CLASSROOM ASSESSMENT PRACTICES BY MATHEMATICS TEACHERS IN TECHNICAL VOCATIONAL EDUCATION TRAINING (TVET) INSTITUTIONS IN KENYA

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DECLARATION

This thesis is my original work and has not been presented examination in another university

Signed:  Date: 14th August, 2023

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This research project has been submitted for examination with my approval as the University supervisor.

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DEDICATION

This project is dedicated to my dear parents, who have been a constant source of encouragement and motivation for me since they have never stopped believing in me and have given my siblings and me a solid academic foundation.

In addition, I would want to take this chance to thank my loved ones, as well as my friends and coworkers, who have always been there to provide me sound counsel and encouraging words. I am grateful for both your time and insightful comments.

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ABSTRACT

Classroom assessment is an integral part of the teaching learning process. Information generated from this assessment serves formative, diagnostic and summative purposes. Over the years, Technical Vocational Education Training examination candidates registered low performance in various Mathematics papers across the TVET courses. The purpose of this research was to determine the evaluation techniques, forms, and methodologies used by mathematics instructors working in TVET colleges located in Kenya. To determine the common classroom assessment practices used by mathematics teachers in TVET institutions; to identify the assessment tools and formats used by mathematics teachers in TVET institutions; to establish how mathematics teachers in TVET institutions make use of assessment information collected from students in the classroom; and to determine the mathematical competencies that mathematics teachers in TVET institutions consider to be important. The study's theoretical underpinnings included constructivism, behaviorism, and David Ausbel's concept of "meaningful learning." The experiential learning theory proposed by Kolb was also considered. Quantitative and qualitative research methods were used to collect and evaluate the data for the study. Information collected from the Kenya National Examinations Council via surveys, interviews, and statistical analysis. Data from surveys were presented in the form of percentages, tables, and graphs, while information from interviews was analyzed qualitatively. Observation, peer evaluation, and portfolios were reported to be the most common forms of classroom assessment used by TVET mathematics instructors in the research. The least employed classroom assessment practices was own production. The most identified assessment tools and formats used by mathematics teachers were Closed-open questions and Open-open questions. It was also found out that the assessment information collected was used to plan for future lessons, diagnose students' learning problems and provide feedback to students. Lastly the study found out that most mathematic teachers have been trained on the assessment item test development. The Kenya National Examinations Council as well as Curriculum Development Assessment and Certification Council were the organizations that provided the training on assessments. According to the findings of the research, improving instructors' ability to evaluate students' knowledge and performance should be a top priority for any effort to make education more meaningful. This might be accomplished via short courses, workshops, or seminars. A comprehensive personnel balance exercise should also be carried out by the government, as recommended by the report, in order to guarantee that all schools have an adequate number of instructors.

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LIST OF ABBREVIATIONS AND ACRONYMS

AFT American Federation of Teachers

CAPS Classroom Assessment Practices

CATS Continuous Assessment Tests

Development

DOS Director of Studies

GDP: Gross Domestic Product

GoK: Government of Kenya

HIV: Human Immunodeficiency Virus

IEA International Association for the Evaluation of educational

Achievement

IHC: International Housing Corporation

KENSUP: Kenya Slum Upgrading Programme

KIPPRA: Kenya Institute for Public Policy Research & Analysis

KNEC Kenya National Examination Council

MLA Monitoring Learning Achievement

NCC: Nairobi City County

NCTM National Council on Measurement in Education

NEA National Education Association

NGO: Non-governmental organization

OECD Organization for Economic Co-operation and

PIRLS Progress for international Reading Literacy Study

PISA Program for International Student Achievement

SACMEQ South African Consortium for the Monitoring of Education Quality

SPSS Statistical Software Package for Social Sciences

TIMSS Trends in International Mathematics and Sciences Study

TVET Technical Vocational Education Training

UNDP: United Nations Development Program

UNESCO United Nations Organization for Education, Science and Culture

UN-HABITAT: United Nations Human Settlements Programme

UNICEF: United Nations Children's Fund

USAID: United States Agency for International Development

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

For the purpose of drawing conclusions about the nature of a person or thing, we engage in a process called assessment (Reynolds, Livingstone, & Wilson, 2009). Assessment is not only a means by which information is gathered; rather, it is a procedure used to evaluate a learner's mastery of course material and is intrinsically tied to the goals set for a given unit, semester, or program (Marriot & Lau, 2008). Technical and vocational education and training (TVET) has a significant problem in the field of competency evaluation due to the scarcity of suitable assessment methods (Baethge and Arends 2009; Liedtke and Seeber 2015). In order to determine whether trainees in Technical and Vocational Education are appropriately prepared for the working world, it is important to conduct assessments that measure the competences and skills relevant to that world. Having data on a country's educational achievements is useful for informing policy and resource choices for enhancement, which is why national and international evaluations are conducted (Best et al., 2012).

Furthermore, Best et al. (2012) pointed out that the information gleaned from assessment programs may be used to determine how well an education system is teaching its pupils the anticipated material, as well as variances in accomplishment levels by sub groups such as gender or geography. Furthermore, if relevant historical data are gathered, variables that contribute to achieving varying degrees of success may be identified and studied. These observations were made in light of the fact that. They also emphasize that there are primarily three types of use of assessment data as

evidence in policy decisions in developing nations: the value of test results as an indicator of product quality, evidence collected for the purpose of determining a system's strengths and weaknesses, evaluation information used for gauging and promoting systemic fairness, using assessment results as a means of enforcing responsibility, or evaluation as proof for exercising power over a set up.

One of the ultimate goals of assessment is to assist in the development of autonomous learners who continue their education throughout their lives and who constantly check and evaluate their own progress (Mazloomi,2016). (This suggests that placing a significant focus on formative assessment in the classroom, which is seen to serve informational objectives, and summative assessment, which is thought to quantify students' success, is of major relevance. Goal 4 of the Sustainable Development Agenda focuses on helping young people and adults develop employability skills including problem solving, critical thinking, creativity, collaboration, communication, and conflict resolution. The development of people's abilities is central to this objective. To develop 21st-century competences, real-world applications of knowledge need authentic assessment for learning (Care & Kim, 2018).

Concerned about the potential harmful influence of high-stakes exams on students' academic achievement, stakeholders in the education system suggest that the frequency with which these examinations are administered should be greatly reduced (Andrews & Wilding, 2004; Harlen & Crick, 2003; Morrison & Tang, 2002; Shepard etal., 2001, Masayi & Nderitu, 2018). Assessment has a significant effect on students' attitudes about learning, therefore assessment paradigms have shifted from assessing students' knowledge to judging their capacity to learn (Watling & Ginsburg, 2019).

Recent ways to assessing students are making an effort to enhance the congruence between what students need to learn and what it is anticipated that they will know after they have completed their education (Gulikers et al., 2006). The issue that has to be answered is whether or not students are taught in order for them to do well on tests, or if they are taught in order for them to create meaning that will be maintained over time.

There has been a significant shift in the way that assessment is carried out in the classroom, with researchers concentrating their efforts on developing new methods of evaluating students. These novel approaches would validly measure critical pedagogical goals and utilize assessment as a tool to motivate student learning (Wiggins, 1990). The most important goal of assessments in the modern day is to determine how effectively students can use their acquired knowledge and abilities in authentic settings (Frisby, 2001; McTighe & Ferrara,1998; Wiggins, 1998). Educators and cognitive psychologists have done a plethora of studies that have all pointed to problems with the way mathematics is currently being taught. One major issue in the approach is the psychological assumption that one learns mathematics via the stimulus-response theory. According to this view, learning takes place when a connection is made between a person's reaction to a certain stimulus and the stimulus itself (Cathcart, Pothier, Vance & Bezuk, 2001).

According to Cathcart et al. (2001), in the situation described above, drill becomes an important part of the instructional process. They reasoned that this is the case because the more frequently an individual demonstrates the ability to give the appropriate response to a stimulus, the stronger the connection between the two becomes.

According to this hypothesis, students are presented with long and often difficult issues, with a special focus on calculations, in the hope that the challenges would improve their mental capacity. Institutions and educators have a responsibility to acknowledge the fact that great thinkers, such as philosophers, psychologists, scientists, mathematicians, and a great many others, generated knowledge by doing research and carrying out experiments (Baroody & Coslick, 1998; Phillips, 2000). They developed an understanding of cause and effect as a result of their inquisitiveness and exploration, which led to them being adept at problem-solving, one of the essential 21st-century talents (Care & Kim, 2018).

The goal of this research is to better understand how mathematics instructors utilize various assessment techniques and tools in the classroom to better understand and assist both the learning and teaching processes by looking at teachers' most often used assessment practices. The second part of the study would investigate how math educators at TVET schools make use of student assessment feedback and what mathematical abilities they consider when designing assessment questions for the classroom.

There is a wide variety of activities that teachers must do in order to evaluate and analyze their pupils' development in the classroom (Stiggins & Conklin, 1992). Most educators believe that the data obtained from these exercises is vital to improving their students' academic outcomes (Stiggins & Chappuis, 2005). Therefore, their abilities and expertise in evaluation are crucial. Classroom assessment plays a significant role in schools, and teachers should acquire some fundamental assessment abilities since they spend so much time on assessment-related tasks (Reynolds,

Livingston, and Wilson, 2009; McMillan, 2008; Nitro, 2001). For this reason, all three research agreed that classroom evaluation is crucial for learning. Assessment is an integral part of mathematical education (NCTM, 2000). Understanding pupils' mathematical strengths and weaknesses is essential for effective teaching.

One proven method for improving students' performance on high-stakes tests is to familiarize them with testing styles similar to those seen in standardized exams taken on a national scale. Students are better prepared for massive standardized tests when they have had experience with these types of tests (Kopriva&Saez, 1997). Other studies have shown that genuine assessment, which involves testing students' actual performance on real-world activities, is effective (Echevarria& Short, 2000; McMillan, 2004a). Valid evaluations in mathematics are those that place more emphasis on a student's capacity to think critically, integrate their knowledge, be creative, and communicate their ideas than on their ability to memorize and regurgitate facts. In addition, the results of collective activities are evaluated.

In addition to learning the mechanics of computing, one must also be able to extrapolate the results of a calculation to novel situations. Furthermore, it is advised that an efficient assessment and teaching strategy involves the use of numerous assessments, also known as different paths for students to show their mastery of the topic. Having pupils show their knowledge in numerous ways is one of the main benefits of doing multiple exams (Echevarria& Short, 2000). Two essential parts of assessment in the classroom are making decisions based on the information obtained from assessments and communicating the outcomes of those assessments to students. In order for instructors to successfully explain assessment findings, they need to have

an understanding of the benefits and drawbacks of a variety of assessment methods, as well as the ability to employ suitable vocabulary and communication strategies related to assessments (Aiello, Di Martino & Di Sabato, 2017).

The significance that teachers place on standardized exams relative to classroom evaluations will also play a role in how they evaluate their students (Irizarry, 2015). Depending on how much weight they give to standardized tests vs teacher-made quizzes, effort, and classroom involvement, teachers might reach quite different judgments about their students' academic progress. These are the causes that led to the search for classroom assessment procedures used by mathematics educators, in particular those working in TVET colleges located in Kenya. Teachers are obligated to maintain students' anonymity whenever they provide comments on assessments (Airasian, 1994). The outcomes of these examinations will be used for such purposes as determining a student's academic placement, determining whether or not they are ready for graduation, and evaluating the efficacy of both particular classes and the whole school as a whole (Stiggins, 1992).

1.2 Statement of the Problem

The method of evaluating students' performance in the classroom at all levels at TVET institutions is mostly accomplished via the use of classroom assessments that are developed by subject instructors. The examinations may be administered on a weekly, monthly, midterm, or final basis, depending on the instructor's discretion. The goal is to compile reports on the overall development of the learners. Classroom assessment is generally implemented reasonably well at TVET institutions that have low enrollment per course in addition to a richness of teaching and learning tools.

This is because instructors only have a limited number of students to whom they need to devote their whole attention. However, they have everything at their disposal to do what has to be done. On the other hand, it is difficult for instructors to successfully conduct out continuous evaluation in many public TVET public institutions due to the huge number of students enrolled as well as the limited resources available.

Even in classrooms where written assessments are used, many of the exams that instructors create are of a subpar quality. With regard to the uniqueness of the writing style, the precision of the language, and the talents that were put to the test. There are some educators who do not even try to create their own assessments for their students. They do not create their own questions but rather use questions from previous national tests or questions from commercial publications. These methods appear to foster rote learning rather than helping to enhance the learning process, which is something that the instructor and the learners feel would boost performance on national tests that are given at the conclusion of each module. Therefore, the fact that teachers are unable to effectively assess the students in their classes and collect information that would contribute to the enhancement of the instructional procedure because of the large class sizes that they are expected to instruct, lack of competence on the part of educators to create reliable evaluation tools, and insufficient and inappropriate educational materials.

The inadequacies of teacher education programs, which place inadequate focus on the development of assessment abilities and are, as a consequence, responsible for the incapacity of a great number of instructors to devise appropriate assessment instruments, because they were not provided with an adequate amount of training

when they were in training colleges, many of the instructors working in TVET institutions are unable to use the principles of assessment for the sake of diagnostic reasoning. This is because pedagogical teaching is given a higher priority in today's teacher education programs. Researchers have been conducting studies for more than three decades with the goal of better understanding the nature and extent of teacher evaluation techniques in the classroom. These studies aim to throw some light on the subject. There is evidence that teachers do not have a solid grasp on testing and measurement as instruments for assessing student progress in the classroom.

In their research, Daniel and King (1998) came at the same conclusions as Schafer and Lissirz (1987), who had advised that instructors increase their expertise on testing and measuring. Daniel and King (1998) observed that educators do not have a sufficient knowledge foundation about the processes of testing and measuring. After another decade, in the year 2000, Campbell and Evans discovered that instructors were not using the suggested classroom assessment procedures when assessing their students' academic development, and hence were not measuring essential mathematical abilities. According to the findings of recent studies, the vast majority of students see mathematics as a challenging subject that has little relevance to the real world (Countryman, 1992; Sobel & Maletsky, 1999; Van de Walle, 2001). This misconception originates in primary school, when children are taught that the subject is too abstract and relies too much on algorithms to be fully understood. This pattern continues all the way up to secondary schools and universities, where students have the same view. Students have already lost interest in mathematics by the time they reach the secondary school level, and many of them are unable to explain some mathematical procedures (Langat, 2015).

That prior studies have taken teachers' CAPs for granted is borne out by the available evidence. This is due to teachers' focusing almost entirely on ways to enhance the effectiveness of standardized tests while paying almost little attention to the quality of classroom evaluations. As a result, routines for evaluating students' progress in the classroom have become standard. Academic assessment and grading practices get less attention from measurement experts than do issues with test development and instrument validity (Smith, 2003, p. 99). The Kenyan Ministry of Education (MOE) maintains that the current summative assessment at the end of each of the several cycles does not adequately measure students' abilities, and that standardized testing is not used in schools.

The present approach to summative assessment at the conclusion of several cycles is essentially test-based, as opposed to growth-oriented. Assessment must be embedded deep inside the instructional process to be in line with Vision 2030 and to increase student accomplishments, competencies, and skills. In other words, rather than judging the teacher, the students should be evaluated in an effort to foster future self-sufficiency via the cultivation of imaginative, creative, and entrepreneurial spirits. Overemphasis on testing has led to a reduction in opportunities to participate in educational and vocational programs that value hands-on experience in the workplace. During teaching, students are exposed to the content that is likely to appear on exams, and they may be asked to memorize this material by hearing it often. According to Countryman (1992), many pupils find the principles and methods that are used in classroom mathematics to make little to no sense. They are able to commit instances to memory, follow directions, complete their assignments, and participate in assessments; yet, they are unable to explain what their results mean.

Boit, Njoki, and Chang'ach (2012) argue that the level of test-taking stress has a greater bearing on whether or not students retain the knowledge and abilities that are being taught. The authors' study reveals that students are unaware of the existence of these talents, and that teachers often introduce them towards the conclusion of the course, rather than weaving them throughout its numerous topics. This, says Khalid (2007), has the unintended consequence of leading educators to assume that they need only address mathematical thinking and problem solving towards the conclusion of the curriculum, after students have completed all of the courses. This highlights the need of fostering the learner's capacity for mathematical thinking, not only so that they can do arithmetic computations, but also so that they can lay a solid foundation on mathematical concepts that will serve them well in the long run. Learning and internalizing mathematics is beneficial since it can be used to many different fields of study and daily life. Because of these factors, the study concentrated on determining the CAPs that are most often utilized by mathematics instructors working in classrooms located inside TVET Institutions.

1.3 Purpose of the Study

The purpose of the study is to determine classroom assessment practices of mathematics teachers in Technical Vocational Education Training Colleges (TVET) in Kenya.

1.4 Objectives of the Study

The following aims served as the basis for the research:

i. To determine the common *classroom assessment practices* used by mathematics teachers in TVET institutions;

ii. To identify *assessment tools* and formats used by mathematics teachers in TVET institutions;

iii. To establish how mathematics teachers in TVET institutions *utilise assessment information* collected from the students in the classroom;

iv. To determine mathematical *competencies* that mathematics teachers in TVET institutions consider when constructing items for classroom assessment.

1.5 Research Questions

The following questions served as the basis for the research:

i. What kind of common *classroom assessment practices* are used by mathematics teachers in TVET institutions?

ii. Which *assessment tools* and formats are used by mathematics teachers in TVET institutions?

iii. How do mathematics teachers in TVET institutions *utilise assessment information* collected from the students in the classroom?

iv. Which mathematical *competencies* are considered by mathematics teachers in TVET institutions when constructing items for classroom assessment?

1.6 Significance of the Study

The study's results should help math educators, school administrators, educators, the KNEC, the Kenya Vocational Education and Training Authority (TVETA), and the Kenya Ministry of Education's Directorate of TVET implement, use, or formulate policies governing educational assessment to raise standards in TVET teaching in

Kenya. Mathematical achievement in the classroom was also expected to rise as a result of the investigated CAPs since they were seen as a crucial means of improving teacher assessment methods.

The study's results laid forth a road map to help educators better incorporate new assessment strategies into their existing assessment routines. Educational interventions addressing the problems with classroom assessment at TVET institutions may be inspired by the results, which may have implications for scholarly study, theory, and practice. Prototypes developed from this research might help the TVETA in its efforts to monitor education quality, which would enhance teacher evaluation processes. The results may prompt this adjustment. Assessment results are used by the Ministry of Education-DTVET as a measure of the program's efficacy. Last but not least, the results may provide a foundation for master's students in the Department of Psychology, School of Education, Measurement, and Evaluation who are interested in pursuing the subject of CAPs by instructors at TVET schools. Competency-based evaluations, or CAPs, are used by the Ministry of Education and DTVET to measure program effectiveness.

1.7 Limitation of the Study

The study was limited in scope and a number of factors including time and financial constraints. The study was also limited in terms of conceptual, contextual, and methodological perspectives. The study used cross-sectional survey design since it is one of the most appropriate method available to time and financial constraints. Cross-sectional design lacks the power to test causal relationship. Whereas cross-section design sheds light on the strength and direction of relationship between variables,

findings are not conclusive with regards to causal linkages. The study was also limited to TVET institution within Nairobi County.

1.8 Delimitation of the Study

The delimitation of the study refers to the confines within which the research is going to be conducted (Best and Kahn,1993). The participants in the research were restricted to mathematics instructors and Directors of Studies (DOS) from TVET colleges located in Nairobi County. The research focused on TVET institutions that have participated in the KNEC Artisan, Craft Certificate, Diploma, and Higher Diploma Technical examinations and had submitted candidates for those exams. TVET Business testing centers were not allowed to participate, despite the fact that they may provide valuable information for these could be biased.

1.9 Assumptions of the Study

Many presumptions underpin this research, the most crucial of which are that the respondents' responses are true and founded in integrity and that the participants themselves are a fair representative of the student body at Kenya's Technical Vocational Educational Training (TVET) schools as a whole. It was assumed that there will be an equal number of participants in each of the categories that have been established. All of this was done so that each group may be accurately compared to the others (gender, years of teaching experience, nature of teacher training program, and location of the institution and course levels as Artisan, Craft, Diploma and Higher Diploma). It is also assumed that the variables under study can be quantified and that the reliability and precision of the data gathering mechanisms can be relied upon. After the data had been analyzed, it was intended that the results would be

extrapolated to a larger population, and that these results would still be of interest to the stakeholders. Study participants were also assumed to get CAPs from teachers at all stages of university instruction.

1.10 Definition of Terms

Assessment – a methodical approach to collecting, evaluating, and interpreting evidence in order to evaluate how closely student learning corresponds to expectations, as well as making use of the gathered data in order to guide improvements in student learning.

Classroom Assessment Practices (CAPs)- Assessment in the classroom covers a broad variety of topics, including instructors' attitudes about and use of assessment training, test design and administration, and grading and feedback on student work (McMillan, 2008; Nitko, 2001; Popham, 2008; Reynolds, Livingstone & Wilson, 2009).

Learning Achievement – what one has picked up via conventional academic training

Evaluation – assessment of learning outcomes, or how well courses are producing desired results

Standardized tests - Summative in nature, these national exams are designed by experts in the field of testing and are used for very important purposes including selecting and placing students in further courses of study (Popham, 2008; Reynolds, Livingstone & Wilson, 2009).

Classroom Assessment tests - Formative assessments are those that instructors create, give, and score in order to gauge their students' progress in class. They serve as a means of collecting information on and providing guidance to students.

Test – a structured, methodical approach of gathering information on students' actions.

Artisan Certificate – the level of courses that produce skilled workers in specific trades (artisans)

Craft Certificate – the level of post school courses that produce skilled technicians (craftsmen)

Module –part of a course offered as an independent unit that imparts skills necessary for employment

Modular – a course consisting of modules

Mathematics as a discipline- Analytical research into concepts like numbers, shapes, and diagrams. Many models in abstract mathematics originate from strictly mathematical or logical considerations, while others are drawn from empirical or applied disciplines. Algebra, Analysis, Geometry, and Applied Mathematics are some of the cornerstones of the mathematical discipline.

CHAPTER TWO

LITERATURE REVIEW

2.1 Related Studies on Classroom Assessments Practices

Assessment, or the practice of carefully gathering data on what students have learned, is a vital aspect of the classroom experience (Dhindsa, Omar, & Waldrip, 2007). Assessment has a clear and noticeable effect on student outcomes, as argued by Struyven, Dochy, and Janssens (2005). Students' perspectives on homework and exams are shaped by their overall approach to learning (Struyven et al., 2005). Recent research has argued that student input should be included into the design of assessment tools because, as Falchikove (2004) argues, peer evaluation including students improves the quality of education.

Students' mathematical achievement may be affected by classroom evaluations like homework (Sitko, 2013). Assessment is described as the procedure wherein data is gathered for the purpose of informing educational choices, providing students with constructive criticism of their own learning, gauging the success of teaching strategies and course content, and informing policy (AFT, NCME, NEA, 1990: 1). Assessment, as defined by Greaney (2001), is any method or action used to collect data on a learner or a group of learners' understanding, perspective, or skill set. Many different qualitative and quantitative methods may be used in this procedure. There are a variety of ways to gauge a learner's proficiency in a language, including standardized tests, oral exams, portfolios, and practical activities. Evaluation of learning (summative assessment) and assessment for learning (formative assessment) are two

independent but associated forms of assessment that may be used in the classroom (Stiggins, 1998).

In general, exams are helpful assessment tools, but other techniques and tools, such as journal writing, diagnostic interviews, and observations, are helpful assessment tools for learning (Pophan, 1999; Stiggins, 1998). One may draw the conclusion that the instructors placed a primary emphasis on evaluating students' progress in terms of their learning since the teachers cited exams as one of the methods they use to evaluate their pupils. It is necessary to evaluate not just what pupils have accomplished but also how they are learning. This evaluation should take precedence. According to Brooks and Brooks (1999), placing more of a focus on evaluation as a tool for learning is likely to result in higher levels of academic accomplishment among students. In conclusion, evaluation of learning is handled via assessment designed to promote learning.

According to Dhindsa, Omar, and Waldrip (2007), students are more likely to develop an authentic and realistic assessment system that rewards true effort and in-depth learning than gauging chance when instructors inquire about students' perspectives on evaluation (p. 1262). As a result, evidence suggests that students should take some measure of responsibility for their own education. Including students' thoughts on evaluation in this study seems to be a promising next step. The concept of assessment in schools did not emerge until the 20th century. Based on the premise that formative and summative assessment are complimentary to one another, Michael Scriven (1967) proposed using them to distinguish between the many roles of evaluation.

As a result, assessment is seen as having two functions: I formative, to guide teaching, and (ii) summative, to evaluate students' performance (Scriven, 1967, p. 41). Assessment is being used to improve the teaching and learning process as well as for accountability reasons (Gordon, 2008). Pellegrino and Goldman (2008) and Shepard (2000) agree with other authors that there are ways to enhance classroom assessment to boost student learning. These include modifying the assessment's content and characteristics, making better use of assessment results, and making assessment a required course for aspiring teachers.

Evaluation paradigms have moved from evaluating the learning of learners to assessing learners for learning since assessment has a substantial impact on how students approach learning (Birenbaum & Feidman, 1998, p. 92). Recent ways to assessing students are making an effort to enhance the congruence between what students need to learn and what it is anticipated that they will know after they have completed their education (Gulikers et al., 2006). The issue that has to be answered is whether or not students are taught in order for them to do well on a test, or if they are taught in order for them to create meaning that will be maintained over time.

According to the findings summarized by Dhindsa et al. (2007), instructors "compromise learning for drilling pupils on the items for which they will be held accountable" (p. 1262). This argument requires careful consideration since there is room for variation in the levels of responsibility placed on teachers both over the short and long terms. As a result, this study provides new information on how well conventional teaching and assessment techniques prepare students to use what they've

learned in real-world contexts. Unlike the emphasis of another body of study, which focuses on the practice of teaching to the test.

Different groups use assessments for different reasons, as stated by the authors Cavangah, Waldrip, Romanoski, and Dorman (2005). Members of the student body, faculty, parents, educational institutions, and governmental bodies all fall under this category. The majority of assessment is decided upon by teachers and principals, however the goals of assessment might change depending on who is doing the evaluating.

As stated by Goodrum, Hackling, and Rennie (2001), assessments play an important role in the educational process. Please note that this is a paraphrase that requires a reference to the following source: (p. 2). Teachers only utilize a small number of assessment methodologies and practices, according to the study's findings, and there is little proof that they use formative assessment to shape their lessons (Goodrum et al., 2005, p. 2). Because the decisions made by students and teachers, as well as the justifications given by teachers, may have an impact on how students are taught and assessed, it is important to get their feedback throughout the design phase of assessment tools.

According to Goodrum et al. (2002), assessment should "increase learning, offer feedback regarding student progress, create self-confidence and self-esteem, and develop competence in evaluating" (p. 2). They also claim that students do better in class when there is a connection between what they are taught, how they are tested, and their final grades. To measure the effectiveness of teaching methods and student

learning, assessment is crucial. These aspects of assessment serve as the cornerstone for the present research project, which focuses on the perspectives of students towards assessment in the classroom. After that, teachers may conduct an analysis of their assessment procedures and determine how much their pupils, in their capacities as students, are aware of assessment in the classroom. Even though there is less evidence to support the idea that students should be included in decision making about assessment assignments, this view has been widely disseminated in the past due to study bias. As just one example, consider the need for research on student involvement in classroom assessment made by Fisher, Waldrip, and Dorman (2005).

Neither the advantages nor the disadvantages of letting students take part in the assessment process of a classroom teacher have been shown by empirical study. In light of the limited amount of research in this area, Cavanagh et al. (2005) advise that two other approaches should be used instead: 1) Conduct research on the various assessment forms and methods that instructors use; 2) ask students about their perspectives on assessment. This research will be enriched by taking a closer look at the ways in which students and instructors think about the function of assessment in the classroom, as well as how students approach learning. Firstly, this is because students' perspectives on assessment will influence their preferred means of learning, which in turn will affect their academic achievement (as this is discussed in the literature). Second, including educators' perspectives will enable for the development of a basis and a justification for the assessment method used in classrooms. This will allow us to discover how and to what degree students' views on assessment in the classroom affect their education.

Due to its central role in evaluating students' development, educators must be equipped with the necessary understanding of and practice with CAPs. A thorough familiarity with their pedagogical practices is crucial, particularly with regards to their analysis and evaluation of the results of student learning. McMillan, Myran, and Workman (2002), who set out to define the nature of assessment and grading methods in the classroom, found that instructors were primarily focused in measuring students' mastery or success, and that performance evaluation was employed often. Moreover, they discovered that educators often use a rating system with five levels (one being the lowest and five the highest) when evaluating pupils. Most middle and high school instructors, according to Morgan and Watson (2002), employ assessments they created themselves to evaluate their students' learning. A national survey of high school mathematics teachers was undertaken by Cooney (1992), who showed that the vast majority of educators surveyed used short-answer exams as their main means of assessing students' progress. According to the findings of the research, evaluation materials published by publishers have a significant impact on teaching methods. The educators employed the pre-made examinations without making any adjustments to them (Cooney, 1992; Garet & Mills, 1995).

Frequently assessing students' mathematical knowledge is critical, according to Sgroi (1995), and classrooms should be set up in a manner that encourages student engagement and allows for the investigation of new themes, he believes. He went on to suggest that educators keep tabs on children' mathematical development in a variety of ways. William J.S.B. (2005) discovered in his study of mathematics teachers' attitudes and methods that they have limited options for evaluating their pupils' progress outside standardized testing. He came to the conclusion that while

though instructors handed out individual activities to students near the end of each and every class, the purpose of such exercises was for the students to put into practice and further develop the skills that the instructor had just displayed. Using this method aids in the encoding and long-term retention of operational processes. Based on these findings, researchers recommend that teachers employ a variety of methods to track their students' mathematical development in the classroom.

Teachers may get insight into their students' mathematical thought processes via the use of techniques including journaling, learning logs, probing questions, observation, clinical interviews, and thinking aloud (Fennema and Romberg, 2001). According on data collected from interviews with practicing educators, Barsdale-Ladd and Thomas (2000) have established a core set of competencies for assessing students in the classroom. Teachers are urged to (a) use assessment as a form of formative feedback, (b) treat assessment as an integral part of a student's work, (c) allow for some wiggle room in assessment so that it doesn't take over the curriculum, (d) use assessment to inform instruction and enhance teaching practices, and (e) employ a variety of assessment strategies when evaluating students' progress.

High-quality evaluation methods, according to Vandeyar and Killen (2003), should adhere to essential criteria that are not exclusive to any particular pedagogical setting. Validity, reliability, fairness, discrimination, and significance are all crucial evaluation factors. Vandeyar and Killen argue that teachers may benefit from an educated framework for using assessment data to make better informed judgements if they have a firm grasp of the relevant ideas and know how to use them correctly. When educators fail to grasp these fundamentals, the assessment procedures they use

are more likely to result in the generation of information that is meaningless. Pre-service teachers who have received education evaluation training were the subjects of a study by Campbell and Evans (2000). From their research, they concluded that many of the suggested evaluation processes were not being followed by student instructors.

Three barriers to using various assessment strategies in the classroom were highlighted by Beckmann, Senk, and Thompson (1997). To begin, not all professors were well-versed in the different testing formats. Second, educators lamented a lack of prep time for standardized tests. Third, teachers didn't feel comfortable experimenting with novel modes of evaluation because they didn't think there was enough professional guidance. McMillan (2001) looked at how instructors in secondary schools really assess and grade students in their classrooms. The study's goal was to ascertain whether significant correlations existed between teachers' evaluation methods, students' aptitudes, and the grades, subjects, and topics they were studying. McMillan found no link between instructors' assessment strategies, student grades, teachers' subject areas, or students' abilities.

2.2 The Education System in Kenya

Vision 2030 for Kenya calls for the country to become a newly industrialized middle-income nation by the year 2030, providing its population with a secure and comfortable level of life. In order to accomplish this goal, Kenya's primary focus will be on the production of industrial products and services that can be exported to other countries and used to bring in substantial foreign exchange revenue for the nation. However, specialists in the area of development economics have long understood that

a country's economy must be one that is open to new ideas in order to accomplish such progress. On the other hand, the realization of a technologically inventive economy is to be attained via economic innovation. If a country wants to reach a critical mass in terms of industrialization and technical growth, it must first ensure that it has a critical mass of technicians and engineers who are well-prepared to act as a driving force behind the progress (Sessional Paper No. 14 of 2012, MOE 2012). Using Kenya's Constitution from 2010 as a background, this debate outlines training shortages that may be exploited by TVET institutions based on the roles of county and national governments as specified in the Fourth Schedule of the Constitution.

Since 1985, Kenya's public education system has followed an 8-4-4 model, with students spending eight years in primary school, four years in secondary school, and four years in higher education. The first part of Kenya's 8-4-4 education system is called Primary Education. Students in Kenya take a national exam in the eighth grade in order to earn the KCPE. Secondary schools in Kenya endure for four years, whereas the National Vocational Certificate in Education and Training (NVCET) from Vocational Training Colleges may be earned in as little as one year. In order to get a KCPE, students take a national test at the end of their fourth year of secondary school.

KCPE examination is graded as follows:

Marks	**Grade**
Over 70	A
75- 79	A-
70- 74	B+
65- 69	B
60- 64	B-
55- 59	C+
45- 54	C
40- 44	C-
35- 39	D+
30-34	D
25-29	D-
Below 25	E

KCSE Examination is graded as follows

Grade	**Remark**
A	Very Good
A-	
B+	Good
B	
B-	
C+	Average
C	
C-	
D+	
D	Weak
D-	
E	Poor

In Kenya, Learners who score average mean grade of C+ and above in KCSE are admitted in Universities for Bachelor's degree programme which take four years. Admission to programmes leading to certificates and diplomas requires a D+ or C- average in KCSE examination respectively and is mostly offered in TVET) institutions and take two and three years respectively. According to Kenya National Examinations Council Statistics (2018), 5.46% of the candidates who sat for KCSE examination scored average of grade C+ and above implying that 94.54% did not

qualify for admission in universities for Bachelor's degree programme and therefore were to be enrolled for Artisan or NVCET, Craft certificate or Diploma courses in TVET institutions.

The Policy Framework on Education and Training on Reforming Education and Training Sectors in Kenya, Sessional Paper No. 14 of 2012, proposed having numerous suppliers of curriculum, exams, assessment, and training services in order to reform curriculum creation and assessment. Doing so helped keep Kenya at the forefront of international competition. In spite of this, the Kenya Institute of Curriculum Development (KICD) has remained the country's preeminent center for the creation of TVET curricula. All KICD-created TVET courses are administered by the KNEC. Public academic, technical, and other national examinations in Kenya are administered by the Kenya National Examination Council (KNEC) in compliance with the KNEC Act No. 29 of 2012.

Mathematics is taught and assessed as a subject in Artisan, Craft certificate Diploma and Higher Diploma in one hundred and fifty five technical courses examined by KNEC. In some cases Mathematics is assessed in one paper together with other subjects such as ICT and Entrepreneurship while in most cases it's a stand-alone subject. For closely related courses for example Diploma in Mechanical Engineering and Diploma in Automotive Engineering, a common Mathematics paper is administered for both courses. TVET Craft certificate is offered in two modules; Module I and II while Diploma is offered in three modules; Module I, II and III. Learners taking Diploma courses specialise by choosing specific options for instance

learners taking Diploma in Electrical Engineering have three options namely Power option, Telecommunication option and instrumentation option.

In November 2021 Examination series, a total of fifty three mathematics papers were administered in one hundred and twenty eight technical courses. Performance in mathematics papers in one hundred and one translating to (78.90%) recorded mean of below 50%. For the KNEC Technical examinations a candidate's attainment in a subject/module is indicated by a grade of which Grade 1 is the highest and grade 8 is the lowest as interpreted in the table below;

Grade	**Category**
1 2	Distinction
3 4	Credit
5 6	Pass
7 8	Refer/Fail

This study will determine classroom assessment practices in Mathematics offered to learners taking Craft and Diploma courses which recorded mean of 35.52% with 1,837 candidates in the November 2021 Examination series and has 1,800 and 2,000 candidates registered in July and November 2022 examination series.

TVET students are graduates of the Kenyan 8-4-4 system. The Kenyan government adopted the 8-4-4 system in 1985, as stated in a 2014 article issued by the Ministry of Education. A student is expected to spend 12 years in school totaling 8 years at the primary level, 4 years at the secondary level, and 4 years at the university level. It is not mandatory for children between the ages of three and five to complete a year or

two of pre-primary education before entering kindergarten. The educational system has always relied on objective-centered curricula, with a heavy focus placed on final summative assessments at the conclusion of each cycle. After finishing the primary and secondary school cycles in Kenya, students take the KCPE and the KCSE, respectively, before continuing their education in TVET colleges and universities. The drive for change in education that has arisen in response to the increased importance of summative assessment has led to the creation of the new Competence-Based Curriculum (CBC), which is meant to replace the 8-4-4 curriculum.

For children aged four and five, the 2-6-6-3 system entails two years of Pre-primary education, with the succeeding six years being divided equally between Lower and Upper Primary. Students must be between the ages of 6 and 11 to enroll in primary school, while those aged 12 to 17 are eligible to continue their education in secondary school, which also spans three years (junior and senior secondary school). The new CBC system in elementary and secondary schools moves away from an emphasis on standardized testing. The new method is meant to foster each student's potential by verifying their mastery of the basic education framework's essential skills. While the 8-4-4 system places a premium on assessment of learning, the CBC will rely on evaluation for learning. The implementation of the new system is taking place in stages, with the first phase beginning with the elementary grades. The strategy paper states that it is the goal of the government that the 8-4-4 system would be entirely phased out in secondary schools by the year 2027.

Figure 2.1 below illustrates the arrangement of the current 8-4-4 education System in Kenya

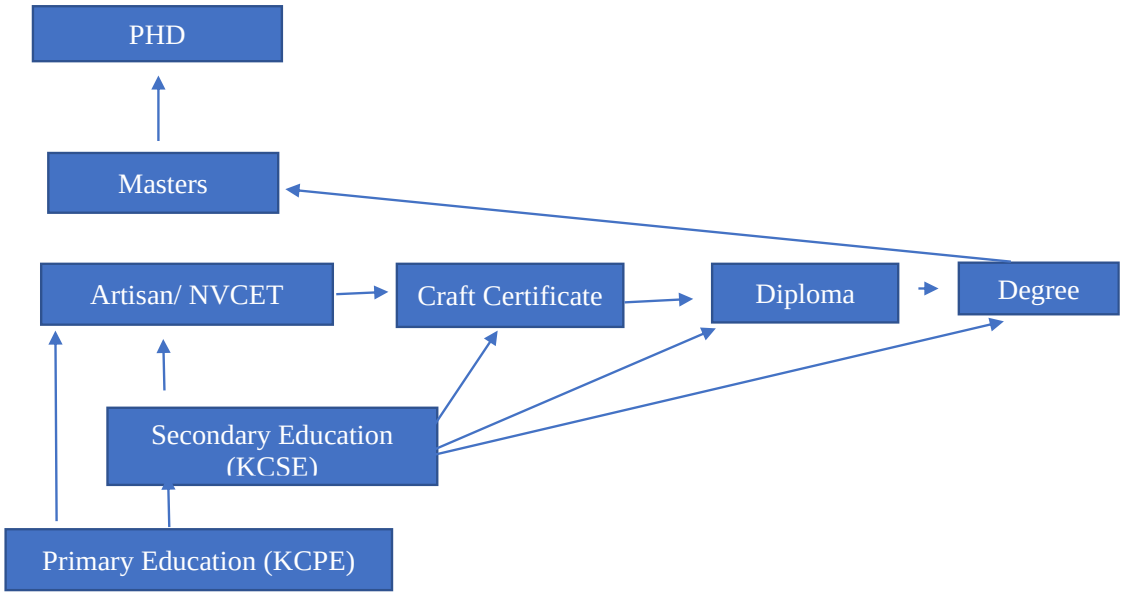

Figure 2.1: Structure of organization of Education and training in Kenya

Source: Ministry of Education

School-based assessment outcomes should be used in the accrediting process, as was recommended by the Presidential working Party on Kenya's second university in 1981. (G.O.K. 1981). Since external evaluation systems lack compassion, the Jomtien conference in 1989, which recommended Education for All, also urged reforming testing systems with that goal in mind. Classroom assessment only counts for 30% of the total, whereas summative assessment accounts for 70%, hence this has not had a major effect on Kenya's examination system.

Figure 2 below illustrates the arrangement of the newly introduced 2-6-6-3 education System in Kenya.

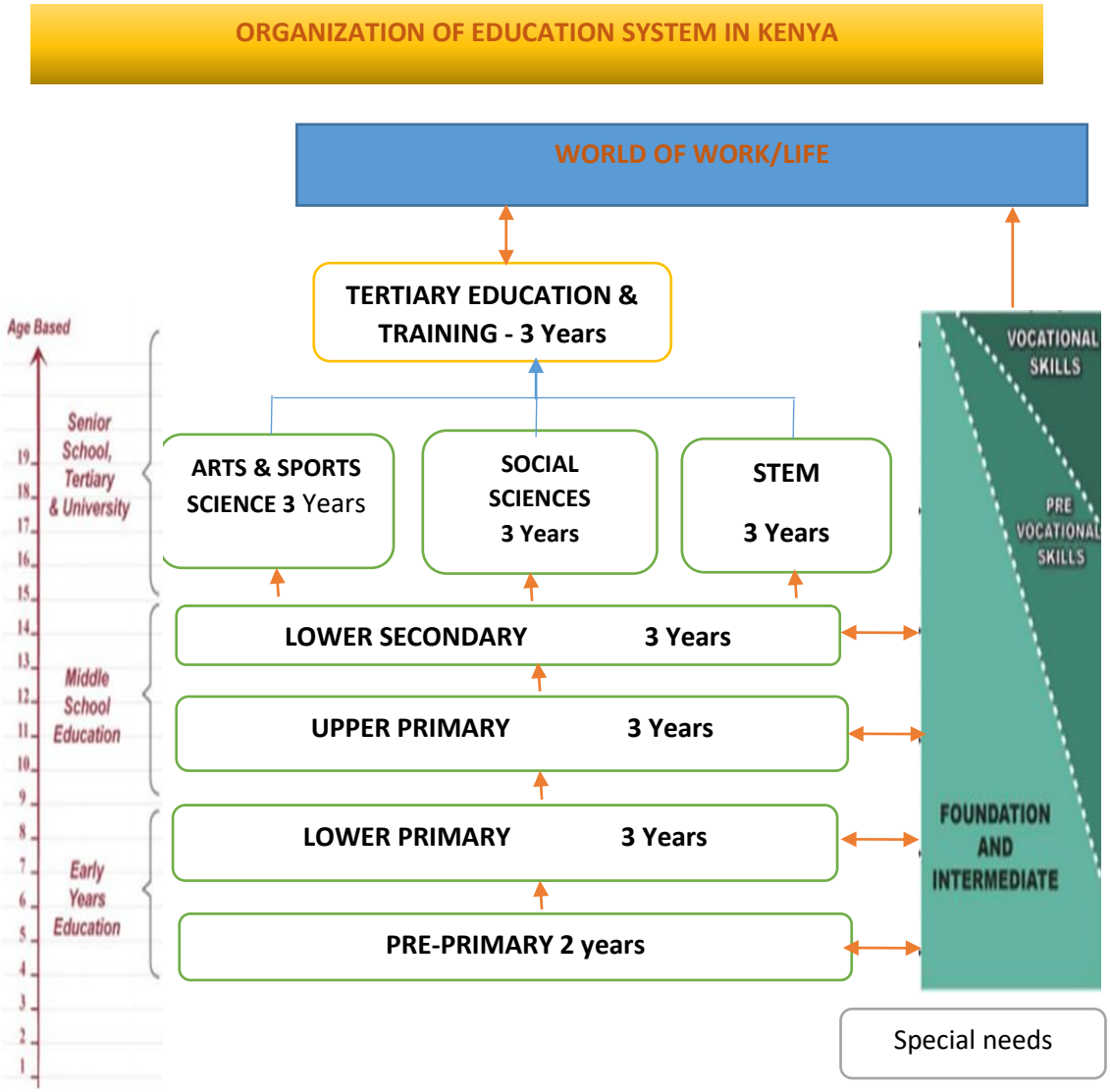

Figure 2.2: Organization of Education system in Kenya.

To guarantee international competitiveness, it was suggested in Sessional Paper No. 14 of 2012 on the Policy Framework for Education and Training that the creation and evaluation of curricula be reformed such that numerous organizations may provide these services. However, the KNEC has been in charge of grading Kenyan students' national exams and the KICD has been the principal organization recognized for designing curriculum designs.

The KNEC was established by the Kenya National Examination Council (KNEC) Act No. 29 of 2012 to organize and administer national exams in Kenya, including those

for elementary, secondary, and postsecondary education. Assessment of TVET tests is within the purview of the KNEC, which is mandated to establish and maintain examination standards and to oversee both school and post-school examinations.

KNEC offers post school examinations in the following levels and requirements for each level is as indicated in the table below;

Table 2.1: Post School Examinations in the Following Levels and Requirements for Each Level

Level	**Requirements**
Artisan	Completion of primary Education Course attendance of at least 75% of the 990 contact hours training
National Vocational Certificate in Education & Training (NVCET),	Completion of primary Education
Craft Certificate	Completion and pass in a relevant Artisan course, or Pass in National Vocational Certificate of Education and Training (NVCET)level II; or KCSE with a Mean Grade D, or KCE Division IV with passes in cluster subjects Any other acceptable equivalent qualification, Course attendance of at least 75% of the 1980 contact hours of training, where 330 hours is time allocated for Industrial Attachment.
Diploma	Pass in relevant Craft Course KCSE Mean grade of C- (Minus) and above
Higher National Diploma	Pass in relevant Diploma Course

Learners prior knowledge in TVET institutions is determined by entry requirements in each level such as KCPE qualification for Artisan, minimum of KCSE mean grade C- (minus) for Diploma and D. (plain) for Craft certificate

2.2.1 Classroom and Summative Assessment in TVET

Homework, assignments, quizzes, and self-evaluation drafts are all tools used in classroom assessment, also known as assessment for learning. This kind of evaluation is focused on the student and provides insight into both his or her strengths and areas of improvement. The second type of assessment that occurs during instruction is known as summative assessment. The purpose of evaluations such as course work evaluations and final examinations, both of which focus on the instructor and are judgemental in nature, is to determine the learner's final grade. Since 2001, the Scottish government has made the adoption of the Stiggins perspective of assessment for learning. As a result, the establishment of a cohesive assessment system, assessment for learning, has been a government priority in Scotland. The Scottish government does not gather information on all students as part of national assessments anymore; however, they do keep track of students' achievements using the Scottish survey of achievement sample survey Whetton, C. (2009). Even though testing has a lot of positive effects on education, there is still some disagreement on whether or not standardized exams are reliable or useful. Canel (1987), Linn (1989), Cravat and Sanders (1989), and Shapen (1990) have conducted research that raises doubts about whether or not changes in test score performance genuinely indicate improvements in learning. As in the case of formative assessments which teachers use as assessments for learning in most of the public and private institutions in Kenya, leave a lot to be questioned in terms of their reliability and validity.

According to Hogan T.P. 2007, dependability is the degree of consistency with which applicants' replies to an evaluation are appraised. When deciding how applicants should be ranked based on their performance, there should be consistent criteria among all assessors and candidates who are participating in the same assessment assignment for the results to be trustworthy. When choices about assessments are dependable, it is because they were derived from legitimate assessments, which were created under circumstances of assessment that were implemented consistently. The selection need to also be made on the basis of clearly established criteria of performance, and the work that has been validated by the candidates ought to be evaluated (SQA, Guide to Assessment, 2017).

The evaluating and certifying of a person's skills and knowledge are essential components of contemporary TVET programs. They make it easier for workers to move within and across countries or regions, as well as between different economic sectors (e.g. informal and formal economies). However, the evaluation and certification procedures have a tendency to reject target groups if they don't meet certain criteria:

i. The assessment is theory-driven and calls for a level of schooling that is often unnecessarily high for the corresponding competence level and for students who come from educational backgrounds with lower levels of attainment. People who have appropriate practical skills but cannot understand the requisite level of theory are not eligible for certification even if they have those practical abilities.

ii. The methods of evaluation are not suitable for the population that will be tested

iii. The amount of time that has been allotted to reach the requisite level of competency is insufficient for students who have learning difficulties and who are in lower levels of education.

iv. The costs of evaluation and certification are too expensive for low-income individuals.

v. Evaluations are held at locations that are difficult or impossible for members of underrepresented groups to reach.

As such assessment in TVET institutions should avoid such gaps. Classroom assessment was implemented in part in response to student complaints that taking an exam on a single day, over a relatively short amount of time, where question difficulty played a disproportionate role in determining test results, was unfair and unduly stressful. This action was taken because classroom assessment was introduced (Miller 1976 in Scatterly 1989). The goal of introducing classroom assessment was to gain a more true picture of a learner's skills by assessing their performance over a longer length of time and in a variety of scenarios, as opposed to depending simply on the manufactured conditions of the examination room. It is true that continuous evaluation has certain drawbacks, and as a result, relying only on it runs the risk of making the examination less reliable. In spite of this, there is no valid reason to depend only on the final test given by the institution as it, too, is not without flaws and is subject to a number of restrictions, some of which were discussed before.

The need for the incorporation of school-based assessment scores in the certification of learners' accomplishments in Kenya arose at the same period as continuous assessment became commonplace and school-based assessment became an integral part of the assessment of learners' achievements. As part of the accrediting procedure, school-based assessment findings were proposed by the Presidential working Party on the second university in Kenya in 1981. (G.O.K. 1981). The Jomtien conference in 1989, which advocated Education for All, also encouraged the investigation of the testing systems with a view to making them more compassionate. This is a trait that is ultimately lacking in external evaluation systems. Despite this, the examination system in Kenya has not been significantly impacted by this change. In accordance with the aforementioned guidelines and the confessions found in the most recent edition of the National Development Plan, which openly acknowledges that.

2.2.2 International Approaches in Assessment in TVET Institutions

Assessment in the classroom is crucial in the field of education, and it is a component of the process behind competence evaluation. Researchers Gamble (2016), Mukhtar (2015), and Ahmad (2015), as well as Sanders et al. (2016), concluded that using Assessment for Learning (AFL) is essential for implementing Competency Based Assessment (CBA) in TVET. The research's findings were recorded in the accounts of students who had utilized portfolios to advocate for AFL. Five hundred and fifty teachers from twenty Peninsular Malaysian vocational schools provided the information. The majority of vocational educators did engage in AFL, according to the findings of the survey. In addition, the educators discussed all of the difficulties encountered throughout the process of putting the AFL into effect.

Using a system that is modular, the Malaysian Ministry of Education established a technique of evaluation that is termed the Competency Based Education (CBE). This system is quite similar to the modular TVET education and assessment system that is used in Kenya. Since the beginning of vocational education in Malaysia, students' progress has been evaluated using linear assessments. However, since 2006, CBE has been used to assess students in secondary schools who want to participate in vocational education, and the curriculum has been designed in a modular fashion (MOE, 2007). This is why the modular strategy calls for a proficiency-based assessment. Competency-based evaluations are based on tried-and-true methods while also conforming to cutting-edge theories in the field of education (Higgins, Hartley, & Skelton, 2002). Portfolios are one of the techniques that are used in the evaluation of competence. Since the advent of competency-based assessment in many regions of the globe, the use of portfolios for the purposes of evidence collecting and evaluation has become widespread (CBA). A portfolio method to evidence collecting entails compiling several pieces of evidence of one's capabilities into a format that is organized for the purpose of evaluation. The learner is responsible for gathering evidence (which is often stored in a file), indexing it, and mapping it to the performance requirements, which may range from assertions to crucial evidence to the underlying knowledge of the certification (Davies, & Le Mahieu, 2003).

The evaluation done in the classroom has been questioned, as stated by Chong (2009), due to the fact that it lacks dependability in particular. As a result of this, several writers have emphasized the need of harmonizing the instructors' talented judgment with the nationwide testing in order to ensure that the nationwide assessment schemes

are comprehensive, rigorous, and meaningful, which will ultimately improve teaching and learning (Queensland Studies Authority, 2009; Pellegrino, Chudowsky & Glaser, 2001). Formative assessment, as argued by Popham (2008), provides teachers with valuable feedback that helps them tailor lessons to students' individual needs (Kovalik, 2002 as cited by Eggen, Kauchack, 2004). Assessment helps learners become more motivated to study by enabling them to improve their present grades via more knowledge acquisition.

In most cases, assessment serves many purposes and involves a wide variety of stakeholders. Assessment yields information that may assist in the improvement of students' learning as well as the improvement of instructors' instruction. In a similar manner, Hill (2008) outlines the job of evaluation, but places more of a focus on ensuring that students realize their full potential:

To ensure that every student reaches his or her full potential, assessment in the classroom is used to improve both student learning and teacher teaching (p. 136). In most cases, instructors realize that assessment is an important step in student development. It's generally accepted that assessing students needs to take place during classroom discussions. The focus of vocational education and training has shifted in recent years from results and competences to the actual content of courses. It is widely agreed that a competency assessment needs to do the following at a minimum: define its purpose; obtain proof of skill using ways that make sense for the task at hand; evaluate the data in light of the required skills; draw conclusions about the assesses competence based on those conclusions; record and report the results to

relevant parties (Gillis & Griffin, 2008). Gathering and reporting evidence is crucial at every stage of this process.

The Kenyan TVET education system can be compared to that of Malawi in Africa where its referred to as The Technical, Entrepreneurial and Vocational Education and Training (TEVET) System which is based on the principle of Competence Based Education and Training (CBET); a methodology which is embraced in delivery and assessment of all TEVET programmes. TEVET assessment in Malawi has two levels of verification, namely; Internal and External where by Internal verification is done within an institution to ensure a fair, valid and reliable assessment process is done by a trainer other than the subject instructor/assessor at an accredited centre other than the trainer of a particular occupation while external verification is the process of checking consistency of the conduct, fairness, validity and reliability of the assessment process both at the institution and the industry. This is done by an external trainer/expert to check the internal verification process authenticating.

Similar to Kenya, KNEC sends external assessors to assess students in practical subjects during administration of summative assessment. The marking of formative assessments in TVET institutions in Kenya is purely done by subject teachers in the institutions and scores submitted to KNEC to account for 30% in the final examinations, this raises concerns in regard to reliability of classroom assessment scores as the teachers might be subjective or biased in marking and therefore this study is necessary to evaluate different classroom assessment practices and formats used by Mathematics teachers in TVET institutions as well as mathematics competencies considered when developing classroom assessment.

2.3 Assessment Formats

Because classroom evaluation may cover such a broad array of learning objectives and abilities, it is necessary to use many distinct types of assessment methods. According to Black and William (1998, page 19), the evaluation process need to be included into the whole procedure of teaching and learning. This necessitates the use of a variety of sophisticated assessment methods, such as written, oral, and demonstrative forms, and assessment formats that aim to evaluate students' level of knowledge and their gaps in that knowledge. Thus, it is crucial to utilize alternative assessment tools including rubrics, concept maps, portfolios, student diaries, self-evaluations, and peer or group assessments to identify students' real knowledge and development (Anderson 1998; Birgin 2011).

How long an exam takes, how realistic its tasks are, and how difficult they are the most telling indicators of whether an evaluation method is traditional or non traditional (Gronlund, 2006). Conventional exams, such as those consisting of multiple-choice questions, true/false questions, and matching exercises, are simple to design and mark, but they fail to adequately capture the nuances of the activities being evaluated (Gronlund, 2006). Portfolios, observations, and other performance-based assessments, in contrast to traditional examinations, are more realistic and complicated in terms of the activities that are reviewed; yet, they take much more time to utilize and grade (Gronlund, 2006). To those who favor nontraditional exams over the traditional ones, the main argument is that students will be more intrinsically motivated to do well (Shepard, 2000). The following is a rundown of the many assessment formats:-

i. **Select-type items**- multiple-choice, true-false, fill-in-the-blank, and matching questions.

ii. **Closed-open questions**- The student will be expected to respond with a number, a yes or no, a definition, a straightforward graph, or a formula.

iii. **Open-open questions**- The student is expected to provide an answer in the form of a number or a formula, but the path to arrive at that answer involves higher-order thinking.

iv. **Extended response-open questions**- student is expected to provide an explanation of his or her line of thought as part of the answer.

v. **Super items**- Activities that encourage student participation in a given context or issue scenario by posing a sequence of open questions of progressively more difficult levels as the students go through the tasks.

vi. **Multiple-question items**- A collection of things derived from a single context or issue scenario, with the range of questions forming a framework that is not placed in a particular rigid sequence.

vii. **Essays**- efficient in assessing complex outcomes such as the capacity to develop, organize, integrate, and express oneself, as well as other capabilities that entail the generation and synthesis of ideas.

viii. **Oral Tasks and Interviews-** Mathematical topics that the students already know, topics that the students have been given 20 minutes to think about before the discussion, and topics that the students have already worked on for homework are all fair game for an oral discussion.

ix. **Journals-** creating diagrams and charts, composing mathematics, sculpting and clarifying thoughts, and stumbling across new insights.

x. **Concept mapping-** used to demonstrate students' conceptualizations of the interconnections between major ideas and words in a field of study.

xi. **Progress- overtime tests-** The use of essentially identical test items or problems throughout administrations, despite the fact that progressively more difficult tasks are being introduced.

Utilizing a variety of approaches to test-taking allows for the collection of many forms of information pertaining to the pupils. Learning outcomes, such as conceptual development, skill acquisition, and application, will be assessed using a wide variety of assessment techniques. In the end, achieving the fundamental goal of assessment which is to get a more in-depth and significant knowledge of what children know and are capable of doing can be accomplished via the use of a wide variety of data gathering forms.

2.4 Classroom Assessments Practices

Assessment encompasses a broad variety of classroom activities, including but not limited to the development of tests and performance metrics, grading, analysis of standardized test results, communication of findings, and incorporation of findings into instructional decisions. Paper-and-pencil tests and performance measures should be used with caution and teachers should be aware of the benefits and drawbacks of various assessment methodologies in order to choose appropriate formats for measuring a wide range of student accomplishment. Educators have difficulties when trying to improve assessment procedures and make judgments because of the inherent contradiction between instructors' opinions about assessments and the values they

carry along with them. This is the primary reason why teachers have such a difficult time with these tasks (McMillan, 2003).

Assessment in the classroom involves a broad variety of methods for the continual evaluation of student success and development. These methods include formal examinations and quizzes, worksheets, homework assignments, and informal evaluations of student involvement, effort, and behavior. There is as much variety in the ways that students are assessed in the classroom as there is in the ways that they are taught (McMillan, 2004). Traditional methods of evaluating students' knowledge and skills often include conducting summative tests at the conclusion of training, either at the completion of an instructional unit or after a predetermined amount of time spent studying. Traditionally, educators have relied on examinations that are objective and that evaluate certain talents by posing neutral questions or providing arbitrary circumstances.

According to Gronlund (2006), one common way to classify the differences between conventional and alternative evaluation techniques is by the degree of realism and complexity of the assessment tasks, as well as the length of time required for the evaluation. Multiple-choice, true-false, and matching-type tests are examples of time-saving traditional assessments, although they tend to be less realistic and less demanding in terms of the underlying tasks (Gronlund, 2006). Traditional methods of evaluating a student's knowledge and skills often involve filling out worksheets and taking multiple choice tests. Alternative methods of evaluating a student's knowledge and skills, such as portfolios, observations, and other performance-based assessments, are more realistic and complex in terms of the tasks that are evaluated, and they take

significantly more time (Gronlund, 2006). There has been a shift in recent years toward the use of alternative evaluations rather than the more conventional types of assessments. The idea that alternative assessments provide a higher level of intrinsic motivation than conventional ones is the cornerstone of the case made for why traditional assessments should be abandoned in favor of alternative ones (Shepard, 2000).

NCTM (1995) describes assessment as acquiring information on a student's knowledge, aptitude to utilize, and attitudes toward mathematics and generating judgments based on that data to fulfill various objectives. This definition can be found in the Assessment Standards for School Mathematics document (p. 3). Any method that is used to evaluate the mathematical knowledge of students should include meaningful goals and objectives (Lin, 2006), as a result of which the results of the evaluation can be put to use in making appropriate instructional decisions (Romagnano, 2001), as well as in assisting teachers in determining how to improve mathematics instruction and education (NCTM, 1989). "We must guarantee that exams measure what is of value, not merely what is simple to test," said the National Research Council's "Everybody Counts" (1989) study (p. 70). Consequently, assessment should serve as a "bridge between teaching and learning," assisting educators in amassing information on student performance to better adapt instructional strategies (Wiliam, 2007, p. 1054).

Educators in the subject of mathematics often place equal importance on students' mathematical practices as they learn and teaching as they learn specific mathematical facts (Kilpatrick, Swafford, & Findell, 2001; Ma, 1999; NCTM, 1989, 2000, 2006).

By putting their conceptual and procedural knowledge of mathematics to use in practice, students are able to build their own understanding of mathematical concepts.

2.4.1 Paradigm shift to Alternative Assessment Practices

Constructivism, which alternative assessment is founded on, emphasizes the necessity of students developing and delivering solutions as opposed to picking or choosing them. Piaget's and Vygotsky's theories stress this importance (Dogan, 2001). Janisch, Liu, and Akrofi (2007, page 221) elaborate on the significance of using various evaluation methodologies in educational settings as follows: Consideration of students as knowledge constructors, discovery of authentic materials and activities, use of dynamic, ongoing evaluation tools, and student empowerment are all components of the theoretical framework that underpins the implementation of alternative assessment strategies in academic settings. Students may be encouraged to develop their particular characteristics such as initiative, choice, vision, self-discipline, compassion, trust, and spontaneity by putting these principles into practice.

When the alternative evaluation paradigm was in its infancy, Murphy and Torrance voiced some of its first concerns and aspirations. Assessments' psychometric purity and reliability are less of a priority for us than their usefulness in the classroom and the ability to provide meaningful information about students' academic progress. This sort of success is hard to quantify, but it is very desired from the perspective of those who care about the skills and knowledge their students gain as a result of their educational experience. Scientific contributions by Murphy and Torrance (1988).

According to their predictions, there will soon be a renewed focus on evaluation methods that provide an accurate image of students' knowledge and abilities. As a figurative means of expressing the idea that evaluations need to value comprehensive knowledge and promote deep comprehension (Hildebrand, 1996). As opposed to comparing one's accomplishments to those of others or to a set of standards, this one focuses on one's own accomplishments (Gipps & Murphy, 1994, p. 261). As a result of this shift in focus, assessment is no longer primarily concerned with sorting students into planned curricular and instructional programs, but rather with linking individuals and groups of students in mutually beneficial learning experiences (LaCelle-Peterson, 2000). This requires an individual approach to teaching and learning, with the assumption that each learner has unique needs. Instead than aiming for a utopian world where everyone has the same opportunities and experiences.

Therefore, fair and just assessment procedures and the interpretation of test scores are what we mean when we talk about ensuring equity in the classroom (Gipps & Murphy, 1994). The focus on enabling each student to blossom into his or her fullest potential underlies the transition from seeing evaluation as a "measure of learning" to a "aid to learning." Gipps (1994) argued persuasively in her book Beyond testing that changes to the traditional evaluation responsibilities of teachers and students are essential to accomplish the assessment reform vision endorsed by the current movement towards assessment for learning. The teacher's traditional function of information delivery has given way to that of facilitator, while the student's traditional position as receiver has given way to that of active creator of their own learning. According to the new paradigm, educators and students alike should see assessment

as a means of gathering context-specific information that can be used to inform and improve classroom practices.

This is made glaringly clear by Cross's attempts to give teachers a taste of their expanded roles in rethinking classroom assessment: Assessment in the classroom has a dual function: it gives instructors feedback on their teaching methods while also giving students an opportunity to demonstrate what they've learned. Continuous evaluation in the classroom allows teachers to determine whether and how well their students are learning the material being presented. In addition, students are required to take part in a wide range of in-class formative assessment activities designed to help them track, reflect on, and better their own learning (Cross, 1998, p.6). The knowledge that students cannot depend entirely on the evaluations that are offered by their teachers is one of the most important components of the new assessment scenario for the classroom that Cross (1998) brings to light. Although these assessments may provide students access to high-quality formative input, they must also be able to self-monitor their progress in order to advance in their education (Sadler, 1989).

Self-evaluation is fundamental to the constructivist approach to learning because it emphasizes the need of knowing one's own learning goals and comparing them to those of one's work (Black, 1999, p. 126). It is widely agreed that students need to have a deeper understanding of their own abilities as thinkers and learners, a more nuanced grasp of how to approach different types of problems, and a more strategic grasp of how to use their knowledge to their advantage in the classroom. This is because growth in all three of these areas is necessary for pupils to effectively learn

(Alexander et al., 1991). As will be shown in the next section, successful formative assessment relies heavily on students' capacity to serve as their own objective evaluators. This is because it is recognized that the progression of students is dependent on their understanding of their own strengths and weaknesses, as well as the methods by which they can address these issues (Harlen & James, 1997):

i. **Discourse**- Communicating via means of talking about, explaining, defending, showing, and comparing (features of reasoning in a mathematics classroom)

ii. **Observation-** utilized to evaluate students' abilities individually and collectively, as well as their degree of preparation for and comfort during debate.

iii. **Student self-assessment-** The process of self-reflection and increased student agency in the classroom.

iv. **Peer assessment-** review another pupil's oral presentation, evaluate conventional examinations, and design examination questions.

v. **Own productions-** welcoming students' proposed solutions to mathematical difficulties

vi. **Projects-** work carried out by a person or a group during a certain time frame

vii. **Portfolio**- Assembly of related writings on a single subject for the purpose of evaluation

2.4.2 Cognitive Processes as a process of Assessment

Cognition refers to the mental processes or representations that manifest in actions like these: problem solving, learning, memory, and reasoning. In certain contexts, the term "cognition" is used instead of "cognitive" (Dunlosky & Metcalfe, 2009).

Examples of cognitive processes include information processing (particularly when requiring significant levels of abstraction or concretization) and processes involving knowledge, competence, and learning. This meaning is associated with a theory that maintains that the mind has its own private mental states (beliefs, desires, and intentions). Cognitive processes, then, are those that occur inside an individual's mind (www.scholar.google.com, 23rd February, 2019). It's difficult to understand the students' thought processes and the wide range of solutions they came up with without seeing their work, hearing their explanations, or talking to them about the approaches they used to solve the problems. Determining the mental activities that they engaged in is equally difficult to do. The cognitive processes that are linked with problem solving are broken down as follows, as described by Montague (2002) of the University of Miami:

i. Realizing the problem's language and quantitative context.

ii. Mathematical notations, methods, and equations are the end result of this translation and transformation

iii. Keeping an eye out for connections between the problem's constituent parts.

iv. Coming up with a strategy to address the issue.

v. outcome prediction

vi. Controlling the solution route in real time and fixing mistakes as they occur are two important steps in solving any issue.

It is difficult to assess pupils' grasp of mathematical concepts without probing them to explain their thought processes in solving problems and paying close attention to their work (Stylianou, Kenney, Silver, & Alacaci, 2000). Stylianou et al. (2000) did a

research in which they evaluated students' work and replies to open-ended assignments, and they discovered that when students write about mathematics, it reveals something about the students' thought processes in relation to the mathematical work they were doing. Students in this study were asked to answer questions that included both symbols and text. When solving an arithmetic word problem, some academics and teachers believe that both problem understanding and computational processes are at play (Rabinowitz & Woolley, 1995).

This view is based on the assumption that the processes required for issue representation exert a high demand on mental resources. In their 1995 paper, Rabinowitz and Woolley argue that the number of cognitive activities that may be done simultaneously is limited by the availability of cognitive resources. They conducted studies to test the veracity of the aforementioned idea about the relationship between conceptualizing the problem and using computation to arrive at a solution to an arithmetic word problem. Studies show that students' problem-solving cognitive operations are slowed down when they engage too many cognitive processes at once, hence researchers recommend that students adopt automatization. The research defines automation as "having automated operation or control of a process or system," which describes this phenomenon (Sweller, 1989; Gagne, 1983; Zentall, 1990).

They assert that the use of automated retrieval does not necessarily result in an improvement in the process of answering mathematical word problems. These writers approach the subject from the standpoint that performance in problem solving might be predicted to be impacted by factors such as issue size and problem type. The nature of the cognitive processes at play during problem solving is also a major area of

interest. They go on to assert that cognitive operations are either sequential, parallel, or sequentially cascading (one process starts before the other is completed). In order to solve a problem using conventional techniques, the problem-working solver's memory must bear a heavy load, as stated by Tarmizi and Sweller (1988). It is clear that dividing one's focus between reading the problem and doing the math required to solve it adds an unnecessary layer of complexity to solving arithmetic word problems. Due to divided focus, an interaction between issue magnitude and problem type might result.

2.4.3 Assessing Mathematical Process

It is essential for pupils to see mathematics as something that is rational, beneficial, and within their reach. Teachers should make fostering pupils' growth of a good disposition toward mathematics a top goal throughout the whole educational experience. An approach that may help achieve this goal is to target the enhancement of students' mathematical process skills (Ontario Prospects: 2002). By getting students involved in substantial mathematical processes, teachers may get a deeper understanding of their students' mental processes, which can help enhance the quality of education overall (NCTM, 2000). Students actively learn when required to keep track of their thinking, communicate mathematically, establish links to real-world situations (authentic), build connections inside and between concepts, understand and produce images, and transform mathematical ideas across representational representations (2002 Ontario Prospects, 2002). Using the Grade 5-8 Mathematics: Classroom-based Assessment document from Manitoba Education, Training, and Youth, the following is an analysis of these benchmarks (2001).

The ability to estimate, picture, and do mathematical operations in one's mind is called mental arithmetic. Mental math consists of a set of procedures that allow a person to do these things. Students are able to use their understanding of fundamental facts to calculate solutions to problems that require higher numbers when they use mental math procedures. Teachers should be on the lookout for both oral and written evidence when evaluating students' mental math skills. Mathematical reasoning may be evaluated using traditional pen-and-paper assessments. Limiting the amount of time students have to complete each exam is necessary to verify that they are using mental math skills.

The ability to make a reasonable correct conclusion based on past information or experience is what we mean when we talk about the talent of estimation. The notion of number, size, and amount may be further developed in youngsters by participation in activities that involve estimation. These activities give a wide and practical environment for this growth. Students employ their knowledge of place value, mental math skills, and algorithmic procedures in order to make educated guesses about the solutions to numerical problems. They have options like rounding off, compatibles, clustering, front-end, and modifying as tactics at their disposal. Students use their knowledge of length, area, capacity/volume, mass, time, money, temperature, and angles in order to make educated guesses about the size or amount of an object. The students need extra tactics so that they can estimate in this manner. Referents, also known as anchors, chunking, and unitizing are all examples of these methodologies.

The ability to see the interconnectedness of mathematical concepts is an important skill for students to develop, as is an appreciation for the relevance of mathematics in

other disciplines and in everyday life. A teacher or a student could lead a class discussion on any number of mathematical topics, including measurement in the industrial arts, ratio in the social sciences, integers in banking, transformations in the visual arts, and data collection, interpretation, estimation, and pattern recognition in the natural sciences. In addition to this, students need to be able to create connections between many representations of a topic, including those that are tangible, visual, symbolic, oral, and written.

When students are given problems that require them to reason mathematically, they should be able to show that they have a thorough understanding of the material. Memorizing lists of regulations and procedures isn't enough; they need to go on to doing their own research to find answers to "why" questions. In order to do this, students need to be presented with a multitude of chances to explain, justify, and improve the quality of their reasoning. Hearing the explanations that other students have to provide and having the opportunity to talk about what they are thinking in a secure setting that encourages taking risks. Students' ability to create, depict, write, and express their own ideas, as well as their ability to conceptualize and draw conclusions, may be used to evaluate their progress in relation to reasoning.

Solving Problems Students put their knowledge of mathematical ideas and abilities to use in the process of solving problems by applying what they have learned. This method includes both the analysis of mathematical issues and the posing of new ones. When it comes to problem solving, teachers need to focus on four primary areas and evaluate students' progress in each of those areas. These four categories are:

comprehending the issue, using suitable tactics, confirming solutions, and coming up with their own difficulties.

Students need to be able to articulate, in both verbal and writing form, their mathematical comprehension of a given issue. This ability is referred to as communication. The student must have the ability to communicate clearly and effectively in his or her native language so that others may learn from him or her. Students are required to show knowledge of mathematical vocabulary and concepts by explaining their thinking, backing it up with evidence, drawing and labeling their solutions, and reflecting on the learning process.

The act of constructing mental models and/or visuals of mathematical ideas and procedures is referred to as visualization. The ability to develop, draw, and describe mathematical ideas may be used to illustrate the concept's ability to be visualized. In addition to that, students must to be able to recognize mathematical principles in the models and pictures that are all around them. This may be used in the field of mathematics for engineering.

2.5 Use of information gathered from Classroom Assessment

In education, assessment serves various purposes, and a single evaluation might serve many purposes that are very different from one another. For instance, a selection test's results may sometimes affect instruction, and a learner's portfolio of completed classroom assessments may be used to determine whether or not the learner should obtain a certificate of completion. It is possible to utilize the data collected via a course's assessment as part of the decision-making process for a larger academic

program or major. The observations that researchers at the secondary level make are applicable to studies at, for instance, the colleges at the intermediate level. Nineteen American secondary school teachers' approaches to assessing students' mathematical proficiency are summarized in Senk, Beckman, and Thompson's (1997) article. Senk, Beckman, and Thompson (1997) compiled a report based on their interviews with these educators from institutions seen as receptive to alternative evaluation.

They found that assessment for the sake of grading appeared prominently in the replies of their participants, and they found that 58 percent of the instructors graded all of their assessment activities. They highlight the following hierarchy of tool usage in relation to the grading process: written exams, quizzes, assignments, and written reports; and at a lower level of use: oral reports, conferencing, and work samples. The results of such evaluations give information that may be used by the student, the instructor, or the parents in order to monitor the learner's development or identify their strengths and shortcomings. Learners' ability to get certificates or other credentials that make it possible for them to achieve their objectives might be determined by the assessments they take. The American Association for the Advancement of Science published a paper in 1998 that classified assessment purposes as either intrinsic or extrinsic. There are many internal uses for assessment, such as conveying academic expectations to students, keeping students and parents up-to-date on their progress, allowing students to reflect on and reflect on their own learning, guiding and improving instruction, sorting and selecting students, and so on. Assessment is used for several reasons outside of the classroom, such as curriculum development and student selection. The objective was to inform those who didn't work or study in schools about what went on there, such donors, parents, school administrators, and policymakers.

According to research conducted by the NASBE in 2006, formative assessments are widely used in classrooms to help direct instruction, making them one of the fundamentals that have been consistently linked with high levels of student achievement. Black and Wiliam (1998b) state that students benefit from feedback when they are given personalized suggestions based on their individual areas of strength and improvement (p. 144). The quality of feedback, for instance, was shown to have a greater impact on students' performance than any of the other factors investigated in a meta-analysis conducted and published by Black and Wiliam (1998a) (p. 36, citing BangertDrowns, Kulik, Kulik, & Morgan, 1991). In a similar line, Marzano (2003) reviewed five synthesis studies on the significance of feedback and discovered some startling findings.

Researchers Bloom (1976), Haller (1988), Child (1988), Kumar (1991), Scheerens (1997), and Walberg (1999) performed these research (p. 37). The results of this study showed that impact sizes, on average, were anywhere from 0.54 to 1.35, with the accompanying percentile improvements falling anywhere from 21 to 41 points. To provide a more in-depth explanation of these findings, Marzano outlined two qualities that feedback must have in order to be useful. The first of these is that it must be delivered at the appropriate moment. It is essential that students get feedback throughout the whole of the learning process, preferably numerous times throughout the course of the academic year (p. 37, citing Bangert-Drowns et al.,1991).

2.6 Mathematical competencies Considered in Preparation of Assessment Items

Competencies in mathematics include comprehension, analysis, computation, and application in a wide range of intra- and extra-mathematical settings where mathematics plays or may play a role (Niss, 1999). According to Niss, these two categories may be used to categorize eight different types of mathematical skills. The first group of competences focuses on the capacity to suggest and analyze mathematical issues, and it involves the following set of abilities and knowledge in particular:

The following are all part of mathematically minded thinking and reasoning: mathematics-typical questioning and answering; familiarity with the ability to operate within the confines of a notion; generalizing conclusions to broader groups of objects; expanding the scope of the notion by abstracting some of its attributes; differentiating between mathematical assertions of varying types.

Problem-posing and problem-solving in mathematics, comprising the identification, formulation, and specification of pure and applied, open-ended and closed mathematical concerns, as well as the solution of such problems, whether posed by oneself or others and using a range of approaches. Problem solving in mathematics includes not only presenting and solving questions of any kind (pure or applied, open-ended or closed), but also overcoming mathematical issues posed by others or oneself.

Mathematical modeling, which incorporates tasks like assessing the applicability and scope of current models and examining their theoretical underpinnings and features; decoding existing models, which requires translating and understanding model parts in terms of the "reality" represented; and active modeling in a specific environment,

which includes tasks like as:- structuring the field; mathematizing; working with(in) the model, including finding solutions to the problems it creates; validating the model, both internally and externally; communication on the model and its findings, as well as monitoring and management of the whole modeling process.

Skills in mathematical reasoning and argumentation, such as understanding what a mathematical proof is and how it differs from other types of mathematical reasoning, following and evaluating chains of arguments put forward by others, and getting to the heart of an argument (especially a proof) by parsing it down to its essentials by separating main points from minor ones and concepts from details. A second set of abilities include being comfortable with mathematical notation and apparatus. Mathematical problem-solving ability would fall under this heading.

To effectively represent mathematical entities (objects and situations), one must be well-versed in a variety of representational options, able to select and switch between them, and have an understanding of the connections between various representations of the same entity, as well as their relative merits and shortcomings. Knowing and making use of the many different ways in which mathematical entities (objects and situations) may be represented is essential for every mathematician.

Converting between symbolic and normal speech, reading and comprehending symbolic and formal mathematical language, working with and manipulating statements and expressions involving symbols and equations, etc. Understanding others' written, visual, or oral "texts," having conversations about topics with mathematical content, using different linguistic registers, and expressing oneself,

orally, visually, or in writing, with varying degrees of theoretical and technical precision are all examples of what we mean when we talk about "communicating in, with, and about mathematics."

This includes the use of information technology and other forms of assistance, such as knowing what is available, how it works, what it can't do, and how to use it, as well as being able to reflect on one's own use of such tools and aids in mathematical work.

2.6.1 Assessments at TVET Institutions in Kenya

The KNEC was established by the passing of Act No. 29 of 2012, which gave it the authority to administer national exams in Kenya at both the secondary and university levels. KNEC has remained the main recognized examination and assessment institution responsible for developing and assessing national exams at TVET institutions in Kenya, despite recommendations to reform of curriculum development and assessment in Sessional Paper No. 14 of 2012 on Policy Framework on Education and Training. Examinations such as weekly quizzes, midterms, finals, ongoing evaluation tests, and trial exams are typical in TVET schools throughout Kenya. TVET institutions are required to submit Course Work Assessment (CWA) marks to KNEC which is collected from classroom assessment and that contributes to 30% weight of the combined score of the candidates results in every module of study.

2.7 Theoretical Basis of Learning and Assessment

The study is based on Behavioural theories; Kolb's theory of Experiential Learning and David Ausbel's theory of Meaningful learning as well as Constructivism theories; Jean Piaget and Lev Vygotsky

2.7.1 Theory of Experiential Learning

Learning is a process that involves the creation of knowledge via the transformation of experiences that learners go through, according to David Kolb's theory of experiential learning (also known as EL). The idea behind this school of thought is that people get the most from their own personal experiences (Conlan, Grabowski & Smith, 2003). According to Sternberg and Hang (2000), the learning process is thus oriented on the learner since experience plays such an important part in it. Group projects and peer evaluations, among other activities, are among the things that, according to Baker and Robinson (2012), offer the push for the experiential learning process. Learners are given the opportunity to learn via experiences that are focused on them as students through doing, finding, reflecting, and applying rather than through experiences that are oriented on the teacher. By confronting issues that really occur in the world, students are given the opportunity to improve their ability to communicate, build self-confidence, and make sound decisions (Northern Illinois University, 2011).

Students are able to apply the mathematical knowledge they have gained in the classroom to real situations by learning by doing in TVET (Cheek et al, 2010) Additional support for this theory comes from an adage credited to Benjamin Franklin and published in 1750: "Tell me and I forget, teach me and I will remember, involve me and I shall learn" (Northern Illinois University, 2011). Practical exercises are an integral aspect of mathematics education because they help students see the relevance of the material being covered. Students won't be able to learn and grow to their full potential academically and professionally if there aren't enough of these opportunities.

2.7.2 Theory of Meaningful Learning

This investigation will use David Ausbel's paradigm for meaningful education. According to this theoretical framework, learning occurs when a person actively generates new knowledge by drawing on their own unique set of prior experiences and insights. The teacher acts more as a facilitator than a lecturer, encouraging and backing up student-initiated activities designed to stimulate critical thought. Learning that sticks involves a process called the spread of activation, in which the recall of one piece of information triggers the memory of a second piece of information, which in turn prompts the recall of a third piece of information that is linked to the first two.

Memorizing the material would prevent this issue from ever occurring. David Ausbel argues that true learning occurs when the learner not only grasps the content being presented but also sees the relevance of that material in the context of other knowledge they already possess. According to their view, in order for humans to learn meaningfully, new information must be related to relevant concepts that the person already knows. The learner's existing knowledge structure has to be engaged in conversation with the newly acquired information. Learning that is meaningful might be compared with learning that is just mechanical. The latter may also integrate newly acquired information into the preexisting knowledge structure in a manner that does not need interaction.

(concepts and propositions) to what they already know, according to Ausbel's perspective, which was quoted by (Asian e University). Because of this, it is necessary for the learner to develop his or her own knowledge rather than have it

communicated to them; as a result, learning is only relevant when the student really engages in the job for him or herself. The goals of the secondary education curriculum include, among other things, the improvement of skills required for the performance of agricultural practices; the development of self-reliance, resourcefulness, and the ability to solve problems; and the promotion of agricultural activities that enhance environmental conservation. Kenya Literature Bureau (KLB,1992). All of this content is covered, from form 1 all the way through form 4, under the agricultural education curriculum of secondary schools. It is important for the student to be able to connect the dots between the many pieces of information they have acquired during the course so that the information may be understood as a whole. During the nine months while the project is being implemented, the learner will have the chance to compile all of this information into a coherent whole. The following might serve to explain and demonstrate this point: In this subject, which spans forms one through four, the students are given instruction on a variety of distinct themes, including planting, field techniques, garden equipment, preparing the soil for planting, and keeping farm records. The learner, on the other hand, is required to bring all of this information to mind and explain it while the project is being implemented for it to be successfully implemented.

2.7.3 Constructivism Theories

The learning theory known as constructivism proposes that the most effective way to acquire information is via an internal process that involves both introspection and active building (Mascolo & Fischer, 2005). Therefore, knowledge is a matter of different people's perspectives. An interpretation of the knowledge being taught must be constructed by the learner after careful consideration of the material being

presented, taking into account prior experiences, personal perspectives, and cultural context. Within constructivism, there are primarily two schools of thought: the radical and the social. Cognitive constructivism, the original form of radical constructivism, holds that each person's unique way of making sense of their own experience actively creating new knowledge. Such extreme cognitivism is a sort of constructivism with radical implications. The second kind of social constructivism stresses the importance of social interactions in the formation of one's personality and their belief in the reality of objective truth. This section discusses the history, the method, some examples in the classroom, and the limitations.

Constructivism may be traced back to its roots in the work of these three basic psychologists. The school of thought known as radical constructivism includes Jean Piaget. On the other side, the social dimensions of learning via experiences are the primary focus of Lev Vygotsky's research. John Dewey is able to bridge the gap between the two schools of thought since he has numerous concepts that are compatible with each of them. The fact that all three of these psychologists shared the belief that the learning theories that were prevalent at the time, such as behaviorism and humanism, did not adequately represent the actual learning process served as the unifying factor that brought them together under the constructivist paradigm. In addition, rather than basing their ideas on studies conducted in a laboratory, they drew inspiration from their experiences in the classroom (compared to behaviorism).

2.7.4 Jean Piaget

One of the first thinkers to work in the constructivist school of thought was Jean Piaget. His theories postulate that people generate new information as a consequence

of a dynamic process including their own experiences and thoughts. His view on constructivism inspired radical constructivism because of his conviction that the individual is central to the learning and teaching process. Most of Piaget's views came from his long work with children, during which he argued against the belief that children's brains aren't as fully formed as an adult's. His findings disprove the idea that kids are mentally behind their older peers. Through the establishment of a theory including cognitive phases, he demonstrates that the development of children is not uniform.

The cognitive theory of Piaget investigates the growth and development of children. According to his idea, development may be broken down into four distinct phases. Despite the fact that Piaget never made a clear connection between his study on cognitive development and education, his theory is very important to the contributions that he made to the field of learning theories.

Piaget argued that the interaction between experiences and ideas is mediated by the processes of accommodation (adjusting one's internal model of the world to incorporate recent observations) and assimilation (a group's members' acquisition of the behavioral norms and psychological makeup of that group). He based his conclusions on studies of kids' brain growth. Both of these procedures lay greater emphasis on the means by which learning occurs than on the variables that shape it.

2.7.5 Lev Vygotsky

The work of Lev Vygotsky has a fundamental scope that focuses on the social elements of learning knowledge. He believes that the most effective way to learn is

through engaging with other people. Learners develop an environment of shared meanings with their peers via the act of collaborating with other people. The learner is able to adjust their subjective judgments such that they are socially acceptable when they are completely submerged in the new environment. Vygotsky places a particular emphasis on the significance of culture in the development of cognitive abilities. He was of the opinion that newborns already have the fundamental capabilities necessary for cognitive development. After then, those fundamental capabilities are improved by contact with other people, which ultimately leads to the development of more complex mental processes. For instance, a youngster is born with the capacity to remember things to some extent. The child's way of remembering things shifts and changes as it engages with the world around it and the other children in it. If the kid is studying in an environment that places an emphasis on flashcards, then the youngster will employ tactics of repetition that are comparable to those used in order to increase their memory.

Vygotsky derives from his own theory of social development, much as Piaget did with his theory of cognitive development when he adapted radical constructivism from it. Vygotsky held the belief that students may reach a much higher degree of learning with the assistance of a more knowledgeable teacher or mentor (instructor). Figure 2.1 is a graphic representation of the areas of the learning process in which the teacher may do the most in terms of assistance and enhancement. The Zone of Proximal Development (ZPD)is the region in which the educator should be most attuned to the need to provide direction. The ZPD is not limited to only a student and an instructor working together to accomplish anything. Learners are strongly encouraged to work in groups according to Vygotsky. The establishment of groups gives youngsters who

are less skilled the opportunity to gain knowledge from their peers who have already achieved mastery in a particular set of abilities.

2.7.6 John Dewey

The viewpoint of John Dewey combines the emphasis that Piaget placed on the cognitive side of constructivism with the emphasis that Vygotsky placed on social learning. A summary of Dewey's position within constructivism may be found in Susan J. Mayer's (2008) work: In contrast to the beliefs of those who, based on the recent history of progressivism, link Dewey and Piaget together, Dewey shared larger concerns with Vygotsky (whose work he never read). Both Dewey and Vygotsky, in their attempts to preserve high-quality human intellect, emphasized the significance of cultural forms and meanings, whereas Piaget was more concerned with the function that logical and mathematical reasoning played in the formation of higher forms of human thinking. John Dewey, who shared a liberal Protestant background with Piaget, emphasized the need of encouraging independent thought in his collaboration with Piaget. It is feasible to see how the research interests of the two psychologists are integrated in Dewey's expansive understanding about democracy's repercussions for education (p. 6).

Dewey, Piaget, and Vygotsky all agree that students who engage in hands-on learning experiences benefit more from the learning experience and demonstrate greater mastery of the material than those who depend only on memorization and a teacher's droning lectures. Learners who take part in authentic activities may show their progress toward these higher levels of knowledge (Behling & Hart, 2008). John Dewey is credited as saying, "If you have doubts about how learning works, engage in

continuous inquiry: study, reflect, explore numerous alternatives, and arrive at your view established in facts" according to (Reece, 2013, p.320). The focus that Dewey placed on inquiry as a means of maintaining learning is most effectively triggered by making certain that the environment is synthesised. The majority of instructors working at the school at the time were adamant about maintaining a wall between school and the rest of the students' life. The pressure of separation was something that Dewey did not adhere to. According to his studies, in order to make learning feasible, students need to draw connections between the things they do in school and things that happen in real life.

2.7.7 Constructivism Learning Theory in Practice

One must have a crystal clear sense of what it means to provide a learner the chance to establish connections between their own experiences and new knowledge in order to have even the most rudimentary understanding of constructivism. In order to further illustrate how constructivism may be used in the classroom, we will next discuss the responsibilities of both students and instructors in this setting. It is anticipated that the student would reflect on the information being provided and draw conclusions based on that analysis as they go through the learning process. The foundation for the interpretation is laid by one's own life history, perspectives, and cultural background. It is expected that the student would reflect on the new knowledge gained after the interpretation.

The character of the learner is seen in a manner that is typically comparable by radical constructivism and social constructivism. The learner is assumed to identify their position at the heart of the process of acquiring and creating new knowledge under the

radical constructivist philosophy. The learner goes via a process of acquisition and assimilation. One of the most important things for the learner to do is to think back on previous experiences and be aware of the factors that might influence how well new information is retained. However, social constructivism also encompasses the social dimensions of learning, and it requires comparable reflection from the learner as does traditional constructivism.

The theory of social constructionism not only recognizes the singularity and complexity of the learner, but it also actively promotes, makes use of, and rewards this complexity as an essential component of the process of education. This indicates that the learner is inspired to think on the one-of-a-kind information that they possess and gives them the opportunity to identify their capacity to stimulate other individuals who are pursuing education in their surroundings. Each individual learner in the ZPD is able to gain new understandings from their fellow students as a result of the ongoing interchange of ideas that takes place in the ZPD. In a constructivist framework, the learners hold the key to obtaining information; nonetheless, the function of instructors is still crucial. This chapter examines a variety of subjects, including capacity building, monitoring and evaluation, stakeholder engagement, financial availability, and the implementation of slum reform programs. The research also investigates several theoretical frameworks, including Maslow's theory of the hierarchy of needs, Arnstein's participatory theory, and stakeholder theory. The conceptual framework provides a synopsis of the literature as well as the research gaps.

CHAPTER THREE

METHODOLOGY

3.1 Research Design

In order to evaluate the typical classroom assessment processes employed by mathematics instructors at TVET institutions, the study will utilize both the quantitative and qualitative research designs as its methods of inquiry. Gall and Borg suggest that qualitative and quantitative research may work together to form a complementary whole by taking on the complementary roles of discovery (surveys) and confirmation (interviews) (2003, p.26). The quality of quantitative assessments that are based on surveys may be improved by using qualitative approaches, which can assist establish evaluation hypotheses, reinforce the design of survey questions, and broaden or clarify the results of quantitative evaluations. According to Merriam (1998), qualitative research encompasses a broad variety of different types of inquiry that aid in comprehending and explaining the significance of social happenings while causing little disruption to the natural environment.

3.2 Study Region

The study took place in TVET institutions in Nairobi county which has 10 sub-counties. The county occupies an area of 684 sq km (approx) and has population 4.4 million people and a population density of approximately 6,000 people per square kilometre. (2019 Kenya Population and Census Volume 1). There are 66 TVET institutions in Nairobi County with 13,285 registered candidates in the July 2022 examination series. 33 of the centres were offering Engineering Mathematics II.

3.3 Target Population

The study targets 66 TVET institutions that registered students for the July & November 2022 Technical examinations in Nairobi County out of which 33 of the institutions are offering Mathematics offered to students taking Craft and Diploma courses. The total number of students registered for Mathematics in the County is 13,285. (Source: KNEC, 2022).

3.4 Sample Size

A total of 33 mathematics educators from the 33 institutions were included in the study, along with 20 research directors.

3.5 Sampling Procedure

Cluster sampling was used because of the usage of a mixed research methodology. We used the classification of institutions as either public or private as a basis for our sampling. From the 33 institutions offering Mathematics in the county, 10 institutions and 10 institutions were randomly sampled from Public and private clusters respectively giving a total of 20 institutions.

3.6 Research Instruments

The main instrument to be used to collect data on classroom assessment practices, assessment formats, utilization of assessment feedback and mathematics competencies considered by mathematics teachers when developing test items were collected using Teacher questionnaire and Director of Study interview schedule.

3.7 Data Collection Procedure

A letter of introduction from the University of Nairobi's Psychology Department, approval to conduct the research from the National Commission for Science, Technology, and Innovation (NACOSTI) via an online application process, a research permit from the County Director of TVET in Nairobi, and permission to collect data from the six institutions have all been obtained. Piloting of the data collection instruments has already been done. During data collection exercise a teacher questionnaire was administered to mathematics teachers while interview schedule was administered to Director of Studies

3.8 Data Analysis

Information gathered from the respondents were analysed via descriptive statistics. The data was presented via tables, charts, mean and standard deviation. The raw data were examined to guarantee that they were accurate and comprehensive. Any mistakes or omissions that are brought to our attention will be corrected. After meticulous examination, the surveys will be coded in a way that facilitates information synthesis.

Table 3.1: Operationalization of Variables

Objective	**Type of data analysis**	**Scale of Measurement**	**Data collection method**
To determine the common *classroom assessment practices* used by mathematics teachers in TVET institutions	**Descriptive statistics**	**Ordinal scale**	**Questionnaire**
To identify *assessment tools* and formats used by mathematics teachers in TVET institutions	**Descriptive statistics**	**Ordinal scale**	**Questionnaire**
To establish how mathematics teachers in TVET institutions *utilise assessment information* collected from the students in the classroom	**Descriptive statistics**	**Ordinal scale**	**Questionnaire**
To determine mathematical *competencies* that mathematics teachers in TVET institutions consider when constructing items for classroom assessment	**Descriptive statistics**	**Ordinal scale**	**Questionnaire**

3.9 Ethical Considerations

The researcher has received the following:

i. A letter from the Psychology department of the University of Nairobi.

ii. Receiving permission from the NACOSTI to carry out the study by way of an online application procedure.

iii. Research permit from County Director TVET Nairobi county,

CHAPTER FOUR

RESULTS OF THE STUDY

4.1 Introduction

The value of the field data is shown in this chapter. Information on the study's respondents and its results are summarized in this chapter, along with how they relate to the study's aims. When describing the results, descriptive statistics have been employed. The study's aims were maintained throughout data analysis, presentation, interpretation, and debate. The major goal of this study was to collect data on how mathematics teachers at TVET institutions in Kenya evaluate student learning.

The specific objectives of the study were; to learn how math educators at TVET schools often evaluate student progress in class, discover how math educators in TVET settings currently evaluate student progress, for the purpose of determining how TVET mathematics educators make use of student assessment data and in order to identify the mathematical skills that math educators at TVET schools take into account while designing assessment tools for their students.

4.2 Questionnaire Return Rate

This section provides an explanation of the percentages and return rates for the questionnaires, which can be found in Table 4.1.

Table 4.1: Distribution of Questionnaire

Response Rate	Frequency	Percentage
Response	53	80.30
Non Response	13	19.72
Total	**66**	**100**

According to the information that was gathered, out of a total of 66 questionnaires that were sent, 53 were answered in their whole and mailed back, making the response rate 80.30 percent. According to Kothari (2004), a response rate that is at least 52.7 percent on average is considered to be acceptable, while rates that are at or above 70 percent are considered to be exceptional. As a result, it was possible to draw conclusions from this research based on the response rate that was achieved, which was 80.30 percent.

4.3 Demographic Information of the Teachers

It was required that the respondents identify themselves according to their gender. The results of their replies are shown in Table 4.2.

Table 4.2: Gender of the Respondent

Gender	Frequency	Percentage
Male	24	45.28
Female	29	54.72
Total	**53**	**100.0**

According to Table 4.2, the majority of the respondents were females, as shown by 54.72% of the total, while the remaining respondents, as indicated by 45.28% of the total, were males. It was discovered that the proportion of men to women was practically same. This demonstrates that the researcher evaluated all respondents, regardless of their gender, in order to acquire credible information on the issue that was being studied. It was required of the responders that they specify their age. The results of their replies are shown in Table 4.3.

Table 4.3: Distribution of the age of the respondents

Age	**Frequency**	**Percentage**
20-30	11	20.75
31-40 years	15	28.30
41-50 years	16	30.19
51-60	5	9.43
Above 61	6	11.32
Total	**53**	**100.0**

The results in Table 4.3 indicate that 30.19% are between 41-50 years, 28.30% were between 31-40 years, between 20-30 years at 20.75%, above 61 years was 11.32% and lastly 51.60% was 9.43%. This implies that most mathematics teachers are youths.

It was required of the respondents that they provide information on their level of education. The results of their replies are shown in Table 4.4.

Table 4.4: Academic Qualifications

Academic Qualifications	Frequency	Percentage
Diploma	5	9.43
Higher Diploma	9	16.98
Degree	13	24.52
Postgraduate Diploma Education	17	32.07
Masters	9	16.98
PhD	0	0
Total	**53**	**100.0**

The results in Table 4.4 indicate that 32.07% had postgraduate diploma education, degree holders were at 24.52%, higher diploma at 16.98%, then diploma holders at 9.43%. This implies that most mathematics teachers were degree holders and postgraduate diploma education. It is clear from the results that literacy levels are high, which is something that should have been taken into consideration when deciding whether or not to administer a questionnaire to identify the classroom assessment practices as well as the assessment formats and methods used by mathematics teachers in TVET institutions in Kenya. As a result, the researcher was able to get replies that were pertinent to the subject matter that was being investigated because of this.

It was required of the responders that they specify their years of work experience. The results of their replies are shown in Table 4.5.

Table 4.5: Teaching Experience of the Respondents

Teaching Experience	Frequency	Percentage
1-5 years	7	13.21
6-10 years	17	32.08
11-15 years	19	35.85
Above 15 years	10	18.86
Total	**53**	**100.0**

The results in Table 4.5 indicate that 32.08% had a teaching experience between 11-15 years,6-10 years was at 32.08%, above 15 years was 18.86% and lastly 1-5 years was 13,21%.This implies that most respondents had adequate years of teaching experience.

It was required of the responders that they specify their present position in the educational system. The results of their replies are shown in Table 4.6.

Table 4.6: Current Designation in School

	Frequency	Percentage
Principal	1	1.89
Deputy Principal	2	3.77
HoD	27	50.94
Classroom teacher	23	43.40
Total	**53**	**100.0**

The results in Table 4.6 indicate that 50.94% of the respondents were HOD, 43.40% were classroom teachers, 3.77% were deputy principal and lastly were principal. This implies that most mathematics teachers were HOD and classroom teachers.

It was required of the responders that they name the mathematics class they attended. The results of their polls are shown in Table 4.7.

Table 4.7: The Mathematics Class Population

Mathematics Class Population	Frequency	Percentage
1-10	2	3.77
10-20	4	7.55
20-30	10	18.87
30-40	19	35.85
Above 40	18	33.96
Total	**53**	**100.0**

The results in Table 4.7 indicate that mathematics class population was between 30-40 at 35.85%, followed by above 40 years at 33.96%, 20-30 student at 18.87%, 7.55% was between 10-20 students and lastly 3.77% was between 1-10 students. This implies that most mathematics teachers have students above 30.

It was required of the responders that they state the number of lessons that were planned to be taught in a week. The results of their replies are shown in Table 4.8.

Table 4.8:Teacher Workload per week

Workload per week	Frequency	Percentage
1-5	19	35.85
5-10	18	33.96
11-15	10	18.87
16-20	2	3.77
20-25	4	7.55
Above 25	0	0
Total	**53**	**100.0**

The results in Table 4.8 indicate that respondents had between 1-5 lessons per week at 35.85%,5-10 lessons at 33.96%, 11-15 lessons at 18.77% and the least lessons was above 25%.This implies that most mathematics teachers are not overloaded with work.

4.4 Common Classroom Assessment Practices used by Mathematics Teachers in TVET Institutions

The initial goal of this project was to investigate and evaluate the various classroom assessment procedures that are used by mathematics instructors working at TVET colleges. A Likert scale with five points was used to collect the data, and the results of the research are shown and described in Table 4.9.

Table 4.9: **Common Classroom Assessment Practices**

Statement	**Never 1**	**Almost Never 2**	**Occasionally 3**	**Almost every time 4**	**Every time 5**	**Mean**	**SDV**
Discourse	13(24.5)	14(26.4)	16(30.2)	7(13.2)	3(5.7)	3.51	1.17
Observation	26(49.1)	9(17)	14(26.4)	1(1.9)	3(5.7)	4.02	1.17
Student self	15(28.3)	14(26.4)	15(28.3)	3(5.7)	6(11.3)	3.55	1.28
Peer assessment	17(32.1)	22(41.5)	11(20.8)	2(3.8)	1(1.9)	3.98	0.93
Own productions	17(32.1)	6(11.3)	16(30.2)	11(20.8)	3(5.7)	3.43	1.29
Projects	18(34)	12(22.6)	15(28.3)	5(9.4)	3(5.7)	3.70	1.20
Portfolio	17(32.1)	16(30.2)	12(22.6)	4(7.5)	4(7.5)	3.72	1.21
Composite Mean and SDV						**3.70**	**1.19**

Descriptive results in Table 4.9 shows that discourse was employed at a mean of 3.51 and S.D 1.17 by mathematics teachers in TVET institutions, observation was employed at a mean of 4.02 and S.D 1.17, student self-assessment was employed at a mean of 3.55 and S.D 1.28, Peer assessment was employed at a mean of 3.98 and S.D 0.93. Own production was employed at a mean of 3.43 and S.D 1.29, while Projects-work was employed at a mean of 3.70 and S.D 1.20 and lastly Portfolio was at mean of 3.72 and S.D at 1.21.The composite mean for the common classroom assessment

practices was at a mean of 3.10 and S.D1.19. This implies that mostly practiced classroom assessment by mathematical teachers at TVET was observation, peer assessment and portfolio. The least employed classroom assessment practices was own production. This implies that classroom assessment practices was done occasionally by mathematical teachers at TVET institutions.

Directors of studies who were interviewed indicated that assignment was used as formative assessment practices and six CATS was used as formative assessments. One of the directors said that "*In TVET institutions Student self-assessment was applied to know the strength and weakness of students while peer assessment was not applied. One of the interviewees responded that the best formative assessment strategy was student own production".* To improve formative assessment strategies it was suggested that regular assignment should be used. The purpose of evaluations like course work evaluations and final tests, both of which are oriented on the instructor and judgemental, is to determine the learner's ultimate grade.

4.5 Assessment Tools and Formats used by Mathematics Teachers in TVET institutions

The second goal was to determine the types of evaluation tools and formats that are utilized by mathematics instructors working in TVET institutions. A Likert scale with five points was used to collect the data, and the results of the study are presented and discussed in Table 4.10.

Table 4.10: **Assessment Tools and Formats used**

Statement	**Never 1**	**Almost Never 2**	**Occasionally 3**	**Almost every time 4**	**Every time 5**	**Mean**	**SDV**
Select-type items	18(34)	12(22.6)	17(32.1)	6(11.3)	(0)	3.79	1.04
Closed-open questions	26(49.1)	8(15.1)	8(15.1)	3(5.7)	8(15.1)	3.77	1.49
Open-open questions	17(32.1)	16(30.2)	12(22.6)	4(7.5)	4(7.5)	3.72	1.21
Extended response-open questions	16(30.2)	13(24.5)	14(26.4)	5(9.4)	5(9.4)	3.57	1.28
Super items	15(28.3)	20(37.7)	8(15.1)	4(7.5)	6(11.3)	3.64	1.29
Multiple-question items	12(22.6)	24(45.3)	8(15.1)	7(13.2)	2(3.8)	3.70	1.08
Essays	26(49.1)	9(17)	14(26.4)	1(1.9)	3(5.7)	4.02	1.17
Oral Tasks and Interviews	15(28.3)	14(26.4)	15(28.3)	3(5.7)	6(11.3)	3.55	1.28
Journals	16(30.2)	13(24.5)	14(26.4)	5(9.4)	5(9.4)	3.57	1.30
Concept mapping	15(28.3)	14(26.4)	15(28.3)	3(5.7)	6(11.3)	3.55	1.11
Progress-overtime tests	18(34)	12(22.6)	15(28.3)	5(9.4)	3(5.7)	3.70	1.20
Composite Mean and SDV						**3.69**	**1.22**

Descriptive results in Table 4.10 shows that essays was used highly in assessment tools by mathematics teachers at a mean of 4.02 and S.D of 1.17,followed by Select-type items at a mean of 3.79 and S.D of 1.04. Closed-open questions was at a mean of 3.77 and S.D of 1.49, Open-open questions was at a mean of 3.72 and S.D of 1.21, Multiple-question items was at a mean of 3.70 and S.D of 1.08. Progress- overtime tests was used as assessment tool by mathematical teachers at a mean of 3.70 and S.D of 1.20. Super items was at mean of at a mean of 3.64 and S.D of 1.29.The least used assessment tool by mathematical teachers was Oral Tasks and Interviews and Concept mapping at a mean of 3.55.The composite mean was 3.69 and S.D was 1.22.This implies that assessment tools and formats was done occasionally by mathematical teachers at TVET institutions.

During the course of the interviews, the directors of studies underlined the need of gathering different types of information on the students using different types of assessments. The many assessment methods used will allow for the accurate evaluation of students' conceptual development, skill acquisition, and application of learned material. According to the argument, *"using a broad array of data gathering forms would generate a deeper and more relevant understanding of what children know and are able to accomplish, which is, after all, the core purpose of assessment."* The data gathered from assessment instruments is invaluable in helping educators tailor their teaching strategies to the diverse learning requirements of their pupils. There are often a lot of people involved and interested in assessment tools. Assessment methods provide useful data that may be used to enhance instruction and raise students' achievement.

4.6 Utilised Assessment Information Collected from the Students in the Classroom

The third goal was to determine how mathematics instructors at TVET institutions use the assessment information acquired from students while they are teaching in the classroom. The information was collected using a Likert scale with five points, and the results of the research are presented and described in Table 4.11.

Table 4.11: Utilised Assessment Information Collected from the Students in the Classroom

Statement	Never 1	Almost Never 2	Occasionally 3	Almost every time 4	Every time 5	Mean	SDV
Provide students' grades or marks	11(20.8)	5(9.4)	13(24.5)	14(26.4)	10(18.9)	3.47	1.40
Provide feedback to students	12(22.6)	8(15.1)	14(26.4)	11(20.8)	8(15.1)	4.23	1.38
Diagnose students' learning problems	14(26.4)	27(50.9)	5(9.4)	4(7.5)	3(5.7)	4.45	1.08
Report to parents	22(41.5)	4(7.5)	5(9.4)	2(3.8)	20(37.7)	3.09	1.83
Assign students to different programs or tracks	18(34)	14(26.4)	10(18.9)	8(15.1)	3(5.7)	4.20	1.25
Plan for future lessons	30(56.6)	9(17)	7(13.2)	5(9.4)	2(3.8)	4.75	1.19
Composite Mean and SDV						**4.03**	**1.36**

Descriptive results in Table 4.11 shows that the information collected from students in the classroom by mathematics teachers in TVET institutions was used to plan for future lessons at a mean of 4.75 and S D of 1.19,followed by diagnose students' learning problems at a mean of 4.45 and S D of 1.08. Provide feedback to students

had a mean of 4.23 and S D of 1.38. Assign students to different programs or tracks with a mean of 4.20 and S.D of 1.25. Provide students' grades or marks with a mean of 3.47 and S.D of 1.40 and lastly report to parents with a mean of 3.09 and S.D of 1.83.The composite mean was 4,03 and S.D 1.36,This implies that mathematics teachers in TVET institutions almost every time they utilised assessment information collected from the students in the classroom.

During the course of the interview, Directors of Studies noted that the obtained evaluation information was used in the process of building a strategy to remedy the issue. "*Assessments give information that may be utilized by the student, the instructor, or the parents to monitor learner development or identify strengths and shortcomings*," said one of the respondents. Learners' ability to get certificates or other credentials that make it possible for them to achieve their objectives might be determined by the assessments they take. The information gathered through classroom evaluation may be put to use when selecting a course of study or an academic program to pursue as a whole. Assessment can be used for a variety of internal purposes, such as communicating to students what is expected of them academically, informing students and parents of their progress, helping students evaluate their own learning, guiding and improving instruction, sorting and selecting students, and so on. Assessment is used for a variety of ends outside of the classroom, such as curriculum development, student sorting, and placement.

4.7 Mathematical Competencies that Mathematics Teacher in TVET Institutions

The fourth objective was to determine mathematical competencies that mathematics teachers in TVET institutions consider when constructing items for classroom

assessment. A Likert scale with five points was used to collect the data, and the results of the research are shown and described in table 4.12.

Table 4.12: Mathematical Competencies that Mathematics Teachers In TVET Institutions

Statement	**Never 1**	**Almost Never 2**	**Occasionally 3**	**Almost every time 4**	**Every time 5**	**Mean**	**SDV**
Communication	36(67.9)	5(9.4)	8(15.1)	3(5.7)	1(1.9)	4.36	1.06
Representation	18(34)	17(32.1)	9(17)	9(17)	(0)	3.97	1.09
Problem solving	32(60.4)	11(20.8)	3(5.7)	5(9.4)	2(3.8)	4.25	1.16
Aids and tools	23(43.4)	5(9.4)	13(24.5)	6(11.3)	6(11.3)	4.12	1.43
Symbols and formal language	15(28.3)	3(5.7)	12(22.6)	11(20.8)	12(22.6)	3.96	1.53
Modelling	17(32.1)	8(15.1)	14(26.4)	9(17)	5(9.4)	4.13	1.35
Mathematical reasoning/ thinking	26(49.1)	9(17)	14(26.4)	1(1.9)	3(5.7)	4.17	1.17
Composite Mean						**4.14**	**1.26**

Descriptive results in Table 4.12 shows that communication was used to determine mathematical competencies by mathematics teachers in TVET institutions at a mean of 4.36 and S D of 1.06,followed by Problem solving at a mean of 4.25 and S D of 1.06. Mathematical reasoning/ thinking at a mean of 4.17 and S D of 1.17, modelling was a mean of 4.13 and S D of 1.35, Aids and tools a mean of 4.12 and S D of 1.43. Representation was a mean of 3.97 and S D of 1.09 and the least used was Symbols and formal language at a mean of 3.96 and S.D of 1.53. The composite mean was 4.14

and S.D 1.26. This implies that mathematics teachers in TVET institutions almost every time consider competency when constructing items for classroom assessment.

The respondents were asked if they have attended training on the Assessment item test development. The results are shown on Table 4.13.

Table 4.13: Attended Training on the Assessment

	Frequency	Percentage
Yes	29	54.72
No	24	45.28
Total	**53**	**100.0**

Table 4.13 shows that most mathematic teachers have been trained on the assessment item test development at 54.72% and while 45.28% have not being trained. The training was offered by KNEC and CDACC. The respondents were asked if they have attended training on the marking of examinations. The results are shown on Table 4.14

Table 4.14: Training on Marking of Examinations

	Frequency	Percentage
Yes	35	66.04
No	18	33.96
Total	**53**	**100.0**

Table 4.14 shows that most mathematic teachers have been trained on the marking of examinations at 66.04% and while 33.96% have not being trained. The training was offered by KNEC followed by CDACC. It was found out that most of the respondents mark KNEC examinations in Mathematics for the Technical examinations as examiner and assistant chief examiner.

According to the directors of studies who were interviewed for this article, the process of problem solving is the way in which instructors use the mathematical knowledge and abilities they have acquired. This method includes both the analysis of mathematical issues and the posing of new ones. According to one of those who were interviewed, *"teachers should be able to explain their mathematical grasp of a topic both vocally and in writing form."* The instructors have to be able to utilize their native tongue to explain and make things as clear as possible in a manner that allows others to comprehend what is being taught. It is important for educators to demonstrate knowledge of mathematical terminology and ideas, provide an explanation of their thinking, provide evidence, draw and label their work, and reflect on what they are learning.

CHAPTER FIVE

DISCUSSION, SUMMARY AND CONCLUSIONS

5.1 Introduction

This part provides a summary of the results discussed in the preceding chapters, as well as a discussion of those findings, draws, and conclusions, and it concludes with some suggestions for the field of additional research. The goal of the research served as the impetus for drawing both the results and the suggestions that were subsequently developed.

5.2 Discussion of Findings

The purpose of the study was examine how math instructors typically evaluate their students in the classroom at TVET schools, to determine the methods of evaluation and formats that are utilized by mathematics instructors working in TVET institutions, to investigate the ways in which mathematics instructors at TVET institutions make use of evaluation data gathered from students while they are teaching in the classroom, and to identify the mathematical skills that TVET mathematics educators prioritize while planning lessons. As a result, the discussion of the study's results were based on the precise goals that were described earlier.

5.2.1 Common Classroom Assessment Practices used by Mathematics Teachers in TVET Institutions

The study found that mathematics Teachers in TVET Institutions practiced common classroom assessment at composite mean of 3.10. The most practiced classroom assessment by mathematical teachers at TVET was observation, peer assessment and portfolio. The least employed classroom assessment practices was own production. It

was also noted by directors of studies that assignment was used as formative assessment practices and six CATS was used as formative assessments.

Results are in line with those found by Stiggins et al (2007) Assessment in the classroom, also known as assessment for learning, may take the form of exercises like homework, assignments, quizzes, and even practiced self-evaluations. This kind of evaluation is focused on the student and gives them insight into their own areas of proficiency and growth. In the classroom, students are graded on their participation and understanding of concepts, while students' performance is evaluated on how well they apply what they've learned. Valid assessments are ones that were made in accordance with generally accepted standards of assessment practice, and hence provide reliable assessment judgements (Whetton, 2009).

5.2.2 Assessment Tools and Formats used by Mathematics Teachers in TVET institutions

The study was to identify assessment tools and formats used by mathematics teachers in TVET institutions. It was found out that assessment tools and formats had a composite mean of 3.69 and was done occasionally by mathematical teachers at TVET institutions. The most identified assessment tools and formats used by mathematics teachers were Closed-open questions and Open-open questions. The directors remarked that the several sorts of assessment formats that will be employed would test a number of facets of the learning that is taking place in the students, and that the majority of the questions will be open-ended.

These results support Gronlund's (2006) assertion that alternatives to standardized testing, such as portfolios, observations, and performance-based assessments, are more realistic and provide more challenging tasks for evaluation, but they also take much more time to implement and score. The results also coincide with Hill's (2008) definition of the function of assessment tool, which emphasizes the importance of students attaining their potential and defining the role in a similar way: The goal of using assessment tools is to enhance the learning of students as well as the instruction that instructors provide in order to guarantee that students will realize their full unique potential.

5.2.3 Utilised Assessment Information Collected from the Students in the Classroom

The purpose of the research was to investigate the application of the used evaluation information that was gathered from the students while they were present in the classroom. It was discovered that virtually often, they used assessment information acquired from students in the classroom, and the composite mean of those scores was 4.03. The information that was obtained from the assessment was utilized to prepare for future sessions, identify learning challenges pupils were having, and offer feedback to students. The administrators highlighted the fact that assessments provide data that may be used to track a student's growth or identify areas of strength and weakness.

The findings, as stated by Thompson (1997), provide an overview of the mathematics assessment practices of a sample of 19 secondary school teachers in the United States. These teachers were selected from institutions with a reputation for being open to

alternate forms of evaluation. They discovered that 58% of teachers scored all of their assessment activities, and that the majority of participants felt that assessment was done primarily for grading purposes. The results also agree with Black and Wiliam (1998b) assertion that feedback helps learning when it provides each student with precise suggestions on where they excel and where they may need improvement.

5.2.4 Mathematical Competencies that Mathematics Teacher in TVET Institutions

Mathematics teachers in TVET institutions almost every time consider competency when constructing items for classroom assessment with a composite mean of 3.69. Most mathematic teachers have been trained on the assessment item test development at 54.72% and while 45.28% have not being trained. The training was offered by KICD and CDACC. According to the directors of studies who were interviewed for this article, the process of problem solving is the way in which instructors use the mathematical knowledge and abilities they have acquired.

The results support the hypothesis put up by Tarmizi and Sweller (1988), which states that traditional methods of problem solving place a significant cognitive burden on the working memory of the individual attempting to solve the issue. The cognitive burden associated with solving arithmetic word problems would increase if the student had to focus on both comprehending the problem and doing the necessary computation at the same time. This opens the door to the possibility of some interaction between issue size and problem type. Gillis and Griffin's (2008) claim that the emphasis of vocational education and training has switched from the content of the curriculum to the outcomes or skills obtained by students is supported by the findings. It is generally agreed that a competency assessment needs to do the following at a minimum: define

its purpose; obtain proof of skill using ways that make sense for the task at hand; evaluate the data in light of the required skills; draw conclusions about the assessee's competence; capture the evaluation and share it with those who need to know.

5.3 Summary of the Findings

It was found out that majority of the mathematics teachers were female and were youths. Most mathematics teachers were degree holders and postgraduate diploma education and had above ten years teaching experience. Mathematics teachers were HOD and classroom teachers and students above 30 in a class making then to above averagely 10 lessons per week.

The most practiced classroom assessment by mathematical teachers at TVET was observation, peer assessment and portfolio. The least employed classroom assessment practices was own production. It was also noted by directors of studies that assignment was used as formative assessment practices and six CATS was used as formative assessments.

The most identified assessment tools and formats used by mathematics teachers were Closed-open questions and Open-open questions. The administrators emphasized the need of using many assessment forms to gauge students' mastery of subject matter, with open-ended questions being the format of choice.

The information that was obtained from the assessment was utilized to prepare for future sessions, identify learning challenges pupils were having, and offer feedback to students. The directors pointed out that assessments give information that may be

used by the student, the instructor, or the parents in order to follow the learner's development or identify strengths and shortcomings.

The vast majority of mathematics educators have received training in the production of assessment items. The KNEC as well as CDACC were the organizations that provided the training. According to the study directors who were questioned, the process of problem solving is the way in which educators put their knowledge and expertise in mathematical ideas and procedures into practice.

5.4 Conclusion of the Study

From the above discussion, several conclusions were made:

The study concludes that most practiced classroom assessment by mathematical teachers at TVET was observation, peer assessment and portfolio. The least employed classroom assessment practices was own production. Reliable assessment judgments are those that are derived from valid evaluations, which are evaluations that were created under circumstances of assessment that were applied consistently.

The study concludes that assessment tools and formats used by mathematics teachers were closed-open questions and open-open questions while the least identified was extended response-open questions and super items. The goal of any kind of evaluation is to help students learn more and improve their teachers' teaching so that every student may reach his or her maximum potential.

The findings of the research also indicate that the information obtained from the assessments was utilized to plan for future classes, detect learning issues in pupils, and offer feedback to those students. The information obtained during assessment

may be utilized by the student, the instructor, or the parents to monitor the learner's progress or to diagnose the learner's strengths and shortcomings.

Further, communication, problem solving and mathematical reasoning are considered when constructing items for classroom assessment. Mathematic teachers have been trained on the assessment item test development. The training was offered by KNEC and CDACC. The focus in vocational education and training has shifted from the subjects covered in the curriculum to the results or competences that are achieved by the students.

It can be concluded that the teachers who teach mathematics in TVET institutions to a great extent shows a connection in practice linking what is taught, how they are tested, their final performance rating therefore and are aware of the processes of assessment. It also show that the ways in which teachers think about the function of assessment is appropriate to a large extent influencing how learners approach their learning. This shows assessment with theories that are appropriate to the culture of learning today, such as constructivists as defined by Vygotsky (2000) and others such as Piaget. Thus it can be assumed that assessment brings out the cognitive types, social skills and behavioral perspectives.

5.5 Implication of the Study

Existing studies suggest that evaluating students' progress in class is most useful when it is informed by assessment for learning principles. Achieving a high standard in classroom assessment is closely related to the amount of dedication shown toward the formative application of assessment practice for the benefit of students. The new

assessment paradigm includes student self- and peer-evaluation, as well as personal productions and portfolio forms of CAPs; additionally, it calls on teachers and students to see classroom assessment as a data-gathering exercise.

5.6 Recommendations of the Research Study

Based on the objectives and conclusion this study recommends the following,

The study recommends that mathematical teachers should adopt the following classroom assessment practices; observation, peer assessment and portfolio. The practices offer numerous advantages for both teachers and students. These advantages contribute to improving the overall teaching and learning experience and fostering academic growth.

The study also recommends that mathematics teachers adopt assessment tools and formats such as closed-open questions and open-open questions. These tools focus on helping the student to learn more and improve their teachers' teaching to enable every student reach his or her maximum potential.

This study also recommend that TVET teachers use the information obtained from the assessment to plan for future classes, detect learning issues in pupils and offer feedback to those students. These information will give insight to teachers to identify students' strength, weaknesses and learning needs. It also helps teachers tailor instruction to address individual student needs and adapt their teaching methods to enhance learning outcomes.

The study also recommends mathematical competencies that TVET teachers should have when constructing items for classroom assessment. Among the mathematical competencies, we have problem solving skills, quantitative literacy and logical reasoning. These competencies are valuable skills that enrich a person's intellectual abilities, enhance decision making, and empower them to thrive in variaous academic settings

5.7 Areas for Further Research

i. It is crucial to replicate this study in other subject areas and contests of other countries so that we can draw comparisons and conduct experiments to see how far we can apply the findings.

ii. The research was carried out with the assistance of multiple linear regression and correlation analysis; however, more investigation may make use of various types of analytic methods such as factor analysis, granger causality analysis, cluster analysis, and discriminant analysis.

iii. The capacity of mathematics educators to create evaluation tools for mathematical abilities in mathematics education needs further investigation. Future progress in mathematical abilities, from both theoretical and applied perspectives, will be exciting to see.

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APPENDICES

Appendix I: Questionnaire for Mathematics Teachers

Mr. Flavian Mutinda is conducting a research study in partial fulfillment of requirements for the award of Masters degree in Education Measurement and Evaluation in University of Nairobi.

You have been sampled to fill Mathematics Teacher Questionnaire, information provided will be treated with utmost confidentiality

1.0 Section A: Teacher Characteristics

1.1 Select your gender. Male ⬭ Female ⬭

1.2. Select your age bracket.

20 – 30 years ⬭

31 – 40 years ⬭

41 – 50 years ⬭

51 – 60 years ⬭

61 years and above ⬭

1.3. Select the sub county where your institution/college is located

Kamukunji ⬭

Makadara ⬭

Starehe ⬭

Kasarani ⬭

Westlands ⬭

Lang'ata ⬭

Embakasi ⬭

Njiru ⬭

Mathare ⬭

Kibra ⬭

1.4. Indicate your highest level of academic qualification?

Academic Qualifications	(Tick appropriately)
Diploma	
Higher Diploma	
Degree	
Postgraduate Diploma Education	
Masters	
PhD	

1.5 How many years have you taught mathematics in TVET institutions?

Period	Tick appropriately (√)
1-5 years	
6-10 years	
11-15 years	
Above 15 years	

1.6. Select your current designation in school?

a) Principal

b) Deputy Principal

c) HoD

d) Classroom teacher

1.7 How many learners are there in Mathematics class for Diploma in Electrical Engineering Module II?

Number of learners	Tick appropriately (√)
1-5	
5-10	
11-15	
16-20	
21-25	
26-30	
31-35	
36-40	
Above 40	

1.8 How many lessons are you scheduled to teach per week?

No. of Lessons	Tick appropriately (√)
1-5	
5-10	
11-15	
16-20	
21-25	
26-30	
Above 30	

2.0 Section B: Teacher's Training and Experience in Assessment Practice

2.1 a)Have you ever attended training on the Assessment item test development?

Yes ◯ No ◯

b) If yes in 2.1 (a) above, the training was offered by which institution?

Institution	Tick ✓
Kenya National Examinations Council (KNEC)	
Kenya Education Management Institute (KEMI)	
Kenya Institute of Curriculum Development (KICD)	
Curriculum Development Assessment and Certification CDACC	
Others (Specify)……	

2.2 (a) Have you ever attended training on marking of examinations/assessment?

Yes ◯ No ◯

b) If yes in 2.2 (a) above, the training was offered by which institution?

Institution	Tick ✓
Kenya National Examinations Council (KNEC)	
Kenya Education Management Institute (KEMI)	
Kenya Institute of Curriculum Development (KICD)	
Curriculum Development Assessment and Certification CDACC	
Others (Specify)……	

2.3 a) Do you mark KNEC examinations in Mathematics for the Technical examinations?

Yes ◯ No ◯

b) If yes in 2.3 (a), Select your designation in marking?

Chief Examiner/Examiner in Cha ◯

Assistant Chief Examiner ◯

Team leader ◯

Examiner ◯

3.0 Section B: Classroom Assessment Practices

3.1 How often do you employ the following Classroom assessment practices in Mathematics lessons.

Classroom Assessment Practices	Rating				
	Never 1	Rarely 2	Sometimes 3	Often 4	Always 5
Discussion, elaboration, justification, illustration, and comparison are all examples of discourse. (aspects of deductive and inductive reasoning taught in maths classrooms)					
The purpose of observation is to evaluate students' individual and group performances, as well as to gauge how well organized students are and to gauge students' degrees of self-assurance when they participate in debate.					
Self-evaluation is a crucial part of students' growth as independent learners and promotes self-reflection.					
Peer assessment might take the form of giving comments on a classmate's oral presentation, grading a test, or even coming up with test questions.					
Students create their own works, in which they exhibit					

Classroom Assessment Practices	Rating				
	Never 1	Rarely 2	Sometimes 3	Often 4	Always 5
their own strategies for solving mathematical issues.					
Work carried out over an extended period of time, either alone or in collaboration with others on a project.					
A portfolio is a collection of various pieces of work that are generally done on the same subject or theme with the goal of receiving an overall evaluation.					

3.2 How frequent do you employ the following tools/formats of assessment in Mathematics lessons.

Tools/formats of assessment	Rating				
	Never 1	Almost Never 2	Occasionally 3	Almost every time 4	Every time 5
Items that need a decision may be broken down into four categories: multiple-choice, true-false, fill-in-the-blank, and matching.					

Tools/formats of assessment	Rating				
	Never 1	Almost Never 2	Occasionally 3	Almost every time 4	Every time 5
Closed questions may be answered with a simple yes/no, a definition, a basic graph, or a formula, but open questions can be answered in a variety of ways.					
Open-ended questions demand students to provide answers in the form of numbers or formulas, but the path to such answers includes higher-order thinking and activities.					
Extended responses with open-ended questions require the student to provide an explanation of his or her line of thinking as part of the answer.					
These "super items" are a kind of assignment in which students are given the opportunity to interact with a given setting or problem scenario via a series of open questions that progress in complexity. The sequence in which these inquiries are posed is arbitrary.					

Tools/formats of assessment	Rating				
	Never 1	Almost Never 2	Occasionally 3	Almost every time 4	Every time 5
Each multiple-question item in a multiple-question item pool has its own unique context or problem situation, and the questions in the pool are not necessarily ordered in any particular fashion. Such items may be found in true/false and multiple-choice forms.					
Oral Tasks and Interviews - These may take the form of a 20-minute pre-discussion on a topic related to a student's take-home assignment, a conversation 20 minutes after the assignment has been done, or a discussion on a recognized topic in mathematics.					
Journaling involves creating diagrams and graphs, writing in a mathematical fashion, and conceptualizing, elaborating, and acquiring new ideas.					

Tools/formats of assessment	Rating				
	Never 1	Almost Never 2	Occasionally 3	Almost every time 4	Every time 5
When students are asked to demonstrate how they understand links between significant ideas or phrases within a body of information, concept mapping is a useful tool.					
The use of items or problems that are essentially identical in nature on exams that are administered at consecutive times but at different points in time, with the expectation that subsequent tasks will be more challenging than those that came before them.					

3.3 How often do you use the assessment information you gather from

Use of Assessment information	Rating				
	Never 1	Almost Never 2	Occasionally 3	Almost every time 4	Every time 5
Provide pupils' grades or marks?					

Use of Assessment information	Rating				
	Never 1	Almost Never 2	Occasionally 3	Almost every time 4	Every time 5
Offer comments and suggestions to the pupils?					
Find out what the issues are with the pupils' learning.					
Do you report to the parents?					
Do you place students in a variety of academic programs or tracks?					
Plan for future lessons?					

3.4 How often do you test on the following Mathematics competencies in classroom assessments

Mathematics Competency		Rating				
	Explanation	Never 1	Almost Never 2	Occasionally 3	Almost every time 4	Every time 5
Communication	One may express themselves on topics in a number of different ways using					
Representation	Mathematical objects and events must be decoded, interpreted, and					

Mathematics Competency		Rating				
	Explanation	Never 1	Almost Never 2	Occasionally 3	Almost every time 4	Every time 5
	differentiated according to the various presenting formats.					
Problem solving	Tables, charts, and graphs should be used to illustrate and examine the connections.					
Aids and tools	Create a variety of mathematical problems, then go through the steps of formulation and analysis (e.g, pure, applied, open-ended, closed)					
Symbols and formal language	Find solutions to a wide range of mathematical problems using a number of approaches.					
Modelling	Be familiar with and able to make					

Mathematics Competency		Rating				
	Explanation	Never 1	Almost Never 2	Occasionally 3	Almost every time 4	Every time 5
	use of a variety of mathematical aids and tools, particularly those related to information technology, in order to facilitate mathematical work. Be aware of the constraints imposed by such instruments and help.					
Mathematical reasoning/ thinking	Learn to decipher and analyze symbolic and formal language, as well as the connections between these types of language and normal language.					

3.5 Did you involve other teachers in the development of classroom assessment?

Yes ◯ No ◯

3.6 Did you use conveyor belt system of marking in marking of classroom assessment?

Yes ◯ No ◯

3.7 If No in 3.4 and 3.5, please state the reason(s)_____

Thank you for your participation

Appendix II: Structured Interview for Director of Studies

1) What classroom assessment practices do the teachers in your institution apply?

.....

.....

What examination policy is applied in assessing student performance in your school?

.....

.....

3) How are they carried out?

.....

.....

What is your view on the contribution of Classroom Assessment practices to student's performance in final examinations offered by KNEC in each module?

.....

.....

5) a) What do you understand by the following forms of classroom assessment?

Student self-assessment……

Peer assessment……

Student's own productions……

Projects……..

Portfolio……

To what extent do the teachers in your school use the classroom assessment practices mentioned in (a) above?

6) What is the best Classroom Assessment strategy that you would recommend to teachers and why?……

……

What suggestions would you make so that teachers can improve on the use of Classroom Assessment strategies?

……

Thank You!

Appendix III: Letter to Respondents

Dear Participant,

You are cordially invited to take part in a research study that will be conducted on the methods of classroom evaluation used in TVET colleges in Kenya.

Please reply to the questions and assertions in as open and truthful a manner as you are able to provide. We will be really grateful to you for both your participation and the contributions you make to this study. Please do not write your name anywhere on the paper since we will not disclose any of the information you provide.

My master's research, as well as potential presentations and publications, will make use of the information that was gathered through the survey.

Thank you in advance

Flavian Mwangangi Mutinda