09%) and requires a lot of resources (9.09%).

View on whether students should take part in assessment or not

A study carried out by Butler & Winne (1995) and Crooks (1988) depicts that feedback enhances achievement and learning when provided effectively. The lack of feedback in the classrooms is caused by the fact that many of the teachers lack adequate time to address each student's work. Andrade, Du, & Wang (2008) argues that learners should take part in assessment as they can be effective source of feedback especially where the information in the feedback is on the processes and the learning goals. Below are the findings from the teachers on whether students should take part in assessment process or not.

Table 4.16: View on whether students should take part in assessment or not

Consolidated Response : View	Frequency	Percentage (%)
Enables *self-responsibility*	2	16.67
Students learn more	7	58.33
Improves *self-confidence*	1	8.33
Enhances *self-regulated learning*	2	16.67
Total	**12**	**100%**

All the teachers hold the view that students should take part in the assessment process with the majority (58.33%) reasoning that in so doing students would learn more. 16.67% of the views is that this will enable learner responsibility, another 16.67% believe that this may enhance self-regulated learning among students while a minority of 8.33% believe that it would improve self-confidence.

Role of students in their learning process

According to the literature, constructivists believe that active student's participation in the learning process is important as it enables students to learn strategies of self-regulated learning (Ng, 2005). Table 4.17 below highlights the study findings on what the teachers perceive as the role of students in the learning process.

Table 4.17: Role of students in their learning process

Consolidated Response : Role of the student	Frequency	Percentage (%)
Asking and answering of questions	5	41.67
Carrying out tasks	6	50.00
Passive learners	1	8.33
Total	**12**	**100%**

46.1% of the teachers believe that students should be engaged in this assessment as it enhances more learning while 23.1% hold an opinion that it enhances self-responsibility. Others believe at 7.7% that it is a crucial aspect of learning, it enhances retention (7.7%) and it also enables students to understand their abilities (7.7%).

Teacher's role in the learning process

The literature holds different perspectives of the role of the teacher in the learning. With the shift towards constructivists approach in learning, Normala Othman and Maimunah Abdul Kadir (2004), the role of the teacher shifts from passing information to a facilitator of learning, a coach and a co-learner. The table 4.18 below illustrates the study findings on the role of teachers in the learning process.

Table 4.18: Role of the teacher in the learning process.

Consolidated Response : Role of the teacher	Frequency	Percentage (%)
Learning facilitator	9	60.00
Guide	6	40.00
Total	**15**	**100%**

Majority of the teachers (60%) hold the view that teachers should be facilitators of learning while a minority of 40% believe that teachers should act like guides in the learning process.

4.2.3.2 Perceptions of students towards student self-assessment.

The literature holds that students are concerned about honesty in undertaking self-assessment in the classrooms. For example, Gamlem and Smith (2013) did a study on students' perceptions of feedback given in classroom. In their study they found out that learners were of the concern about the anticipated issues of honesty. Hattie & Timperley (2007) believe that the climate of the classrooms is important in providing honest feedback. Table 4.20 below highlights the perceptions of students towards self-assessment.

Table 4.19: Perceptions towards self-assessment

Self-assessment makes you:

Aspect	Male	(%)	Female	(%)	Total	(%)
Dependent	0	0.0	2	40.0	2	18.18
Independent	4	66.67	2	40.0	6	54.55
Neither	2	33.33	1	20.0	3	27.27
Do not think more	1	16.67	0	0.00	1	9.09
Think more	4	66.67	5	100.00	9	81.82
Neither	1	16.67	0	0.00	1	9.09
Did not learn anything	1	16.67	1	20.00	2	18.18
Learn more	4	66.67	4	80.00	8	72.73
Neither	1	16.67	0	0.00	1	9.09
Lack of confidence	1	16.67	1	20.00	2	18.18
Gain confidence	4	66.67	4	80.00	8	72.73
Neither	1	16.67	0	0.00	1	9.09
Uncritical	1	16.67	1	20.00	2	18.18
Critical	4	66.67	4	80.00	8	72.73
Neither	1	16.67	0	0.00	1	9.09
Work in an unstructured way	0	0.00	0	0.00	0	0.00
Work in a structured way	5	83.33	4	80.00	9	81.82
Neither	1	16.67	1	20.00	2	18.18
Not analytical	1	16.67	0	0.00	1	9.09
Analytical	4	66.67	5	100.00	9	81.82
Neither	1	16.67	0	0.00	1	9.09

A greater percentage (66.67%) of the male students and 40.00% of the female students are of the opinion that this strategy makes them independent. 40.00% of the girls believe that self-assessment makes them dependent. Cumulatively, 57.55% of the students believe that this strategy makes them independent, 18.18% `of them believe that it makes them dependent while 27.27% of the

students do not have a stand. More girls (81.82%) than boys (66.67%) are of the opinion that self-assessment makes them think more while more boys (16.67%) than girls (9.09%) are of the opinion that the strategy do not make them think more. In overall, most students (81.82%) believe that the strategy makes them think more while 9.09% are of the contrary opinion.

More girls (80.00%) than boys (66.67%) learnt more from this strategy while in overall, 72.73% of the students learnt more over 18.18% who did not learn more from it. 80.00% of the girls gained confidence from the strategy as compared to 66.67 % of the boys who gained confidence.20.00% of the girls did not gain confidence as compared to 16.67% of the boys who share the same opinion. More students believe that self-assessment makes them gain confidence (72.73%) as compared to 18.18 % who are of the contrary opinion. More girls (80.00%) believe that the strategy makes them critical as compared to the boys (66.67%). 72.73% of the students believe that the strategy makes them critical while 18.18% hold a contrary opinion. Comparatively both genders hold an opinion that the strategy makes them work in a structured way, boys (83.33%) and girls (80.00%). Most students (81.82%) hold that the strategy makes them work in a structured way against 18.18% who hold no stand. Self-assessment makes all the girls analytical as compared to 66.67% of the boys. 81.82% of the students believe the strategy makes them analytical.

Opinion on self-assessment

Studies reveal different perspectives about student self-assessment. For example according to Cooper (2006), self-assessment makes students to possess more skills that can enable them to adjust in their learning to better the value of their output and increases responsibility (Dochy et al,

1999). Some studies also reveal that it can be time consuming compared to other assessments (Bullock, 2011). Below are the opinions of students concerning self-assessment.

Table 4.20: Opinion on self-assessment

The self-assessment is:

Aspect	**Male**	**(%)**	**Female**	**(%)**	**Total**	**(%)**
Time consuming	2	33.33	1	20.0	3	27.27
Time saving	3	50.00	4	80.0	7	63.64
Neither	1	16.67	0	0.00	1	9.09
Not enjoyable	1	16.67	1	20.00	2	18.18
Enjoyable	4	66.67	4	80.0	8	72.73
Neither	1	16.67	0	0.00	1	9.09
Hard	2	33.33	2	40.00	4	36.36
Easy	3	50.00	3	60.00	6	54.55
Neither	1	16.67	0	0.00	1	9.09
Not challenging	2	33.33	2	40.00	4	36.36
Challenging	3	50.00	3	60.00	6	54.55
Neither	1	16.67	0	0.00	1	9.09
Not helpful	1	16.67	0	0.00	1	9.09
Helpful	4	66.67	5	100.00	9	81.82
Neither	1	16.67	0	0.00	1	9.09
Not beneficial	1	16.67	0	0.00	1	9.09
Beneficial	3	50.00	5	100.00	8	72.73
Neither	2	33.33	0	0.00	2	18.18

Majority of the girls (80.00%) and boys (50.00%) believe that self-assessment is time saving and in overall 63.64% of the students are of the opinion that the strategy is time saving. 20.00% of the girls and 50.00% of the boys hold a contrary opinion that the strategy is not time saving. 80.00% of the girls and 66.67% of the boys believe that the strategy is enjoyable against 16.67% of the boys and 20.00% of the girls who hold a contrary opinion. 72.73% of the students in overall believe that the strategy is enjoyable against 18.18% who hold a contrary belief. Majority of the boys (50.00%) and girls (60.00%) are of the opinion that the process is easy against 40.00% of the girls and 33.33% of the boys having a contrary opinion while majority of the students (54.55%) believe the strategy is easy to learn. 33.33% of the boys and 40.00% of the girls hold the opinion that the process is not challenging. On the other hand, 50.00% of the boys and 60.00% of the girls believe that the process is challenging. In overall, 54.55% of the students hold that the self-assessment strategy is challenging against 36.36% holding a contrary opinion. All the girls and 66.67% of the boys believe that the strategy is helpful against 16.67% of the boys. 81.82% of the students hold that the process is helpful.

4.2.4 Objective 4: Attitude of students towards mathematics.

Issues related to attitudes influencing learning of mathematics

From the literature, some of the challenges students face in their learning of mathematics are attributed to student's attitude. For example, SMASSE Project Report (1998) argues that the causes of dismal achievement in mathematics which originates from substandard learning of the subject could be as a result of the formed attitudes towards the subject by the students; inappropriate instructional strategies and inadequate resources of learning. The students identified the challenges they encountered which influence learning of mathematics. Below are the views:

Table 4.21: Problems associated with attitudes affecting learning of mathematics

Problem	Males (%)	Females (%)	Total (%)
Lack of interest	55.00	36.00	45.00
Inadequate text books	9.00	0.00	5.00
Difficult language of instruction	9.00	18.00	14.00
Lack of confidence	27.00	46.00	36.00

More males (55%) than females (36%) giving a total of 45% who lack interest in mathematics. 36% of the students held that lack of confidence is a challenge 55% of whom are boys and 36% girls. Difficult language of instruction was also cited as a challenge by 14% of the students while inadequate text books being a problem at 5%. The students were thereafter required to mention any other problem besides the above. Below are the findings.

Table 4.22: Any other problem

Problem	Males (%)	Female (%)	Total (%)
Inadequate revision	45.00	45.50	45.00
Negative attitude towards mathematics	33.00	45.50	40.00
Lack of peer support	22.00	9.00	15.00

A major problem was inadequate revision among the students at 45% with both boys and girls commonly experiencing it equally. This is followed by negative attitude towards mathematics; boys (33%), girls (45.5%) and in overall (40%). Lack of peer support was the third problem taking 15% of the responses. Students were asked to cite some possible solutions to the problems they experience. The table below summarizes the solutions.

Table 4.23: Possible solutions to the problems

Possible solution	Percentage (%)
Consistent practice	36.00
Having positive attitude towards mathematics	52.00
Peer support (discussion groups)	4.00
Frequent consultations	4.00
Simple language of instruction	4.00

A greater percentage (52%) believe that having positive attitude towards mathematics is a major approach to solve the problem they experience. Another 36% of the students advocate for consistent practice to solve the problems associated with mathematics. Peer support (4%), frequent consultations (4%) and use of simple language of instruction (4%) are some of the possible solutions that the students cited.

Students' feelings with regard to studying and achievement in mathematics

Below are the feelings students hold as regards studying and achievement in mathematics.

Table 4.24: Male students' feelings as regards studying and achievement in mathematics

MALE	**Percentages (%)**				
Students' Feelings	**SA**	**A**	**U**	**D**	**SD**
I enjoy learning mathematics	36	55	0	9	0
Mathematics classes/lessons are not interesting	9	9	9	37	36
I would like to continue doing mathematics after completing secondary school education	27	46	18	9	0
To understand mathematics is difficult	27	0	18	37	18
Mathematics is very useful in life	82	18	0	0	0
I think it is the teacher who can make mathematics learning easier	37	27	9	27	0
Among the subjects taught, mathematics is my favorite	9	46	0	36	9
I am given a lot of unnecessary mathematics assignments	0	9	9	36	46

I am well provided with mathematics textbooks and other learning resources	46	27	0	27	0
I feel extremely anxious and fearful, when mathematics examinations are mentioned or brought	0	18	9	37	36
Mathematics should not be a compulsory subject	9	9	0	18	64
I do a lot of mathematics exercises on my own or with a friend	18	55	9	9	9
Mathematics is impossible to learn	0	9	0	18	73
Learning mathematics is just remembering what the teacher says and does while in class	37	27	9	9	18
The best way to learn mathematics is to discover a concept by oneself	37	36	27	0	0
My grades (marks) are always low in mathematics	37	18	9	36	0
I do mathematics for the sake of it	0	18	0	36	46
I like my mathematics teacher	36	55	0	9	0
My friends don't like learning mathematics	27	46	0	27	0
My parents and siblings encourage me to learn Mathematics and to perform well in the subject	73	9	0	18	0
Being a girl or a boy interferes with my learning and my performance of mathematics	0	0	0	36	64
I learn mathematics well regardless of the gender of my teacher	55	27	0	9	9

Table 4.25: Female students' feelings as regards studying and achievement in mathematics

Female	**Percentages (%)**				
Students' Feelings	**SA**	**A**	**U**	**D**	**SD**
I enjoy learning mathematics	27	55	0	18	0
Mathematics classes/lessons are not interesting	0	0	18	46	36
I would like to continue doing mathematics after completing secondary school education	9	64	27	0	0
To understand mathematics is difficult	0	0	9	46	45
Mathematics is very useful in life	100	0	0	0	0
I think it is the teacher who can make mathematics learning easier	55	18	0	9	18
Among the subjects taught, mathematics is my favorite	9	36	28	9	18
I am given a lot of unnecessary mathematics assignments	0	0	0	18	72
I am well provided with mathematics textbooks and other learning resources	64	36	0	0	0
I feel extremely anxious and fearful, when mathematics examinations are mentioned or brought	0	46	0	18	36
Mathematics should not be a compulsory subject	0	0	27	27	46
I do a lot of mathematics exercises on my own or with a friend	27	37	0	27	9
Mathematics is impossible to learn	9	0	0	36	55
Learning mathematics is just remembering what the teacher says and does while in class	46	45	9	0	0
The best way to learn mathematics is to discover a concept by oneself	37	18	18	27	0
My grades (marks) are always low in mathematics	46	27	0	27	0
I do mathematics for the sake of it	0	9	0	46	45
I like my mathematics teacher	46	54	0	0	0
My friends don't like learning mathematics	9	18	0	37	36
My parents and siblings encourage me to learn Mathematics and to perform well in the subject	73	27	0	0	0
Being a girl or a boy interferes with my learning and my performance of mathematics	0	0	18	9	73
I learn mathematics well regardless of the gender of my teacher	55	27	0	18	0

From the findings, 36% of the boys and 27% of the girls strongly agree to enjoy learning of mathematics. On the other hand, 36% of both boys and girls strongly agree that mathematics lessons are not interesting. 64% of the girls and 46% of the boys agree that they would like to continue learning mathematics after completing secondary school. 82% of the boys and all the girls hold that mathematics is useful in life. Teachers of mathematics do make learning of mathematics easier as 37% of the boys and 55% of the girls strongly agree. 46% of the boys and 36% of the girls agree that mathematics is their favorite subject. 46% of the boys and 64% of the girls strongly agree that they are given learning materials and textbooks in the process of learning. Mathematics as a subject should remain a compulsory subject. 64% of the boys strongly disagree that mathematics should not be made a compulsory subject. A good number of the students agree that they do a lot of mathematics assignments on their own or with a friend. 55% of the boys and 37% of the girls hold a similar opinion. 73% of the boys and 55% of the girls strongly disagree that mathematics is impossible to learn. 37% of the boys and 37% of the girls believe that the best approach to learning is to discover a concept by self.

The performance in mathematics has been low as 37% of the boys and 46% of the girls strongly agree to this. An average percentage of 46% of the boys and 45% of the girls says that they do mathematics just for the sake of it. Parents also have a role in molding learners. 73% of both genders agree that parents and siblings encourage them to learn. The gender issues have very minimal effect on learning mathematics as 64% boys strongly disagree that being a boy or girl affect their learning of mathematics. 55% of the boys and girls strongly agree that they learn mathematics irrespective of their genders.

Aspects that can better learning of mathematics:

Table 4.26: Female students' opinions

Aspects	Frequency (%)
Regular practice	73.00
Approach of the teacher	9.00
Learner involvement	9.00
Consultations	9.00

Table 4.27: Male students' opinions

Aspects	Frequency (%)
Regular practice	73.00
Availing resources e.g. text books	9.00
Having positive attitude	18.00

Table 4.28: Overall students' opinion

Aspects	Frequency (%)
Regular practice	73.00
Availing resources e.g. text books	5.00
Having positive attitude	9.00
Approach of the teacher	5.00
Learner involvement	4.00
Consultations	4.00

From the tables 4.26 and 4.27 both girls (73%) and boys (73%) are of the opinion that regular practice is a feasible solution to the problems they experience in learning mathematics. The boys at 18% adds that they need to have positive attitude towards learning mathematics. Other solutions include availing of text books (5%), learners' active involvement (4%) and consultations (4%).

The students were asked to give comments on learning mathematics. Below are some of the comments:

- Group discussion is necessary for students
- Mathematics is crucial in life
- Teachers of mathematics should devise a better approach to mathematics lessons
- Learning mathematics depends on one's mentality. One can pass if he/she changes the attitude.
- Regular practice is key to success
- One can learn and pass mathematics even without the teacher
- We should develop positive attitudes towards mathematics.

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussions

This chapter provides the discussions of the study findings, the conclusions arrived at based on the results and recommendations for possible action by the relevant authorities and for further research.

5.1.1 Classroom assessment practices that arise while teaching mathematics.

From the results, this study found out that different classroom assessment practices were in use by secondary school teachers of mathematics in Rachuonyo-East Sub-County. The major assessment practices in use were discourse, own production and observation. According to Stiggins and Chappius (2002), discourse may be categorized under personal communication and can manifest in form of conversation and dialogue. Discourse entails the use of questions by the teacher during instruction, pays attention as learners participate in the class and finally administer oral questions. The teacher discusses, illustrates and explain concepts and ideas of mathematics.

Own productions enable the learners to provide own approaches of handling problems of mathematics. According to Oosterhof (2003), observation is a type of performance assessment where a person is required to observe a given behavior and make judgment on the best response. Alternative assessment practices from the findings are least used. Most teachers sometimes employ these assessments in the classrooms. Forms of alternative assessments include portfolio assessment, peer-assessment and self-assessment. Self-assessment as a concern for this study is also sometimes (rarely) used.

5.1.2 Effectiveness of self-assessment in improving achievement in mathematics

From the findings above, the performance of the students in the post-test was slightly greater than that in pre-test. Similarly, the mean improvement index for the experimental group was slightly greater than that of the control group. To test whether the difference in the improvement means of the experimental and the control groups was statistically significant, an independent t-test was employed which yielded a p-value of 0.232 which was greater than the alpha 0.05. This implied absence of a significant statistical difference between the two means which is in agreement with the findings of Hotard (2010).

Despite the fact that the literature commends self-assessment strategy as effective in enhancing learning, the findings from this study proved differently. This could have been attributed to several challenges experienced during the study. There was relatively average attendance coupled with absenteeism. This often slowed down the process of self-assessment through the use of rubrics. Secondly, prior to the study, the students had learnt the topics using strategies different from self-assessment. This implies that the introduction of self-assessment strategy could have led to some discomfort among students. May be the short time of the experiment (4 weeks) was not enough for the full effect of self-assessment on learning to be manifest. According to Black, et al. (2004), this would agree to the information given in the literature.

5.1.3 Perception of teachers and students towards student self-assessment

From the study findings, behavioral feelings formed the major reasons for integrating student self-assessment. On the other hand, control feelings were the major reasons for not implementing student self-assessment. This assertion is in line with the results in the literature according to

Panadero et al. (2014) that the use of self-assessment strategy was predicted by the expected positive results whereas the much more time the strategy takes negatively impacted on its use. Most teachers expect to realize some positive effect from their work in class and this could be the reason why most teachers provided positive results for the use of self-assessment (behavioral factors).

Teachers who do not use the strategy gave reason which are the control factors like time taken and the ability of the students. These teachers' reasons depict the thinking that the learning outcomes from the use of student self-assessment does not outweigh the challenges it comes with. Panadero et al. (2014) argue that concentrating on the benefits of self-assessment tool when availing solutions as compared to perceived constraints may help solve the control factors. It is also evident from the findings that teachers hold mixed feelings about student self-assessment merits and demerits. According to Gregoire (2003), it could be difficult for teachers to change, if teachers are not used to the new strategy as they might perceive it as a threat to their current assessment practices unless there is right amount of support and motivation.

From the findings, understanding perception of teachers on student self-assessment is a bit complex. The teachers who took part in this study irrespective of whether they have been using self-assessment strategy or not are aware of the reasons for using and for not using it. Teachers who use the strategy hold reasons for not using it and at the same time those teachers who do not use the strategy gave reasons for using it.

This study adds to the existing literature by letting the reasons to manifest naturally instead of participants choosing from given options (Panadero et al., 2014). This ensured more complex responses to emerge as the awareness of reasons and beliefs were contradicting own practices. The reasons for using and not using student self-assessment strategy as well as the beliefs the teachers hold towards it became manifest and diverse. In so doing this study prompted new areas and questions of research which as per Panadero et al (2014), may not be manifest in previous studies.

Other aspects responded to by the teachers are on how the administrations affect the assessment choice and decisions, the effect of students' development stage on the assessment choice and decision. Also, the effect of the content of learning, parents and community on assessment decisions and the place of the student and the teacher in learning process. As DuFour et al (2013) argues, there is dire need for development of the implementation of self-assessment strategy effectively as this may be of importance to education practice by enabling instructors to compare their struggles and experiences on the usage of the strategy. Similarly, Brown & Harris (2014) advocate for training of the learners in this strategy to enable then regulate their learning.

On the students' perceptions towards self-assessment strategy, most of them (greater than 54%) applaud the strategy as enabling them be independent, learn more, gain confidence in learning, work is a structured way and being analytical. Avery good number did not express strong feelings towards the strategy except for the fact that it was challenging to learn. Self-assessment strategy generally enhances competency among the students as majority of the students (more than 70%) felt that the strategy made them analytical, critical and work in a structured way. This result is in line with that of Falkichov (1986) who found out that students felt more critical, analytical and

were able to work in a structured way as a result of self-assessment exercises. A smaller percentage felt that the strategy is time consuming (27%) which is in line with the finding of Schunk (1996).

5.1.4 Attitude of students towards mathematics.

One of the main challenges to learning of mathematics from the respondents was the fear factor or anxiety during examination with 46% of the females and 18% of the males having such a feeling. This then reduces the confidence of the students as 73% of the females and 55% of the males agree that their performance in mathematics is very low. The anxiety factor can be reduced by exposing the students to so many tests thereby alleviating their level of confidence. However, nearly all the students (100% of the girls and 82% of the boys) hold the feeling that mathematics is very useful subject in life.

About 80% of the boys and 80% of the girls hold a feeling that they enjoy learning mathematics and about a similar percentage disagree to the fact that mathematics lessons are not interesting. This confirm the observation from most of them that mathematics is their favorite (55% of the boys and 45% of the girls). A substantial (64% of the boys and 73% of the girls) disagreed that their gender affected their learning of mathematics. It was evident from the findings that parents, peer, teachers and siblings to the students were concerned with the students' learning and developing their attitudes towards mathematics. All these implies that students can do well in mathematics if the necessary support is given.

There is need for improvement in the performance of students in mathematics from the findings. About 50% of the boys and 73% of the girls admit to be performing dismally in mathematics. For this goal to be achieved there is need to develop positive attitudes towards mathematics among the students and motivate them more towards the subject. Peers, teachers, parents and siblings took part in the creation of attitudes among the students. If the persons mentioned above held such negative attitude then there is a high chance that these were enforced on learners. This could have led to dismal performance in mathematics which could have further resulted into desperation. The results of this study should awaken all the education stake holders to promote among the students, positive attitude towards mathematics. Similarly, the learning processes conducted in the classes should promote students' participation and in-depth understanding of mathematical concepts. Teaching strategies that promote self-efficacy, motivation and determination should be employed to mitigate this challenge.

5.2 Conclusions

The purpose of this study was to determine the effect of student self-assessment on academic performance in mathematics through measuring the improvement in a test. Although there are valuable merits of student self-assessment strategy as indicated in the literature, this study did not yield results to make a conclusive determination that the integration of student self-assessment promoted better performance in mathematics to the extent desirable. More studies are needed to establish trends to be able to make conclusive arguments. However, there was agreement that the process does lead to more regulated learning

5.3 Recommendations

From this study the following are recommended:

1. There is need for a step-up in the integration of the alternative assessment strategies in the classrooms as formative assessment methods to enhance more meaningful learning especially student self-assessment.
2. Efforts should be made to ensure both teachers and students embrace the alternative forms of assessments especially self-assessments more so in this era of authenticity.
3. Alternative assessment approaches or policies especially student self-assessment should be infused in the curriculum to instill self-regulated learning strategies among learners, core to make them life-long and autonomous learners.
4. All the stakeholders to education need to motivate and instill positive attitude to both male and female students towards learning mathematics as such would lead to better performance.
5. A connection exists between performance, learning, attitude and practical use of mathematics competencies. It is the view of the researcher that such a connection be identified at the early stages in a child's mathematics education.

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APPENDIX A: PERMISSION TO CONDUCT RESEARCH

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 921815

Date of Issue: 25/September/2019

RESEARCH LICENSE

This is to Certify that Mr.. Zacharia Oloo of University of Nairobi, has been licensed to conduct research in Homabay on the topic: EFFECT OF STUDENT SELF-ASSESSMENT ON ACADEMIC PERFORMANCE for the period ending : 25/September/2020.

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APPENDIX B: LETTER OF INTRODUCTION TO SCHOOLS

Zacharia Onyango Oloo
University of Nairobi
Department of Psychology
Box 30197
Nairobi.
To

The Principal
---------- Secondary school

Dear sir/madam

RE: PERMISSION TO CONDUCT RESEARCH AT THE SCHOOL

I am a post graduate student at the University of Nairobi pursuing a Master of Education degree in Measurement and Evaluation conducting a research on the topic "Self-assessment and Academic performance."

I am hereby requesting you to allow me to visit your school and collect the required data. The information collected will be treated with utmost confidentiality and will only be used for the purpose of research.

Thank you in advance for co-operation.

Yours faithfully,

Zacharia O. Oloo.
University of Nairobi

APPENDIX C: LETTER OF INTRODUCTION TO RESPONDENTS

Dear student,

RE: SELF-ASSESSMENT AND ACADEMIC PERFORMANCE

I am a post graduate student at the University of Nairobi pursuing a Master of Education degree in Measurement and Evaluation conducting a research on the above topic.

I am kindly requesting you to respond to the survey, interview and tests schedules attached as honestly as possible. The information is required for academic purposes only and will be treated with utmost confidentiality. Do not put your name or any other form of identification on the interview sheet.

I look forward to your honest participation.

Thank you for accepting to participate.

APPENDIX D: QUESTIONNAIRE FOR THE MATHEMATICS TEACHER

SCHOOL. CODE_____ CODE_____

RESEARCH DESCRIPTION

Dear Participant,

You are invited to take part in a research study on student's self-assessment and performance in mathematics in secondary school. I am of interest to work with you in order to explore your use of student's self-assessment while teaching mathematics in secondary schools.

Please kindly respond to the questions and statements as truth fully as you can. Your cooperation and contribution towards this research will be very much appreciated. All information given will strictly be kept confidential. (Do not write your name)

The data collected will be used for my master's project and possibly in presentations and publications.

Thank you

Zacharia O. Oloo

SECTION A: Teacher characteristics (Adapted from Kemboi Eliud Kipkorir)
Please *Tick (*√) the response that describe you in the box that applies.

Teacher characteristics	**Options**	**Tick (**√)
Gender	Male	
	Female	
Age	Under 25 yrs.	
	25 – 29 yrs.	
	30 – 39 yrs.	
	40 – 49 yrs.	
	50 or more yrs.	
Academic qualification	PhD	
	Masters' degree	
	Bachelors' degree	
	College Diploma	
	Any other. Specify	
Teaching experience	Two years	
	Three years	
	Four years	
	Five years	
	Six years	
	More than six years	
Subjects taught	Mathematics	
	Sciences	
	Languages	
	Humanities	
	Technical	

Lessons per week	Below 12	
	12 – 19	
	20 – 29	
	30 or more	

SECTION B: Classroom assessment practices

Please grade the following on a 5-point scale format where 1-*Never, 2-Seldom, 3-Sometimes, 4-Often, 5-Always*. Put 1,2,3,4 or 5 in the Ratings column.

Consider the following aspects of the daily classroom assessment practice

Item	**Classroom assessment**	**Ratings**
State which of the following classroom assessment practices you often employ in your mathematics class.	**Observation-** used to identify individual and group performance, how organized student(s) are and determines confidence levels of students as they engage in argumentation.	
	Student self-assessment-Students reflect on their own understanding and help them take more responsibility for their own learning.	
	Discourse-Discussing, explaining, justifying, illustrating and analogizing. (features of reasoning in a mathematics classroom)	
	Own productions- allowing students to present own ways of tackling math problems	
	Projects- (work done individually or in groups over a period of time)	
	Peer assessment- comment on oral presentation of another student, grade traditional tests, construct test items, etc.	
	Portfolio- (Collection of separate pieces of work done usually on one topic or theme for an overall assessment purpose).	

Part C: Usage of student self-assessment in classroom (Adapted from Chris Andrews)

Teacher Reasons

1. What reasons would you give for using (or not using) student self-assessment?

……

2. How does the content area you teach affect your assessment decisions?

……

3. How do the school administration, district administration, or state or federal requirements influence your assessment decisions?

……

4. How might the age of the students affect your assessment?

……

5. How do your students' parents or the community influence your assessment decisions?

……

Teacher Beliefs

6. If you have used self-assessment with your students, how would you describe your experience?

……

7. What do you think might happen if you used student self-assessment in the classroom?

……

8. What advantages do you feel self-assessment practices might have?

……

9. What disadvantages do you feel self-assessment practices might have?

……

10. Do you think that it is important or useful for students to participate in the assessment process? Why?

……

11. What role do students play in the learning process?

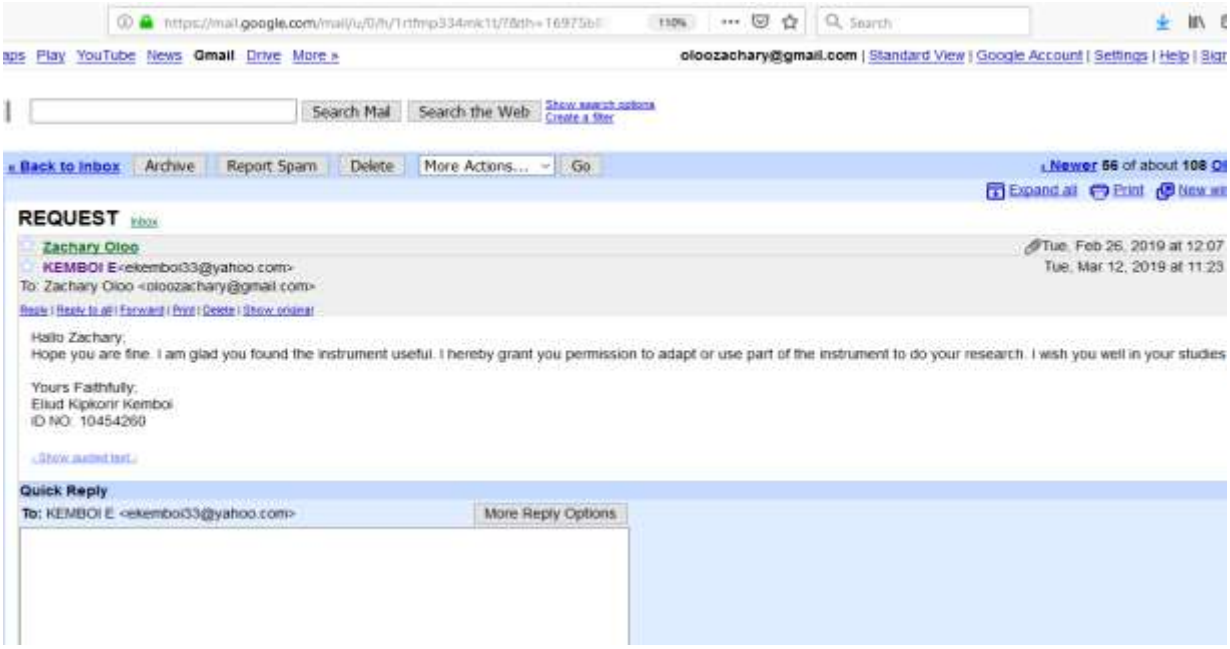
……

12. What role does the teacher play in the learning process?

……..

Thank you participating in this survey

PERMISSION TO USE THE QUESTIONNAIRE (From Mr. Eliud Kemboi)



PERMISSION TO USE THE QUESTIONNAIRE (From Mr. Chris Andrews)

APPENDIX E: QUESTIONNAIRE FOR THE FORM THREE STUDENT

(Adapted from Dr. Lee-Fong Siow)

Dear student

Before filing this questionnaire, kindly let us know what is happening. The aim of this research is to improve learning in our schools. Your contribution is what will be recommended for in our schools.

What is required of you is to state your gender (male or female). Your name is not required anywhere in this questionnaire. You should not think that we are looking for faults in you. Read the question well and go through the responses then choose the one that is suitable for you.

Thank you.

PART A: Demographic details

1. My gender is;
    a. Female ☐
    b. Male ☐
2. My age lies between
    a. 13 – 16 ☐
    b. 17 – 20 ☐
    c. 20 – 24 ☐
    d. Above 24 ☐
3. I am in form;
    a. One ☐
    b. Two ☐
    c. Three ☐
    d. Four ☐
4. I am married
    a. Yes ☐
    b. No ☐

PART B: Perception on self-assessment (**ADAPTED FROM DR. LEE-FONG SIOW**)

The self-assessment makes you: (Tick appropriately)

Dependent ☐ Independent ☐ Neither ☐

Do not think more ☐ Think more ☐ Neither ☐

Did not learn anything ☐ Learn more ☐ Neither ☐

Lack of confidence ☐ Gain confidence ☐ Neither ☐

Uncritical ☐ Critical ☐ Neither ☐

Work in an unstructured way ☐ Work in a structured way ☐ Neither ☐

Not analytical ☐ Analytical ☐ Neither ☐

The self-assessment is:

Time consuming ☐ Time saving ☐ Neither ☐

Not enjoyable ☐ Enjoyable ☐ Neither ☐

Hard ☐ Easy ☐ Neither ☐

Not challenging ☐ Challenging ☐ Neither ☐

Not helpful ☐ Helpful ☐ Neither ☐

Not beneficial ☐ Beneficial ☐ Neither ☐

PERMISSION TO USE A QUESTIONNAIRE

REQUEST Inbox

Zachary Oloo

Lee Fong Siow<siow.lee.fong@monash.edu>
To: Zachary Oloo <oloozachary@gmail.com>

Reply | Reply to all | Forward | Print | Delete | Show original

Dear Zacharia,

My apology for the delay in response. Yes, please have my consent. Thank you.

Cheers,
Lee Fong

- Show quoted text -

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Ph.D, Associate Professor
Head of Discipline, Food & Physical Sciences

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APPENDIX F: QUESTIONNAIRE ON STUDENT'S ATTITUDE TOWARDS MATHEMATICS

(Adapted from Jackson Kiprono Mutai)

Dear Student, the purpose of this questionnaire is to find out students‟ attitudes towards learning of mathematics.

Instructions 1. You may not write your name anywhere in this questionnaire. 2. The information you give concerning your feelings towards learning of mathematics will be handled confidentially. Please respond to the items below as honestly as is possible. 3. Put a [√] in the brackets corresponding to your answer.

Section 1: General information about the student and school

1. Type of school: Boys [ ] Girls [ ] Mixed [ ]

2. Gender: Male [ ] Female [ ]

3. Which of the following problems do you think affect you most when learning Mathematics?

(i) Lack of interest in mathematics [ ]

(ii) Inadequate mathematics textbooks and learning resources [ ]

(iii) Language used by the teacher is difficult to understand [ ]

(iv) Lack of confidence [ ]

Any other, specify ……

Suggest possible solutions to your problem

……
……
……
……

Section 2: Your feelings towards learning and performance in mathematics (1) **Instructions**: This section has statements that you are to decide carefully whether you strongly agree (SA), Agree (A), Unsure (U), Disagree (D), or Strongly Disagree (SD). Put a tick [√] against each statement depending on your feelings. If you make a mistake, cross by putting (X) through the tick [√] and then tick in the appropriate box in the table below.

Students' Feelings	**SA**	**A**	**U**	**D**	**SD**
I enjoy learning mathematics					
Mathematics classes/lessons are not interesting					
I would like to continue doing mathematics after completing secondary school education					
To understand mathematics is difficult					
Mathematics is very useful in life					
I think it is the teacher who can make mathematics learning easier					
Among the subjects taught, mathematics is my favorite					
I am given a lot of unnecessary mathematics assignments					
I am well provided with mathematics textbooks and other learning resources					
I feel extremely anxious and fearful, when mathematics examinations are mentioned or brought					
Mathematics should not be a compulsory subject					
I do a lot of mathematics exercises on my own or with a friend					
Mathematics is impossible to learn					
Learning mathematics is just remembering what the teacher says and does while in class					
The best way to learn mathematics is to discover a concept by oneself					
My grades (marks) are always low in mathematics					
I do mathematics for the sake of it					
I like my mathematics teacher					
My friends don't like learning mathematics					
My parents and siblings encourage me to learn Mathematics and to perform well in the subject					
Being a girl or a boy interferes with my learning and my performance of mathematics					
I learn mathematics well regardless of the gender of my teacher					

2. What according to you can make learning of mathematics interesting and easier to understand?

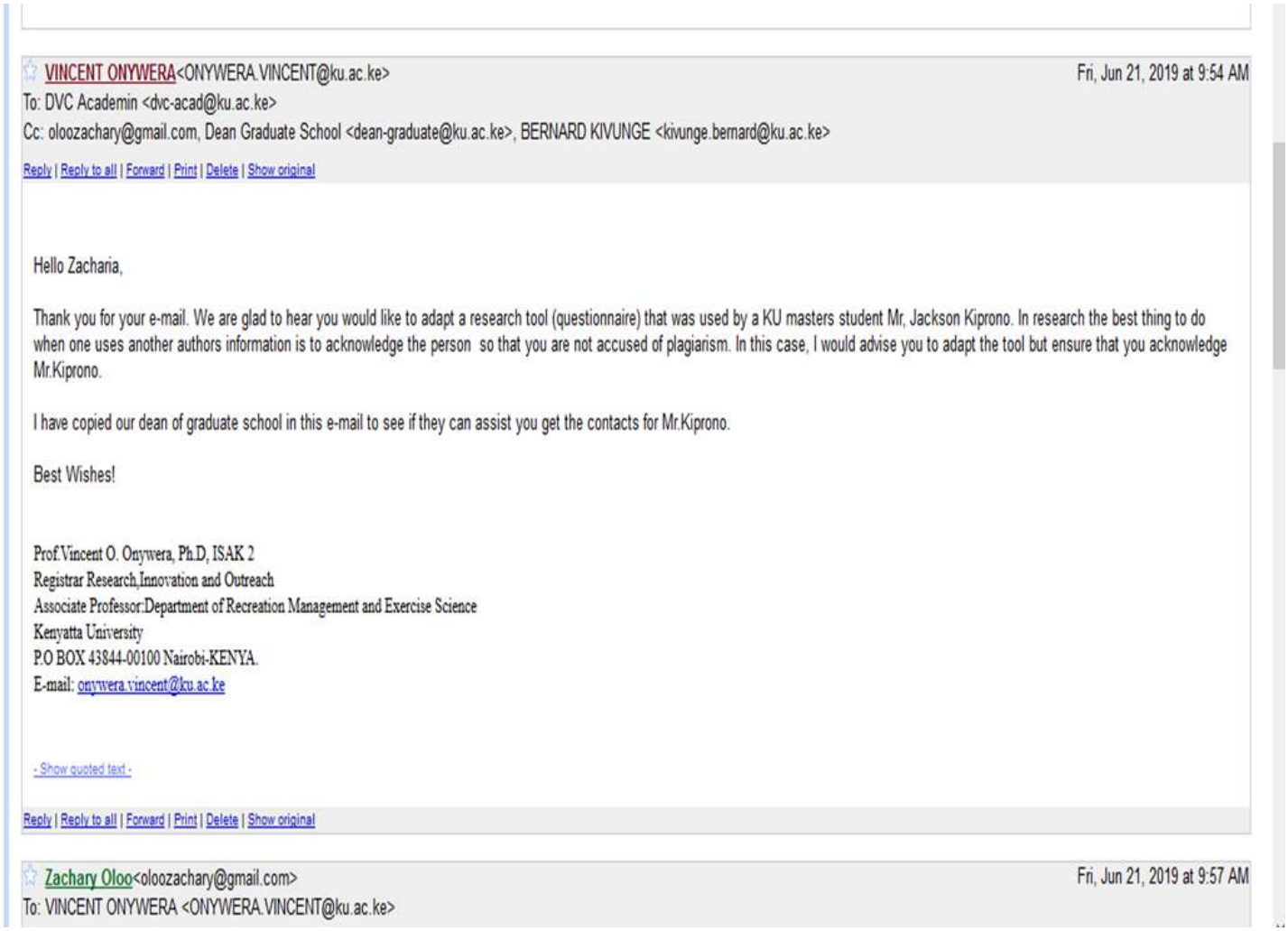
……

(3) What other comment do you have in regard to mathematics learning?

……

Thank you very much for your time, effort and thought you have put into this survey.

PERMISSION TO USE A QUESTIONNAIRE



VINCENT ONYWERA<ONYWERA.VINCENT@ku.ac.ke> Fri, Jun 21, 2019 at 9:54 AM
To: DVC Academin <dvc-acad@ku.ac.ke>
Cc: oloozachary@gmail.com, Dean Graduate School <dean-graduate@ku.ac.ke>, BERNARD KIVUNGE <kivunge.bernard@ku.ac.ke>
Reply | Reply to all | Forward | Print | Delete | Show original

Hello Zacharia,

Thank you for your e-mail. We are glad to hear you would like to adapt a research tool (questionnaire) that was used by a KU masters student Mr, Jackson Kiprono. In research the best thing to do when one uses another authors information is to acknowledge the person so that you are not accused of plagiarism. In this case, I would advise you to adapt the tool but ensure that you acknowledge Mr.Kiprono.

I have copied our dean of graduate school in this e-mail to see if they can assist you get the contacts for Mr.Kiprono.

Best Wishes!

Prof.Vincent O. Onywera, Ph.D, ISAK 2
Registrar Research,Innovation and Outreach
Associate Professor:Department of Recreation Management and Exercise Science
Kenyatta University
P.O BOX 43844-00100 Nairobi-KENYA.
E-mail: onywera.vincent@ku.ac.ke

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Zachary Oloo<oloozachary@gmail.com> Fri, Jun 21, 2019 at 9:57 AM
To: VINCENT ONYWERA <ONYWERA.VINCENT@ku.ac.ke>

APPENDIX G: ASSESSMENT
(Adapted from Hotard J.)

Algebra I

Unit 5
Assessment

Systems of Equations and Inequalities

2009-2010

1. What is the solution to this system of equations?

$$\begin{cases} y = -3x - 2 \\ 6x + 2y = -4 \end{cases}$$

A. (6, 2)
B. (1, -5)
C. no solution
D. infinitely many solutions

2. Which ordered pair is the solution to the system of equations below?

$$\begin{cases} x + 3y = 7 \\ x + 2y = 10 \end{cases}$$

A. $\left(\frac{7}{2}, \frac{13}{4}\right)$

B. $\left(\frac{7}{2}, \frac{17}{5}\right)$

C. (-2, 3)

D. (16, -3)

3. In the following equations, the value of x represents the price per pound of gravel and the value of y represents the price per pound of sand.

$$2y = 3x + 8$$
$$5y - 15x = -30$$

At what price for sand do the two lines intersect?

A. $6.67
B. $10.00
C. $12.33
D. $14.00

4. Cassie has $20 in her savings account. She plans to save $2 per week from her babysitting job. Mitch, Cassie's brother, has only $8 in his savings account but plans to save $5 per week from his lawn mowing job. How many weeks will it take before the amounts in Cassie's and Mitch's savings accounts are the same?

A. 2
B. 4
C. 10
D. 28

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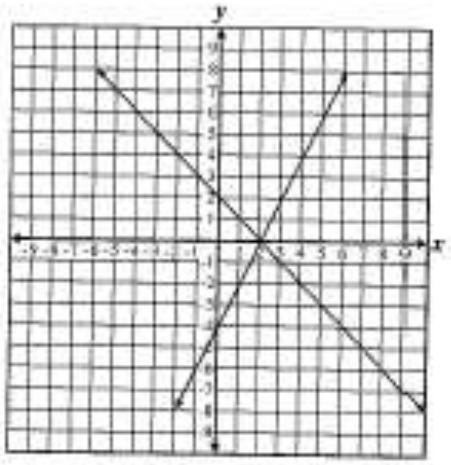
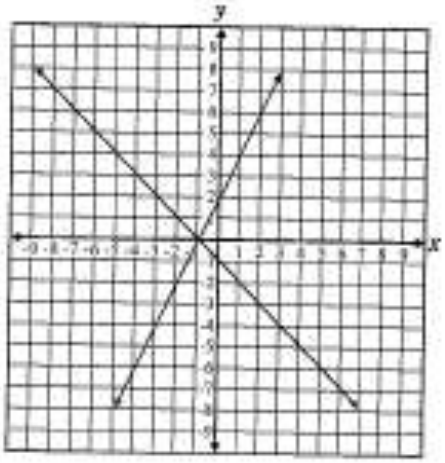
5. Which of these graphs represents the solution to the system of equations $y = 2 - x$ and $y = 2x + 2$?

A.



C.



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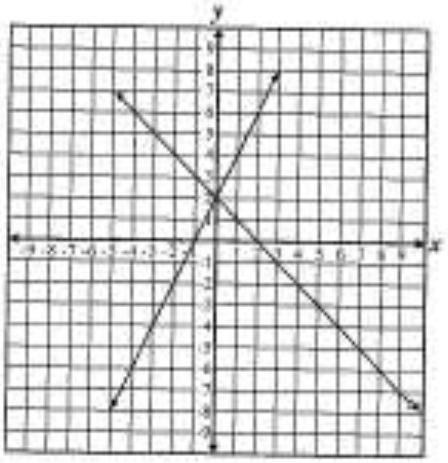
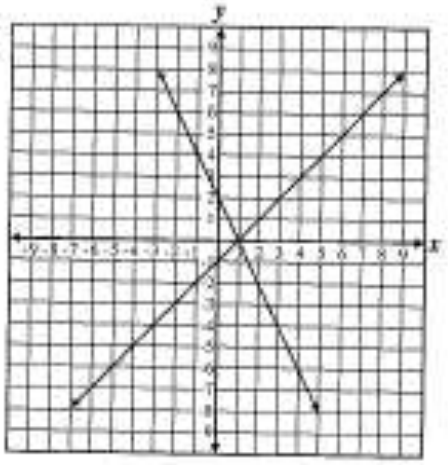


D.



6. What is the difference of the two matrices?

$$\begin{bmatrix} 5 & -2 & 10 \\ 4 & -5 & 20 \\ 1 & -3 & 30 \end{bmatrix} - \begin{bmatrix} 9 & -3 & 15 \\ 1 & -4 & 21 \\ 8 & -7 & 30 \end{bmatrix}$$

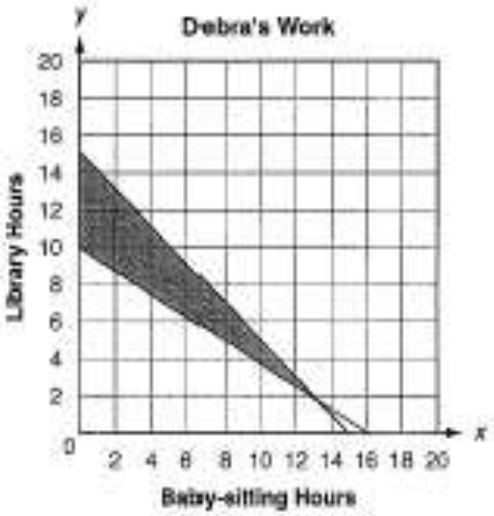
A. $\begin{bmatrix} 4 & 1 & 5 \\ 3 & 1 & 1 \\ 7 & 4 & 0 \end{bmatrix}$

B. $\begin{bmatrix} 14 & -5 & 25 \\ 5 & -9 & 41 \\ 9 & -10 & 60 \end{bmatrix}$

C. $\begin{bmatrix} -4 & 1 & -5 \\ 3 & -1 & -1 \\ -7 & 4 & 0 \end{bmatrix}$

D. $\begin{bmatrix} -4 & 7 & -14 \\ -3 & -1 & -24 \\ 2 & 4 & 0 \end{bmatrix}$

7. Debra earns $5 an hour baby-sitting and $8 an hour working at the local library. Her goal is to earn at least $80 this week, but she can't work more than 15 hours. Debra models this situation using the graph below.



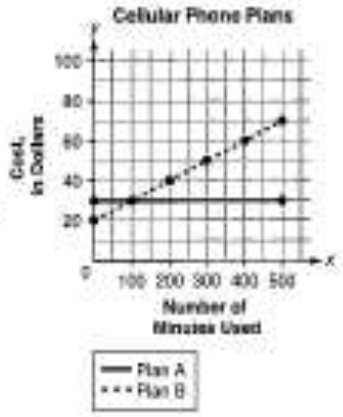
According to the graph, which combination of hours will allow Debra to meet her goal?

A. 9 hours baby-sitting and 3 hours at the library
B. 12 hours baby-sitting and 4 hours at the library
C. 3 hours baby-sitting and 9 hours at the library
D. 4 hours baby-sitting and 12 hours at the library

PLEASE GO ON TO THE NEXT PAGE →

8. The Kramer Cellular Phone Company offers two payment plans. Under Plan A, customers pay a monthly fee of $30 and $0.05 per minute. Under Plan B, they pay a monthly fee of $20 and $0.10 per minute. Which graph correctly shows when the cost of these plans will be equal?

A.



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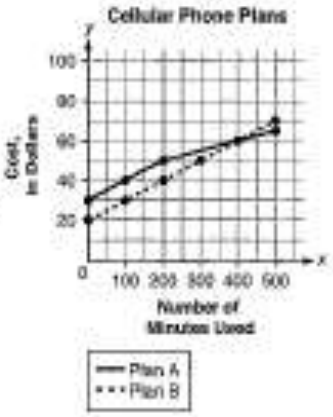

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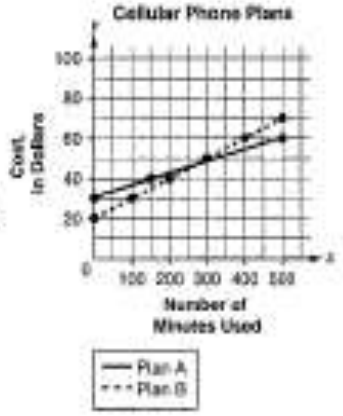

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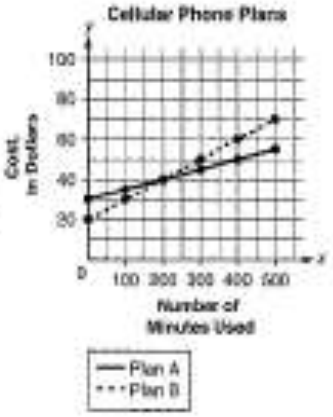


9. Kayla works four days a week as a waitress and as a nanny. The hours she works each day are shown.

	M	Tu	W	Th
waitress	6	5	4	7
nanny	4	4	6	3

Once school starts, she wants to cut all her hours by one-half. Which matrix represents the new work schedule?

A. $\begin{bmatrix} 6 & 5 & 4 & 7 \\ 2 & 2 & 3 & 1.5 \end{bmatrix}$

B. $\begin{bmatrix} 12 & 10 & 8 & 14 \\ 8 & 8 & 12 & 6 \end{bmatrix}$

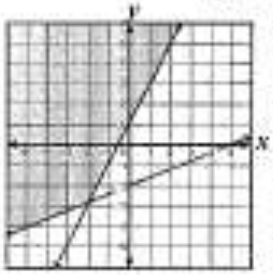
C. $\begin{bmatrix} 3 & 2.5 & 2 & 3.5 \\ 2 & 2 & 3 & 1.5 \end{bmatrix}$

D. $\begin{bmatrix} 3 & 2.5 & 2 & 3.5 \\ 4 & 4 & 6 & 3 \end{bmatrix}$

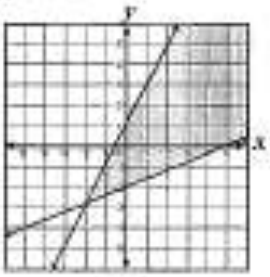
10. Which graph BEST represents the solution to this system of inequalities?

$$\begin{cases} 2x \geq y - 1 \\ 2x - 5y \geq 10 \end{cases}$$

A.



C.



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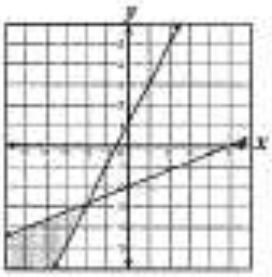

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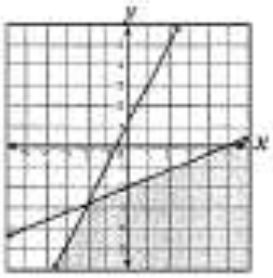

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DIRECTIONS: On a separate sheet of paper answer the following.
Be sure to label your answers A and B.

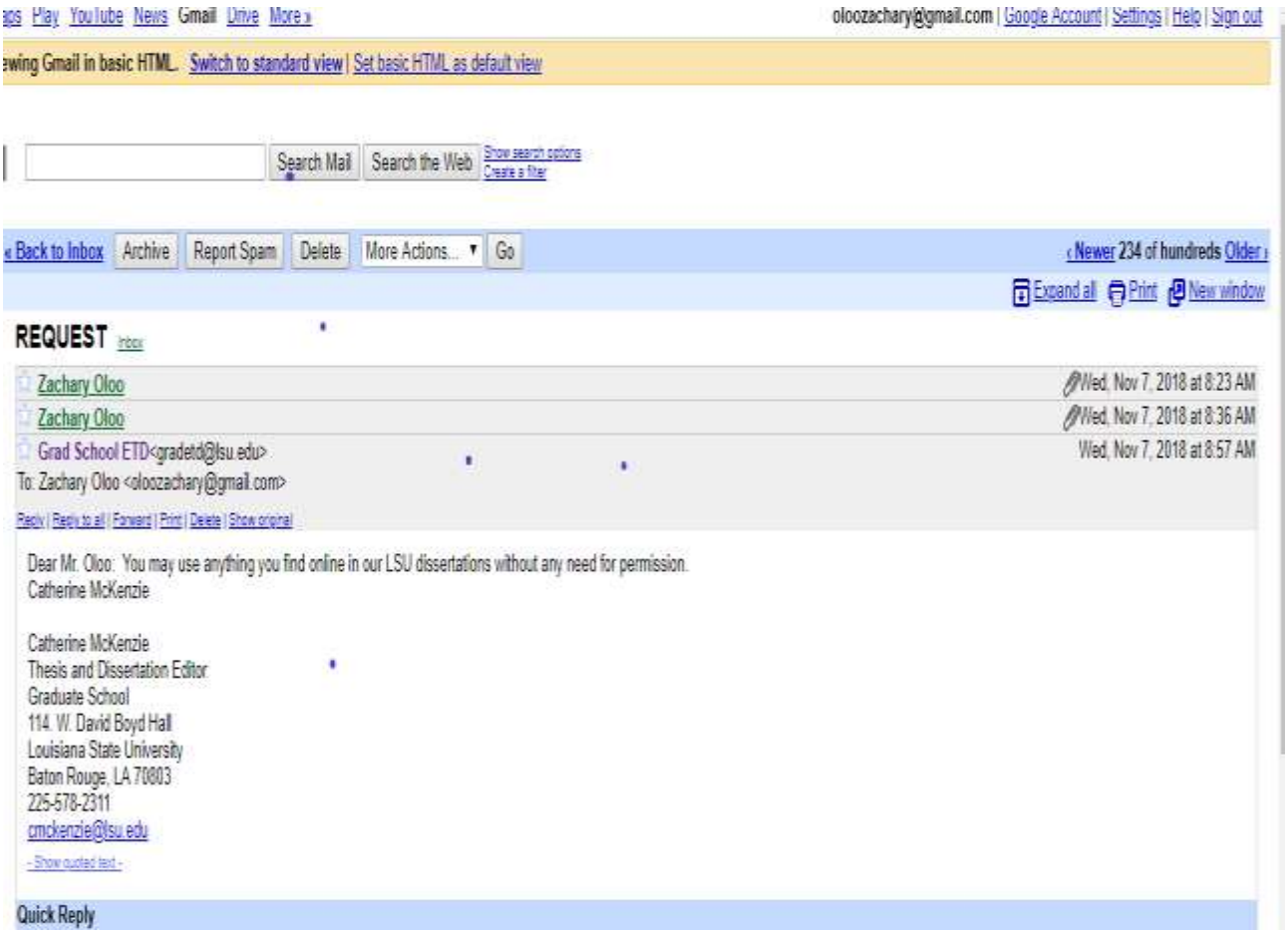
11. The manager of a movie theater found that Saturday's sales were $3675. He knew that a total of 650 tickets were sold Saturday. Adult tickets cost $7.50 and children's tickets cost $4.50.

A. Let A represent the number of adult tickets sold and C represent the number of children's tickets sold. Write 2 equations: Write one to represent the number of tickets sold and write one to represent the amount of money collected.

B. How many of each kind of ticket were sold? Show your work. Include all steps.

PERMISSION TO USE THE PRE &POST –ASSESSMENT INSTRUMENTS

(LOUISIANA STATE UNIVERSITY)



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Zachary Oloo — Wed, Nov 7, 2018 at 8:36 AM

Grad School ETD<gradetd@lsu.edu> — Wed, Nov 7, 2018 at 8:57 AM

To: Zachary Oloo <oloozachary@gmail.com>

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Quick Reply

APPENDIX H: TEACHERS' RESPONSE ON PERCEPTION TOWARDS STUDENT SELF-ASSESSMENT

i. Teacher reasons for using or not using student self-assessment

Teacher	**Response**
1.	It enables student to retain the learnt concept
2.	Some students are not honest, they may award themselves more marks
3	Engages the learner more Helps the learner to learn at their own pace
4	Not often used due to time constrains
5	Most of them are not willing to learn, they need to be pushed to take responsibility hence create time wastage.
6	When using this approach, students take their time to look for the correct methods of tackling maths problems. It makes them own these procedures
7	Using it as it enables students gain confidence in their ability to do mathematics
8	Students self-assessment brings motivation to the learner
9	It absolutely enables students to acquire confidence during learning.

10	Students self-assessment approach consumes more time and hence limiting the stipulated time for teaching mathematics
11	The students need to be pushed therefore it consumes time
12	It is used to assist students in evaluating whether the content learnt is internalized or not

ii. Effect of the content area of teaching on the assessment decision

Teacher	**Response**
1	Provides adequate opportunities for student self-assessment
2	Prevents content delivery during the process
3	The attitude of the student varies with content taught and this makes it hard for assessment method to be used
4	Doesn't affect
5	Some area of content require formative or summative assessments. The content area affect the type of assessment chosen
6	It assist in choosing the relevant assessment method
7	Some areas are low level while some areas require high level thinking. Change of assessment style is important to carry along all the learners
8	Some content areas need the teacher to simplify for the students, while some areas the students have prior knowledge hence making assessments simple since it will need the teacher to just guide and support
9	Wide content area does not give room for student self-assessment adequately
10	It dictates the nature of assessment strategies to implore
11	Specific subjects require specific types of assessments. I therefore choose the appropriate methods depending on the areas to be tested

12	It enables the teacher to predict the method used to deliver given concept to the students

iii. Influence of school administration, district administration or state or federal requirements on assessment decisions

Teacher	**Response**
1	They influence by providing the instructional materials that could enable the learners to assess themselves
2	My assessments are based on the resources availed by the school administration
3	At times the school system dictates certain decisions on assessments while some are decided on by the teacher
4	Exposure to seminars and team marking help in shaping assessment decisions
5	Support learning through workshops Provides necessary resources for assessment process Provides ways and techniques of assessing students
6	Policy on education restricts assessment decisions. Some policies imposed on teachers help in improvement of outcomes of learning while others are destructive
7	The school administration readily provides adequate assessment materials like past exam papers and photocopy papers which easien my assessment
8	Government policies affect the type of assessment and the school administration support helps in good assessment decisions in order to improve performance
9	The administration decides how many exams are to be done and the marks awarded
10	The school administration provides necessary materials and conducive environment for assessing students

11	The school administration provide resources for learning such as past papers
12	Teacher performance appraisal development (TPAD) tool introduced by the teachers employer to some extent strengthen student self-assessment

iv. Effect of students' age on assessment

Teacher	**Response**
1	Students aged over 18 years sometimes find challenges in carrying out self-assessment due to age differences with younger ones
2	Young students (14-18yrs) are easy to deal with and definitely follow instructions
3	The age of students sometimes affects assessment as some are overage and feel that proper assessment infringes their rights
4	Age doesn't affect
5	Young students are not serious with their academic while aged students are difficult to deal with
6	Younger students (aged 13-18 yrs) are easy working with as they are much willing to work
7	The age and stage of development of learners either slows down or increases rate of content delivery. Not all assessment designs suit a particular age and level of students
8	Young students are difficult to assess, since most of them are not serious with their work. The aged ones are abit serious though some of them have difficulties to understand
9	Age does not affect the assessment
10	Their ages affect the seriousness they attach to learning hence assessment at times may not reveal more them
11	The age of students dictates the method and level of assessment

12	The more aged students would use the assessment than little ones since they understand themselves and become responsible

v. Influence of parents and the community on assessment decisions

Teacher	**Response**
1	Both the parents and the community support the learner and the teacher
2	Cooperating parents also make assessments to be successful
3	They do not affect
4	Parents/community always expect the learners to be assessed more frequently
5	Ensuring the students are available by early payment of school fees, making me as a teacher to have ease in assessing my students effectively
6	Parents and community may not affect the internal assessment decisions in a boarding school
7	Parents who co-operate and support the childrens' class work makes the teacher feel motivated to work
8	Some parents are negatively affected when their children fail. Their support enhance proper assessment decisions
9	They don't affect or influence the assessment decision
10	The students' parents do not follow up on their children to ensure that their children are doing the recommended work in school.

11	Proactive parents support childrens' education process. Some parents also motivate teachers by supporting learners' activities
12	The parents' role in assessment decisions are minimal

Teacher Beliefs

i. Experience with student self-assessment

Teacher	**Experience**
1	Enables students know their academic ability and work hard to improve on their abilities
2	Slow-learners are disadvantaged as they face set-backs of assessment. They rely mostly on others
3	Quite hectic but a good approach
4	Has helped in improving on my teaching and in assessment
5	Most students do not understand their responsibilities in their own learning
6	Some of the students who are slow learners are left behind as they rely on others for help
7	Sometimes self-assessment slows down rate of content delivery. Some assessment approaches require attending to every student individually. This consumes time
8	Satisfactory
9	Good practice but it consumes much time
10	Learning is interesting and student's centered
11	Good experience. Some of the learners are always honest and active during self-assessments
12	The self-assessment enable learnt material to be retained more by the students

ii. Expectations if student self-assessment is used in classroom

Teacher	Expectation
1	Might enable learners be more self-responsible hence direct themselves
2	The objectives would be achieved faster since most of the individual needs of the learners will have been met
3	Students would learn more
4	The understanding of mathematics concepts would increase
5	There will be more time wastage
6	Students would love the content since it is self-discovered. It is unlike a case when content and concepts are imposed on them
7	Majority of the students will not have been helped because most of them are slow learners and don't believe in themselves
8	It will waste time
9	It would be a tool of motivation
10	It will improve students' performance and change their attitude towards mathematics
11	Self-defeat among slow-learners prevent them to acquire first-hand work since they don't believe in themselves
12	Students' morale would increase

iii. Advantages of self-assessment

Teacher	Advantage
1	Improve self-esteem among the students who are involved in self-assessment
2	Learners individual needs are catered for Time wastage is minimized Learning through self-assessment is direct

3	Increases learner motivation Improves performance
4	Increases student's confidence in mathematics
5	It will make students have more understanding of the content taught More understanding of their ability and understanding Might make students be abit serious with their work
6	Improved learning outcomes
7	One gets the immediate response from the students and checks the level at which the objectives have been achieved
8	Students are able to understand their responsibilities in their own learning
9	Motivating
10	Improves students cognitive skills It helps the student to do self-evaluation
11	Encourages the learners to follow through their work and better learning
12	Immediate feedback from learners is achieved which ultimately confirm the learning objectives

iv. Disadvantages of student self-assessment

Teacher	**Disadvantage**
1	Not measurable in terms of content delivery
2	The follow-up of self-assessment is quite time consuming
3	It consumes more time Weak students do not find it easy
4	Bias
5	Time consuming
6	It is not measurable
7	Slows syllabus coverage

	Time consuming leading to objectives remaining unmet
8	Time wastage Victimization among students Character assassination of other students by their colleagues
9	Time consuming exercise
10	Takes a lot of time It's demanding
11	It requires more time It is expensive: a lot of resources are required to produce tests for each learner
12	It is not measurable on the level of content mastery by the learner

v. View on whether it is important for students to take part in assessment process or not

Teacher	**Opinion**
1	It is important since it enables student to be self-responsible
2	Yes, students learn through involvement in assessment
3	To enhance their learning as assessment is part of learning process.
4	Students should participate as it makes them internalize what is taught
5	Yes, to give them opportunity to understand their ability and also improve their self-confidence
6	Yes, education is about improving the individual students. If it is proven that self-assessment leads to improvement then it should be used
7	It is important as it enhances the retention of the learnt concepts
8	Yes, to enable them understand their role/responsibility in their own learning
9	Yes, this would also help when they are reading on their own. They can set problems and solve.

10	Yes, because it makes the basis of their performance and a good future
11	Yes, it makes them understand their abilities
12	It is significant since it enhances the concept understanding among learners

vi. Role of students in their learning process

Teacher	**Response**
1	Students ask questions and answers sample questions thus easien teachers' work during the learning session
2	Carry out the tasks given by the teacher
3	They listen and participate in learning process
4	Listening, answering of questions, ask questions and problem solving
5	They should be actively involved in the learning process
6	They ask and answer questions which enables the teacher to choose appropriate teaching and learning method
7	They are the receiver of the information They participate actively in the process of learning
8	Ask questions Answer questions Listening Take part in discussions
9	Most cases passive learners
10	Learning
11	Learning is student centered. Students are therefore very important because it is only through them that objectives are achieved
12	The students listen carefully to the learnt concepts and conceptualize the best

vii. Role of the teacher in the learning process

Teacher	Response
1	Learning facilitator
2	Guides the students as they interact with the environment through learner centered approach as a methodology of instruction
3	Guiding the learning process
4	The teacher is in charge of the lesson
5	Explaining the difficult concepts to the students Guiding the students through worked examples Simplifying the concepts to the students Match every student with same ability for easier understanding of the concept
6	Pass the information to the students Identifies the learner challenges and strengths and acts appropriately for better outcome
7	To facilitate the learning process
8	Facilitate the learning process Guide the students on the content areas
9	Teach, listen and assess
10	The teacher facilitates the learning process to ensure its running smoothly
11	Teach the content to learners
12	Facilitate the learning process Class control during lesson