UNIVERSITY OF CAPE COAST

TEACHER QUALITY AND ASSESSMENT LITERACY AS PREDICTORS OF SENIOR HIGH TECHNICAL STUDENTS' PERFORMANCE IN CORE MATHEMATICS IN AKUAPEM NORTH MUNICIPALITY

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BY

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Thesis submitted to the Department of Education and Psychology of the Faculty of Educational Foundations, College of Education Studies, University of Cape Coast, in partial fulfilment of the requirement for the award of Master of Philosophy Degree in Measurement and Evaluation.

SEPTEMBER 2023

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature: ……. Date……...

Name……..

Supervisor's Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of the thesis laid down by the university of Cape Coast.

Supervisor's Signature: ……..... Date…...…….....

Name:……

ABSTRACT

This study examined the connections between teacher quality, assessment literacy, and students' performance in core mathematics in the Akuapem North Municipality. The study used a descriptive survey design and an extensive census approach to collect data from teachers. Its key goals were to assess teachers test construction skills, evaluate their feedback methods, and investigate how their qualifications and teaching experience affected students' core mathematics performance. Three research questions and two hypotheses led the investigation. The data suggested that, on average, teachers had a moderate level of skill in test construction. Furthermore, core mathematics teachers had a moderate level of proficiency with respect to offering assessment feedback. A further in-depth examination of the data revealed notable positive relationships between the quality of assessment feedback practices and critical criteria such as pedagogical knowledge, knowledge of the subject, and classroom management. This study's recommendations include the introduction of professional development programs, curricular modifications, and the encouragement of research projects targeted at improving methods for assessment.

KEYWORDS

Assessment

Assessment literacy

Assessment quality

Students' performance

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DEDICATION

To my dear headmistress, Mrs. Winifred Siebu Arthur. The headmistress of Methodist Girls' Senior High School, Mamfe.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
CMS	Construction of Classroom Management Scale (CMS)
NCTM	National Council of Teachers of Mathematics
PCK	Pedagogical Content Knowledge
WASSCE	West African Senior School Certificate Examination
ZPD	Zone of Proximal Development
SHS	Senior High School

CHAPTER ONE

INTRODUCTION

Educational researchers have been interested in factors that affect student performance for a long time. Earlier research (Campbell, Coleman, Hobson, McPartland, Mood, Weinfeld, and York, 1966) proposed that educational institutions had an insignificant effect on students' academic performance, but more recent research (e.g., Wright, Horn, and Sanders, 1997; Wilmot, 2009) has demonstrated that places of learning, and therefore educators, have a significant impact on how well students perform in school. So, it is crucial to understand the positive traits that educators contribute to a classroom setting (Ofem, Iyam, & Bassey, 2015). However, the contentious issue has been which school-related factors are noteworthy.

Background to the Study

Education is regarded as an essential component of humanity that can aid in the growth of any country throughout the world and so cannot be undervalued in a country's progress (Wambugi, 2014). Education is a powerful tool to reduce inequities, eliminate poverty, promote tolerance, enhance equality, and healthy living among people in the society. Also, the truism that a country's educational system is judged by the calibre of its teachers (Abe and Adu, 2014) still valid. Educational practitioners and policymakers concur that instructor quality is the most significant school-related factor influencing students' academic success and reducing performance gaps (Gichuru & Ongus, 2016; Fenster, 2014; Gichuru & Ongus, 2016). Ansah (2020) emphasized that

teacher knowledge of the educational challenge has a substantial influence on students' learning outcomes.

According to Sinclair (2015), teacher assessment literacy refers to the knowledge, skills, and understanding that educators possess regarding the design, implementation, and interpretation of assessments in the context of teaching and learning. Assessment literacy encompasses a range of competencies that enable teachers to effectively use assessments to gather meaningful information about student progress, make informed instructional decisions, and support the overall improvement of educational outcomes.

According to Sinclair (2015), teacher quality refers to the overall effectiveness and proficiency of an educator in facilitating student learning, fostering positive educational outcomes, and contributing to the development of students' academic and non-academic skills. It encompasses a range of characteristics, competencies, and attributes that distinguish highly effective teachers from less effective ones. Teacher quality is a multifaceted concept that goes beyond academic qualifications to include instructional practices, interpersonal skills, and the ability to create a supportive and inclusive learning environment.

Studies show that several factors, both teacher and non-teacher elements such as school characteristics, have an impact on students' academic performance (e.g., Bidya, 2003; Kosgei, Mise, Odera, & Ayugi, 2013; Ofem, Iyam, & Bassey, 2015). When it comes to teacher-related criteria, teaching experience as assessed by the total number of years spent instructing is a common metric of teacher quality. The performance of pupils in secondary schools is significantly influenced by the experience of the teachers. Experienced teachers are more open to criticism, may contribute knowledge and

insight to facilitate learning and instruction, and tend to be less autocratic in the learning environment (Kosgei, Mise, Odera, & Ayugi, 2013). According to Olaleye (2011), trainees who receive instruction by seasoned instructors perform better because these educators understand subject matter better and have developed managerial abilities to deal with a number of impediments. Additionally, it is said that experienced instructors can focus on the most successful approaches to teach topics that benefit learners with a range of cultures, skills, and prior expertise (Wirth & Perkins, 2013). Conversely, some studies found that years of expertise had little bearing on student performance (Hanushek & Rivkin, 2006; Borisade, 2011).

Educators' certifications are still another important aspect of teacher factors. The professionalism and scholarly training and certification of a teacher have favourable effect on academic advancement of students (Obasi, 2010s). This reinforces the notion that the calibre of our institutions of learning are not feasible to be greater than the standard of our educators. However, Individual teacher qualifications, as indicated by George (2004) and Koedel and Betts (2007), have no effect on how well learners improve; rather, low student achievement in mathematics is related to a lack of materials and administrative issues.

The knowledge of a teacher's educational content has also been recognized as a teacher element that may influence students' performance. Ball (2003) asserts that a teacher with strong content knowledge in mathematics pedagogy may simplify abstract mathematical concepts so that students of different cognitive abilities can understand them, such as breaking down into discrete parts (Korau, 2011).

Korau (2011) views assessment literacy as possessing the ability to evaluate students' knowledge and skills, analyse the outcome of those analyses, and use those conclusions to improve student learning and course effectiveness. An assessment literate teacher is knowledgeable about assessment and abilities required for the proficient discharge of their duties (Popham, 2009). In other words, assessment literacy is the capacity to perform successful assessments and use the data to improve instruction and learning. This requires that a teacher must have an understanding of test design to create high-quality items, appropriate use of feedback to pinpoint students' areas of strength and weakness, and consequently alter their methods of instruction to help pupils learn better.

Wenglinshy (2002) opines that classroom assessment feedback affects professional development, which affects instructional strategies, and consequently affects student performance. Feedback is regarded as a strong influence on student learning outcomes (Attie, 2009) and a means to help students fix learning errors (Mory, 1996). However, there are claims that teachers do not provide students with adequate feedback on their learning results (Quyen & Khairani, 2017; Kankam, Bordoh, Eshun, Bassaw, & Korang, 2014; Ababio & Dumba, 2013). There is yet no consensus on the efficacy of feedback on learning. Some research suggests that the assurance of positive learning outcomes from feedback cannot be assured (e.g., Kluger & DeNisi, 1996; Shute, 2008; Van der Kleij et al., 2015).

Mathematics is essential and widely acknowledged as fundamental to a well-rounded education (Vorderman, Porkess, Budd, Dunne & Rahman-Hart, 2011) and has connections to everything in the world that influences the manner that individuals live their lives on a daily basis (Mefor, 2014). Core mathematics

has connections to everything in the world that influences how people go about their daily lives. It is necessary for persons working in the public sector and other industries to have a foundational understanding of mathematics to carry out their everyday tasks. Every educational system places a high priority on teaching and understanding mathematics (Guinocor, Almerino, Mamites, Lumayag, Villaganas, and Capuyan, 2020). Many facets of human living make use of the knowledge learned from studying mathematics. In support of this, Jha (2012) highlighted the vital role of mathematics in fostering creative thinking and critical analysis of issues in everyday life, problem solving (Sa'ad, Adamu, and Sadiq, 2014), and growth of fundamental computational abilities. In most countries, including Ghana, all primary and secondary students are required to take core mathematics Nonetheless, it is heartbreaking to see students' performance continue to decline despite the many benefits of mathematics. As observed in several countries (e.g., Obasi, 2010; and Kamoru and Ramon, 2017 in Nigeria; Agyei, 2010 in Ghana; Capuno, 2019 in the Philippines), a large percentage of students today struggle with mathematics and do poorly on their final exams.

Both Darling-Hammond (2000) and Harris and Sass (2011) acknowledge the importance of teacher quality in influencing student achievement, but there is a research gap in understanding the specific mechanisms through which teacher quality exerts its impact. Further research could explore the nuanced pathways and interactions among teacher knowledge, skills, experience, and student outcomes. The studies provide insights into the correlation between teacher quality and student achievement at a specific point in time. A research gap exists in the absence of longitudinal studies that track the long-term impact of teacher

quality on student outcomes. Longitudinal analysis could help discern the sustained effects of high-quality teaching on students' academic progress. The studies provide insights into teacher quality in general, but there is a research gap in understanding how teacher quality manifests in diverse educational settings (e.g., urban, rural, socioeconomically diverse). Research could explore variations in the impact of teacher quality across different school environments. The studies primarily rely on quantitative data, and there is a research gap in incorporating qualitative perspectives. Qualitative research could provide deeper insights into the experiences, beliefs, and practices of teachers that contribute to their perceived quality and effectiveness in the classroom.

From the preceding discussion, it is evident that there are divergent opinions about some of the issues around the teacher variables being examined. As a result, it is necessary to examine these variables to determine how they affect students' academic performance, particularly in core mathematics, in the Akuapem North municipal. This study will therefore examine the contribution of teacher characteristics or factors (teaching experience, pedagogical content knowledge, prior education, and training) alongside teachers' assessment literacy (knowledge of test construction and assessment feedback practice), to the prediction of students' mathematics performance in Akuapem North municipal, Ghana.

Statement of the Problem

Mathematics performance among secondary school students in Ghana is consistently below average (Agyei, 2010). Furthermore, according to the Educational Sector Performance Report (2015), cited in Asamoah (2018), pupils nationwide obtain a much lower pass rate in core mathematics than in other core

disciplines including Social Studies, Integrated Science, and English Language. Students' arithmetic skills continued to drop from 2013 to 2015, based on by the Chief Examiner's Report in Core Mathematics. Performance in 2015 was worse than in 2014, and in both years, it was lower than in 2013. Also, as stated in Ansah (2020) and the Chief Examiner's Report (2018), candidate performance declined from the previous year.

Table 1: *Unpublished Data of Performance of Students in the Akuapen North Municipal Educational Directorate in Core Mathematics from 2019 to 2022*

Core Mathematics	2019	2020	2021	2022
Core mathematics pass percentage	54.1	49.3	45.1	44.7
Core mathematics fail percentage	45.9	50.9	54.9	55.3

Source: Education Management Information System (EMIS). (2023). Senior High School Core Mathematics Performance Data for Akuapem North Municipality, 2023

As shown in Table 1, In the Akuapem North Municipal, there is a steady downward trend in the performance of learners in core mathematics. Furthermore, mathematics has earned a track record for being difficult for pupils, and students' performance in the subject during external certificate examinations is regularly scrutinized due to repeated poor results of learners in the subject (Mensah, 2018). It might be claimed that these students' success in classroom assessments of mathematics during teaching and learning should match their achievement in WASSCE in mathematics because they were deemed prepared to write external tests in that subject. To better understand the

reason for students' poor academic performance in mathematics and to provide solutions, further research is required in this field.

Numerous studies have looked into the variables affecting mathematics performance in Ghana (Ankomah 2015; Mereku, 2003, and Appiagyei, Joseph & Fentim, 2014). However, a substantial number of these studies concentrated on student qualities as being the most important effects on SHS mathematics performance, including attitude, curiosity, a lack of practice, inadequate instruction and learning materials, home circumstances, and peer variables. Around the nation, various studies have examined the qualities of teachers. It seems that the research solely took into account the traits of a particular educator when predicting secondary school students' mathematics achievement. For instance, Appiagyei (2014) did not examine other teacher characteristics like experience, pedagogical content knowledge, subject matter knowledge, prior education and training, or teachers' assessment literacy (test design and assessment feedback), instead focusing solely on the effects of teachers' professional qualifications on SHS students' academic performance in Akuapem North. It is necessary to explore how well teachers' assessment literacy and other teaching characteristics work together to predict students' mathematics success.

Ansah's (2020) study also examined other teacher qualities, such as experience, pedagogical content knowledge, subject matter knowledge, and prior education and training, as well as their impact on students' performance in elective mathematics, without specifically addressing core mathematics teachers. Moreover, Ansah's (2020) study did not consider whether teachers' assessment literacy influenced students' performance in core mathematics.

There is a need to investigate Mathematics teachers' assessment literacy on students' Mathematics performance.

A study conducted by Ansah (2020) looked at teachers' assessment literacy nevertheless, the study did not include senior high school core mathematics teachers but college tutors for nursing students. Furthermore, because her study did not look at other teacher characteristics including experience, pedagogical content expertise, knowledge of the subject, and prior education and training, more research is needed to determine how these teacher attributes affect students' success in core mathematics.

While the studies suggest a positive correlation between teachers' assessment literacy and students' mathematics performance, there is a research gap in understanding the specific mechanisms that mediate or explain this relationship (Ansah, 2020). Future research could delve into the processes through which enhanced assessment literacy translates into improved student achievement in mathematics. The existing studies provide a cross-sectional view of the relationship between assessment literacy and student achievement. A research gap exists in the absence of longitudinal analyses that track changes in teachers' assessment literacy over time and how these changes relate to students' long-term academic progress in mathematics (Guinocor et al., 2020). The studies focus on assessment literacy without extensively exploring the contextual factors that might influence teachers' development of assessment literacy. Research gaps include investigating the impact of school policies, professional development opportunities, and institutional support on teachers' assessment literacy (Guinocor et al., 2020).

Assessment literacy encompasses various components, such as designing assessments, interpreting results, and providing feedback. There is a research gap in understanding which specific components of assessment literacy have a more significant impact on students' mathematics achievement. Differentiated analyses could provide targeted insights for educational interventions (Guinocor et al., 2020). The studies focus on the general relationship between assessment literacy and students' mathematics performance. A research gap exists in understanding how assessment literacy impacts diverse student populations, including those with varying socio-economic backgrounds, learning abilities, and cultural contexts.

Also, it appears that little to no research has been done to combine teacher qualities and assessment literacy and how these relate to core mathematics performance among students across the country, and specifically in Akwapim North Municipal. Based on this, the current study examined the individual and joint contribution of teacher qualities (teaching experience, pedagogical knowledge, subject-matter knowledge, and prior education and training) and teachers' assessment literacy (knowledge of designing assessment, perception of assessment and feedback practices) to predict students' core mathematics performance in Akwapim North Municipal.

Purpose of the Study

This investigation tries to ascertain how well certain educator characteristics and assessment literacy predict students' performance in core mathematics in senior secondary schools in Ghana's Akuapem North Municipality. The research specifically intended to:

1. Assess the assessment quality of mathematics teachers in Akuapem North Municipality in terms of teaching experience, knowledge of pedagogy, subject-matter knowledge, prior education, and training.
2. Determine the level of assessment literacy of mathematics teachers in Akuapem North Municipality with respect to their understanding of test construction, practice of assessment and feedback practice.
3. Examine the individual influence of teacher assessment literacy factors to performance of students in core math in Akuapem North Municipality.
4. Examine the differences in test construction skills among teachers in Akuapem North Municipality based on their highest qualification.
5. Explore the difference in years of teaching in Mathematics and teachers' assessment feedback practices in Akuapem North Municipality.

Research Question

1. What is the assessment quality of Mathematics Teachers in Akuapem North Municipality in terms of teaching experience, pedagogical knowledge, subject-matter knowledge, prior education, and training?
2. What is the level of mathematics teachers' assessment literacy in Akuapem North Municipality in terms of their knowledge of test construction, practice of assessment, and feedback practice?
3. What is the impact of teacher assessment literacy factors on performance of students in core mathematics in Akuapem North Municipality?

Research Hypothesis

1. H_o: There is no statistically significant difference in test construction skills among teachers based on their highest qualification in Akuapem North Municipality.

H_A: There is a significant difference in test construction skills among teachers based on their highest qualification in Akuapem North Municipality.

2. H_o: There is no statistically significant difference in teachers' practice of assessment feedback based on teaching experience of teachers.

   H_A: There is a statistically significant difference in teachers' practice of assessment feedback based on teaching experience of teachers.

Significance of the Study

The study provided empirical verification that educator-related variables may have had an impact on students' academic achievement in core mathematics. It also gave light on educators' and other stakeholders' perceptions on teacher-related characteristics that may be useful as predictors of students' academic success in fundamental mathematics. This could aid policymakers in developing ways to increase the quality of teaching personnel and senior high school core mathematics outcomes. The study also helped mathematics teachers recognize where they needed to improve to positively impact students' learning. It shed light on the need for retraining among educators and educational policymakers to keep instructors current on the newest and best practices in their area of expertise and provide the best knowledge distribution to students.

Delimitation

The study examined if teacher-related factors were impacted by teachers' demographic features and whether these teacher-related characteristics might have an impact on learners' academic performance in core mathematics. It was limited to the municipality of Akuapem North

Municipality in the Eastern Region. The study excluded teachers from other subject areas or other municipalities, and it only included instructors of core mathematics in the municipality.

Additionally, the survey only included public secondary schools; private schools were excluded. In order to get comprehensive data on students' performance, the study was further limited to Senior High School Form 2 students in the municipality and excluded participants from other grade levels.

Limitations

Descriptive surveys are often correlational, meaning they identify associations between variables but do not establish causation. Therefore, the study may highlight relationships between teacher quality, assessment literacy, and students' performance, but it cannot definitively prove that one causes the other. The findings may be specific to the Akuapem North Municipality, and caution should be exercised when generalizing the results to other regions or educational contexts. Factors such as cultural differences, curriculum variations, or socioeconomic conditions could impact the generalizability of the study. The study focuses on teacher quality and assessment literacy as predictors, but other factors influencing students' performance in mathematics may not be fully considered. Variables such as student motivation, parental involvement, or school resources could also play significant roles.

Organization of the Study

This research report consists of five chapters. The introduction chapter, chapter one, covered the background of the study, the problem statement, the purpose of the study, the hypotheses and research questions,

the significance of the research, the limitations, the delimitations, and the operational definition of terminology. In chapter two, the literature on teacher variables and the performance of students in core mathematics was covered. The literature review covered the study's theoretical foundation, conceptual framework, and empirical analysis.

The study paradigm, research design, population, sampling strategy, data collection device, data collection techniques, and data processing and analysis are the main topics of the third chapter. The fourth chapter covered data analysis and how the findings should be interpreted. The outcomes will also be discussed. Chapter five will wrap up the entire study by presenting summaries, key findings, conclusions, suggestions, and identifying a subject for additional investigation.

Definition of key terms

Teacher quality variables

Teaching experience refers to the practical knowledge and skills acquired through instructing or guiding others, typically in an educational setting. It encompasses the number of years the teacher has been in the teaching service. Teacher qualification refers specifically to the formal academic qualifications attained by educators before the designated point in time of the research. It encompasses degrees, certifications, and other educational credentials acquired through recognized institutions and programs. The emphasis is on the educational background and training that contribute to a teacher's knowledge, skills, and expertise in the field of mathematics education.

Pedagogical subject knowledge refers to a teacher’s understanding of how to teach a specific subject effectively. It goes beyond knowing the content itself

and includes insights into how students learn, the potential challenges they might face, and the most suitable instructional strategies.

Content knowledge refers to a person's understanding and proficiency in a specific subject or field. It involves having a deep and comprehensive grasp of the facts, principles, theories, and concepts related to that subject.

Assessment Literacy variables

Test construction skills deals with the ability of the teacher to design, develop, and create assessments or tests that effectively measure the knowledge, skills, or abilities of learners. This involves crafting questions, tasks, or prompts that are clear, fair, and aligned with the learning objectives.

Feedback practices involve the strategies and methods used by the teacher to provide constructive information about learner's performance, behavior, or work.

Assessment design refers to the intentional planning and creation of evaluations or tests to measure an individual's knowledge, skills, abilities, or performance in a specific context. This process involves defining clear objectives, selecting appropriate assessment methods, creating relevant tasks or questions, and establishing criteria for evaluating responses.

CHAPTER TWO

LITERATURE REVIEW

Introduction

The central objective of the research project was to look into teacher-related factors that might affect how well students in the Akuapem North municipality performed academically in core mathematics. The study further examined the influence that teachers' demographic characteristics or biodata had on teachers' assessment literacy variables. The chapter reviewed what other authors have reported concerning the above subjects. The findings, statements, and observations of various writers or authors in regard to the subjects mentioned above were reported in the study's literature evaluation. The review included both a theoretical and conceptual analysis. The topic's conceptual framework and empirical investigations were also mentioned and reviewed, respectively.

Theoretical Review

The mathematical theory of Relational and Instrumental Understanding and the Zone of Proximal Development (ZPD) concepts was used to support the research. The rationale behind picking these hypotheses was that they both have important concepts that can influence teachers' quality and their assessment literacy which will then affect mathematics performance of the students. Below are the explanations of the theories, their importance in helping students learn mathematics with ease and consequently affect their performance in mathematics and how they linked to the study.

Zone of Proximal Development (Vygotsky, 1930)

Vygotsky published the Zone of Proximal Development (ZPD) theory in 1930. According to this viewpoint, social interaction comes before development, and socialization and community behaviour result in an increase of awareness and cognition. This theory's general premise is founded on three key ideas: (a) social interaction is essential for cognitive development, including the acquisition of skills like mathematics; and (b) the more others know, the better. In the broader setting of this study, this refers to someone with greater expertise than the student (for example, mathematics teachers)., (c) The zone of proximal development (ZPD). ZPD is the term used to describe a broad variety of responsibilities that are thought to be too demanding for young people to complete on their own but can be successfully completed with the help and guidance of a more seasoned expert. The lower limit and upper limit are the two sections that constitute the zone of proximal development. In other words, the young child's level of independence-related abilities represents the lower limit of ZPD. The upper limit of ZPD depends on how much extra responsibility the youngster accepts with the support of those who are more qualified (Vygotsky, 1930).

Teachers that are knowledgeable about the ZPD and how it influences learning will be able to employ an educational strategy that leads students into greater levels of knowing rather than just assigning or supplying material to them.

Also, in relation to students' mathematics performance, this theory provides the teacher with an understanding that enhances their subject matter knowledge, pedagogical skills, test designing skills, perception in assessment

and feedback practices, in addition to the activities they will take students through which are necessary to improve student performance. In support of this, Reys, Lindquest, Lambdin, Smith, and Marlyn (2001) stated that studying mathematics involves the following principles, thus using resources and past knowledge to immerse learners in the process of education. Also, actively involve pupils in mathematics learning in a way that will aid in long-term retention.

It is therefore not a stretch to utilize this concept to support the study because it presents a solid argument that can assist teachers in using suitable models and practical information to demonstrate mathematical ideas and actively engage students in the learning activity. The primary pedagogical consequence is that academics must present unknown knowledge in the context of what pupils already know.

Theory of Instrumental and Relational Understanding in Mathematics

The Relational and Instrumental Understanding Model in Mathematics was created and put forth by Skemp in 1976. Skemp (1976) utilized the example of a person visiting a new place to illustrate the mathematical concept behind relational and instrumental comprehension. An individual would try to figure out how to navigate their way from point A to point B when they were unfamiliar with a town. The first successful route would become the set route that person would always take to move from one position (A) to another (B), regardless of time or distance. The individual is guided between these two sites by the noted references along the way. With these references, the person can exit the front door to the right, walk directly past the church, and so on. After a period, the person will start to wander around the town in an effort to build a

mental map of it rather than with much intention of getting to or from any one location. However, as they continue their study, they find links to more paths that successfully connect sites B and A.

In contrast to the previous instance, an individual with a mental image of the town would be in a better position to develop multiple different paths from point A to point B if the original path was deviated from. Additionally, if the person followed the derived travel plan incorrectly, they may effectively reroute their journey while being aware of their location on the mental map. Skemp (1976) termed instrumental understanding to be the specialized knowledge required to travel from one spot to another utilizing wrote analogies. In the second case, relational understanding, as defined by Skemp (1976), was the process of developing a general mindfulness of points A and B as they are seen on a mental map of the town.

The comparison Skemp made between learning mathematics and touring a new city is a good one. Instrumental learning occurs when students are given a problem to solve and are taught how to do it step-by-step (Skemp, 1976). When students can devise an infinite number of solutions to a problem, they are engaging in relational learning, as stated by Skemp in 1976. Instructional strategies based on exploration are more likely to promote relational learning.

This theory holds that students should be trained in a manner that provides them with knowledge as well as the capacity to apply, synthesize, and judge that knowledge in a variety of situations. Educators who lack teaching experience and have weak pedagogical expertise will find it effortful to impart knowledge to learners, which will have a negative impact on their test design

abilities in addition to how effectively they offer students with feedback. Thus, while discussing issues of academic accomplishment, teacher experience, pedagogical skills, test design, and assessment feedback practice are crucial components.

These two ideas are related to the study in that it is concerned with teacher quality and assessment literacy, as well as how it predicts the mathematical success of students. The theories contain useful assumptions that can influence teachers' quality and assessment literacy, and thus the mathematical proficiency of learners. The study will combine Vygotsky's Zone of Proximal Development (ZPD) with the core ideas of Skemp's (1976) mathematical framework for grasping relational and instrumental comprehension.

Conceptual Review

Concept of Mathematical Learning

Mathematical learning describes the entire procedure of gaining understanding and skills connected to mathematical principles and techniques. According to Baroody and Dowker (2015), Mathematical learning entails the attainment of both conceptual insight and procedural accuracy. Conceptual understanding is the ability to comprehend mathematical ideas, laws, and relationships, whereas procedural accuracy is the capability to do mathematical operations precisely and effectively. Research has shown that mathematical learning in early childhood is critical to later success in mathematics and other academic subjects (Clements & Sarama, 2009).

A significant theoretical approach to mathematical learning is grounded in the cognitive perspective. This viewpoint suggests that mathematical

understanding is developed within the learner's mind through cognitive processes (Vygotsky, 1978). Vygotsky's Zone of Proximal Development (ZPD) theory proposes that students can attain higher levels of mathematical competence with the guidance of a knowledgeable teacher or peer (Vygotsky, 1978). This perspective underscores the importance of social interaction and scaffolding as facilitators of mathematical comprehension.

Constructivism represents another noteworthy theory within the realm of mathematical learning. It advocates that students take an active part in building their mathematical understanding through engagement with their surroundings (Piaget, 1970). This perspective views mathematical learning as a dynamic blend of cognitive and social processes, which are significantly influenced by cultural and contextual factors (Lave & Wenger, 1991). Within this framework, there is a focus on the importance of hands-on experiences, experiential learning, as well as problem-solving as integral components of mathematics education (Polya, 1945).

Connectionism, championed by neural network models, offers valuable insights into the neural mechanisms underlying mathematical learning. According to connectionist models, mathematical knowledge is encoded within the brain through interconnected nodes (McClelland & Rumelhart, 1986). These connections between nodes strengthen over time with repeated exposure and practice, thereby fostering the growth of mathematical skills. Implementing these theoretical perspectives in educational settings yields effective instructional strategies. For instance, within the cognitivist framework, the utilization of scaffolding techniques, such as guided problem-solving, has the capacity to assist learners in comprehending intricate mathematical thought

(Wood et al., 1976). Constructivist approaches embrace the integration of tangible resources for learning and real-world scenarios to actively engage students in mathematics exploration (National Council of Teachers of Mathematics, 2000). Connectionist models underscore the significance of repetitive practice and spaced learning to strengthen neural connections, which has implications for educational practices (Pashler et al., 2007)

Diverse mathematical learning theories provide valuable perspectives on the means to gain mathematical knowledge and skills. Cognitivism highlights the importance of cognitive processes and social interaction, constructivism places emphasis on active learning and problem-solving, while connectionism offers a neural perspective. The application of effective instructional strategies grounded in these theories has the potential to substantially elevate mathematics proficiency among students.

In addition, the National Research Council discovered in 2001 that early exposure to mathematics could support pupils' social, cognitive, and emotional growth. It is imperative that we offer young children an avenue to indulge in meaningful and pertinent mathematics experiences that foster mathematical learning. Effective mathematical learning experiences for young children involve hands-on, active exploration of mathematical concepts and operations (Ginsburg et al., 2006). These experiences should be based on children's interests and experiences and should be integrated into all areas of the early childhood curriculum (NCTM, 2010). Mathematical learning experiences should also be designed to promote children's problem-solving, reasoning, and communication skills, as these are important for success in mathematics and other academic subjects (Baroody & Dowker,

2015)

The Philosophy of Mathematics and Teaching

The philosophy of education in mathematical computation is concerned with understanding the goals and essence of mathematics, as well as how it should be taught and learned. According to Ernest (1991), "mathematics is a way of thinking, a powerful tool for representing, describing and exploring the world, and a cultural phenomenon in its own right." As such, the teaching of mathematics should aim to develop students' ability to think mathematically, to take part in mathematical culture and to comprehend and value the function of mathematics in the global community.

Mathematics instruction should be more active and engaging than merely transferring knowledge, teachers should motivate students to produce their own unique intellectual grasp on the material. This concept is emphasized by the NCTM (National Council of Teachers of Mathematics) in their guidelines and requirements for school mathematics, which state that "mathematics education must include aiding participants establish an extensive awareness of mathematical ideas and methods, as well as the ability to utilize them to address problems" (NCTM, 2000).

To do this, mathematics education should prioritize problem-solving, reasoning, and communication over memorization and calculation. Teachers should give students opportunities to participate in meaningful mathematics assignments that are applicable to their personal lives and hobbies and require them to utilize their mathematics understanding and abilities. This kind of teaching, known as constructivist classroom instruction, emphasizes its significance of active student participation in their educational experience (Fosnot & Dolk, 2001).

Teacher Knowledge in Mathematics

The NCTM, which stands for the National Council of Teachers of Mathematics in the United States asserts that educator expertise is a pivotal element for successful mathematics instruction (NCTM, 2014). Mathematics educator expertise spans not only content knowledge but also pedagogical competence, which includes knowing how learners are learning, instructional methodologies, and mathematics-specific classroom management practices (Ball, Thames, & Phelps, 2008).

Educators must be well-versed on both the rules of mathematics and the methods they are instructing alongside the way schoolchildren acquire those concepts and procedures with the goal to teach mathematics successfully (Ball et al., 2008). They should be capable of designing and implementing effective instructional strategies that support student learning and be able to assess and evaluate student progress (NCTM, 2014). Teacher aptitude for math, according to research, is an accurate determinant of student success in mathematics (Hill, Rowan, & Ball, 2005). Therefore, it is essential that teacher education programs provide prospective teachers with a solid foundation in mathematics content and pedagogy and opportunity for continued professional development to expand the breadth of their expertise (NCTM, 2014).

Concept of Assessment

Gullickson (2015) views assessment as the approach of collecting and synthesizing data pertaining to student learning and achievement. It is a major unit of the instructional process, providing information to educators about their students' progress and enabling them to make informed decisions about instruction (McMillan, 2011).

More realistic forms of assessment have been used in education in recent times, in particular for early childhood education, because they offer vivid depiction of what children comprehend and can accomplish (Gibbons & Cobb, 2017). Authentic assessment is a form of assessment and it is centred on concrete assignments, activities, and projects that have meaning and relevance for students (Muñoz & El-Hindi, 2017).

The importance of authentic assessment in preschool education may be due to the fact that it allows educators to gather information on students' development in a way which is both relevant to their learning and meaningful to the students (Laurillard, 2013). It allows teachers to assess students' being capable of use expertise and skills in practical settings as opposed to just their ability to memorize and recall information (Gullickson, 2015). Development of deeper mental skills such as imaginative thinking, critical thinking, and effective problem-solving abilities, which are vital for success in the modern era, is additionally reinforced by authentic assessment (Muoz & El-Hindi, 2017).

Types of Assessment

Assessment may be classified into different types based on its purpose, timing, method, and other criteria. According to Black and Wiliam (1998), in total, there are two primary categories of assessment: summative and formative assessment. Formative assessment is an ongoing technique that tracks students' progression as they study. Formative assessment's objective is providing teachers and students feedback to improve how students learn. Contrarily, summative assessment is a final assessment that is used to measure students' levels of performance or achievement at the conclusion of a unit, course, or programmed (Black & Wiliam, 1998).

Another classification of assessment is based on the method used to collect data. This includes traditional or paper-and-pencil tests, performance assessments, and authentic assessments. Traditional assessments are the most common form of assessment that encompass multiple-choice, true-false, and short-answer questions. Performance assessments demand displaying the ability or task, such as answering a problem or carrying out an experiment. Authentic assessments hold real-world tasks and situations that pupils are going to come across outside of school (Popham, 2008). Additionally, depending on when an assessment is conducted, it can be categorized as diagnostic, formative, or summative. Prior to the start of education, diagnostic testing is done to assess the advantages and disadvantages of the students. Throughout instruction, formative assessments are carried out to track student progress and offer suggestions for improvement. In order to evaluate students' learning outcomes after the conclusion of instruction, summative evaluation is performed (Tomic & Stojanov, 2015).

Formative Assessment

Formative assessment, in the words of Black and Wiliam (1998), involves gathering proof of students' academic progress in order to give feedback that can be utilized to enhance and modify education. Formative assessment is one of the most successful techniques for enhancing student outcomes, as reported by Hattie and Timperley (2007), who identified that it had a strong impact on student learning and success with an effect size of 0.9. Further studies have shown that formative assessment can assist children of all ages across a diverse range of subject areas, for example both high-achieving and low-achieving students (Heritage, 2007; Wiliam, 2011).

Formative assessment relies largely on feedback (Hattie and Timperley, 2007). In relation to mathematics, constructive feedback is utilized to keep students informed about their progress, identify areas for improvement, and give practical recommendations for enhancing their learning (Sadler, 1989). Prompt and constructive criticism increases the student's retention of mathematical principles and problem-solving ability significantly. In mathematics, formative assessment processes span an extensive number of techniques and practices. To measure students' knowledge, methods such as discussions in class, tests, tasks for homework, and assessments by peers are employed (Heritage, 2007). These approaches stimulate student involvement, encourage active participation, and provide opportunities for self-evaluation and reflection.

Numerous studies have found that formative assessment improves mathematics proficiency. Groundbreaking study by Black and Wiliam (1998) demonstrated how properly used formative assessment can significantly improve learning outcomes. The constant practice of monitoring and changing instruction based on formative assessment data promotes the personalization of teaching to fit the specific requirements of every student (Wiliam, 2011)."

Regardless of the obvious benefits, successfully using assessment in the teaching of mathematics poses several challenges. These challenges may include time limits, a reluctance to accept change, and the need for educators to participate in professional development (Popham, 2009). It is critical to address these obstacles in order to completely grasp the promise of formative assessment. Formative assessment presents a dynamic strategy for improving student performance in the teaching of mathematics. It stresses the need of delivering immediate feedback, actively engaging students in their academic

path, and tailoring education to meet individual needs. Substantial research continuously underlines the positive influence of formative evaluation on mathematical learning results.

Summative Assessment

Summative assessment is an assessment format intentionally crafted to measure the progress of learners and achievement at the conclusion of an activity, course, or project. It is frequently applied to determine marks or if the learner has mastered an appropriate degree of learning. According to Shepard (2000), summative assessments "are used to predict student's overall achievement, performance, or mastery of content and skills, and are typically administered at the conclusion of a unit, semester, or year" (p. 9). Final exams, standardized tests, and end-of-year projects are a few examples of evaluations that are summative. Summative assessment in mathematics provides a thorough glimpse of pupil's competence in mathematical understanding as well as abilities. It evaluates their ability to apply mathematical principles and problem-solving techniques (Shepard, 2000).

Summative assessments, such as standardized exams, final tests, and end-of-year assessments, are critical in determining student achievement and the effectiveness of educational programs. While summative evaluation is overwhelmingly evaluative in nature, it can nonetheless provide valuable insight into issues where learners might require more assistance (Taras, 2005). Though not instantaneous, post-assessment feedback has the potential to inform instructional preparation for future learning.

According to research, summative exams have an enormous effect on how well children do in mathematics (Guskey, 2007). High-stakes summative

exams can encourage students to concentrate on their work and show off their mathematical proficiency (Hattie & Timperley, 2007). Summative evaluations also provide information on the efficacy of educational programs and curriculum to instructors, parents, and authorities. According to critics (Wiliam and Black, 1996), a high dependence on summative exams may encourage a limited concentration on topic mastery at the expense of deeper comprehension. It is also a cause for concern that students may experience test anxiety and tension, which could negatively affect their performance (Zeidner, 1998).

Summative assessment is essential in mathematics education for evaluating students' overall performance and programmed productivity. Though it provides useful information to aid with decisions, it additionally comes with issues and shortcomings that demand attention. A more thorough and effective mathematics education can be achieved by balancing the use of summative evaluations with the inclusion of formative methods.

Purposes of Classroom Assessment Practices

Classroom assessment practices performs several functions in education. One of the primary purposes is to evaluate students' understanding of the material taught in class. This examination supports teachers in recognizing each student's distinct capacities and constraints, allowing for the customization of instruction to satisfy the peculiar want of each learner. Another goal is to track students' progress over time and assess the efficacy of teaching tactics. This helps teachers adjust their teaching strategies and instructional methods to improve student learning outcomes (Stiggins, 1991).

Furthermore, classroom assessments assist student learning by giving students advice on their progress, which can encourage them to engage in

learning and strive for improvement. Classroom assessments also Provide a way for pupils to judge themselves in terms of their learning and set goals for themselves (Black and Wiliam, 1998). Furthermore, by giving students opportunities to exhibit their knowledge and skills, classroom assessments help to engage students and establish a good learning environment (Popham, 2008).

Teacher Quality

Teacher quality pertains to the expertise, capabilities, and traits that teachers possess and use in their instructional roles to improve student learning and growth (Darling-Hammond, 2000). The effectiveness of the instructor exerts a notable influence on students learning and achievement, as per to research by Darling-Hammond and Bransford (2005). According to research, effective teaching significantly affects student outcomes, such as academic performance, engagement, and social and emotional growth (OECD, 2005; Stronge, 2007).

The qualifications of a teacher are often used to judge their quality, experience, and pedagogical practices. Studies have shown that teachers who possess strong understanding of content, pedagogical content expertise, and general pedagogical knowledge are more effective in promoting student learning and achievement (Ball & Cohen, 1999; Shulman, 1986). A good attitude, high levels of motivation, and strong interpersonal skills are just a few of the professional and personal traits that effective instructors also possess (Hattie, 2003). Furthermore, teacher quality is not only influenced by individual teacher characteristics, but also by the school context and the support provided by school leadership and administration (Ingersoll &

Strong, 2011). Schools that provide professional development opportunities, collaborative teaching environments, and adequate resources and support for teachers have a greater chance to attract and retain top-notch teachers (Darling-Hammond, 2000)

Relevance of Teachers' Assessment Literacy

As elaborated by Stiggins (1991), literacy in assessment is the grasp of assessment concepts and methodologies, as well as the ability to apply them efficiently to boost student learning. Effective utilization of assessment in educational settings hinges on teachers' assessment literacy. According to Popham (2006), "Assessment literacy is essential for every teacher who hopes to use assessment as a tool to advance, rather than merely measure, student learning" (p. 20). Teachers who are assessment literate can create and implement high-quality assessments that measure accurately student growth and in turn give meaningful feedback to students, parents, and other stakeholders (Black & Wiliam, 2009).

Assessment literacy among teachers has become increasingly important due to the shift towards more formative assessment practices in education (Popham, 2009). With the focus on formative assessment, teachers obligated to use assessments to determine student strengths and shortcomings, set appropriate learning goals, and adjust instruction accordingly (Wiliam, 2011). Without assessment literacy, teachers may depend on assessments that are inconsistent with their class objectives or provide them false information about what their pupils are learning (Popham, 2006).

In addition, assessment literacy among teachers can improve student

achievement. A study by Brookhart, Moss, and Long (2009) found that when teachers were trained in assessment literacy and used formative assessment practices, student achievement improved significantly. This emphasizes how crucial assessment literacy is as a driving force behind bettering student learning outcomes.

Relevance of Teachers' Assessment feedback

Educators assessing and improving students' learning and performance through feedback is crucial. In the opinion of Hattie and Timperley (2007), one of the most powerful factors determining learning and achievement is feedback. Students receive feedback to learn more about how they performed and to help them do better. Students can identify their abilities and shortcomings, set improvement objectives, and track their advancement towards reaching those goals with the use of teachers' evaluation comments, according to Black and Wiliam (1998). Another benefit is that favourable feedback motivates students to adopt an evolving attitude, in which problems are seen as chances for advancement (Dweck, 2006). The environment in the classroom that arises from teachers' feedback on assessment is one that encourages students to take risks and make errors as a necessary element of learning (Hattie & Timperley, 2007).

Furthermore, Teachers' feedback can support students fill in the gap between their present and intended performance by providing concrete, tangible strategies towards growth (Hattie & Timperley, 2007). Teachers can provide feedback via a range of assessment tools and approaches, such as rubrics, written comments, peer and self-examination and oral feedback in class discussions (Brookhart, 2008).

Professional Qualification in Education and Teachers' Assessment Literacy

Research has shown that professional development programs are crucial for enhancing teachers' assessment literacy and feedback practices (Brookhart, 2013; Klinger & Akcaoglu, 2017). In fact, it has been found that teachers who have completed formal training or professional development programs in assessment are more likely to have higher assessment literacy skills (Black & Wiliam, 1998). Moreover, studies have shown that effective professional development programs in assessment help teachers in understanding the purpose of assessment, aligning assessments with learning objectives, creating valid and reliable assessments, providing effective feedback, and using assessment data to improve student learning (Stiggins et al., 2004; Brookhart, 2013).

Professional education degrees, such as an undergraduate or graduate certificate in higher education, can also help teachers improve their assessment literacy. These programs give instructors a theoretical background as well as practical abilities in assessment practices that may be used in the classroom (Popham, 2009). Davis et al. (2008) discovered that teachers with greater levels of education had stronger assessment literacy abilities and were more likely to employ a broader range of assessment procedures. Overall, professional development programs and credentials in education Can assume a significant role in improving teachers' assessment literacy and feedback practices, which eventually contribute to enhanced student learning outcomes.

Empirical Studies

Assess the Quality of Core Math Teachers in Terms of Prior Education and Training, Teaching Experience, and Pedagogical Content Knowledge.

Hill, Rowan, and Ball (2005) explored the association between instructors' mathematical knowledge and mathematics achievement of their students. The study concentrated on the mathematical expertise required for teaching, which extends beyond content knowledge. The researchers discovered that teachers' mathematical skills for instruction had a substantial impact on their pupils' mathematics achievement. Specifically, teachers' knowledge of mathematics content, as well as knowledge of how to teach math content, were important predictors of student achievement. The inquiry underscores the value of teacher preparation programmes that put an emphasis on enhancing teachers' mathematical expertise for instruction.

Study by Hill, Sleep, Lewis, and Ball (2007) discusses the assessment of teachers' mathematical knowledge, with a focus on determining what knowledge is important for effective teaching and how to gather evidence of that knowledge. The authors argue that teachers' content knowledge and knowledge of mathematics pedagogy are both important for effective teaching, and that both types of knowledge should be assessed in teacher evaluations. They propose several ways to gather evidence of teachers' mathematical knowledge, including observations of classroom instruction, analysis of teachers' lesson plans, and tests of teachers' content knowledge. The authors conclude that careful assessment of teachers' mathematical knowledge can help improve teaching effectiveness and ultimately improve student learning outcomes.

Darling-Hammond (2000) explored state laws and research initiatives to look into the causal connection connecting teacher quality and achievement by students in her study. Her findings provided solid evidence backing the idea that teacher quality is critical to student growth. Furthermore, she argues that policies should focus on increasing the quality of teachers rather than simply increasing the number of teachers. The study presents a comprehensive overview of published research on teacher quality and its impact on student accomplishment, making it an invaluable resource for policymakers, educators, and researchers.

Wilson, Floden, and Ferrini-Mundy's (2001) report concludes that teacher preparation programs need to be improved. They discovered that instructor training courses lack consistency and coherence, and that many programs do not effectively equip teachers to train different student populations. The report also illuminates the importance of subject matter knowledge, pedagogical knowledge, and critical experiences in teacher preparation. Finally, the investigation underscores the relevance of ongoing professional growth for educators for the purpose of improving their efficiency in the classroom.

Hiebert and Grouws (2007) undertook a thorough review of the literature on the impacts of classroom mathematics instruction on student learning. They analyzed studies that evaluated various aspects of classroom teaching, including curriculum, instruction, and assessment. The authors identified several key findings that quality of mathematics instruction is strongly related to student achievement. Effective instruction involves using multiple representations, providing opportunities for active engagement, and promoting understanding through discussion and reflection.

The existing studies touch upon the importance of teacher quality, but there is a need for research that delves into the specific contextual factors influencing teacher effectiveness. Examining how teacher quality interacts with factors such as school culture, community demographics, and classroom diversity could contribute to a more comprehensive understanding of effective teaching practices. While the studies acknowledge the significance of ongoing professional development for teachers (Hill et al., 2005; Wilson et al., 2001), there is a gap in understanding the implementation and effectiveness of specific professional development initiatives. Research focusing on the design, implementation, and outcomes of professional development programs aimed at improving teacher quality would be beneficial. The existing studies focus on teacher knowledge and preparation, but there is a research gap in exploring the dynamics of teacher-student interactions in the classroom. Investigating the quality of interactions, feedback mechanisms, and communication styles between teachers and students could provide additional dimensions to understanding effective teaching.

Assess the levels of core math teachers' assessment literacy in terms of knowledge of designing assessment, perception of assessment and feedback practices.

Wong and Cheng (2018) studied Hong Kong teachers' assessment literacy. The aim of this investigation was to look at Hong Kong teachers' degree of assessment literacy in terms of assessment design, assessment perception, and feedback practices. The study used a mixed-methods approach, which included a questionnaire survey and follow-up interviews with teachers. The survey included 429 secondary school instructors from 26 Hong Kong schools.

According to the study's findings, Hong Kong instructors exhibited intermediate levels of assessment literacy in terms of developing assessments, perception of assessment, and feedback practices. Teachers were discovered to have a higher comprehension of design assessment than the other two factors. The study also discovered that teachers were more inclined to incorporate formative assessment strategies into their instruction when they had higher levels of assessment literacy. The study also discovered a relationship between teachers' evaluation literacy levels and their teaching background and professional development.

Study conducted by Yenilmez and Özdamar (2018) aimed to concentrate on the literacy levels in assessment among Turkish mathematics teachers. The survey included 46 teachers of mathematics from different secondary institutions in Turkey. The researchers employed a strategy that uses mixed methods to data collection, employing a questionnaire and semi-structured interviews. The survey was created to examine instructors' assessment literacy in terms of assessment design, assessment practices, and assessment evaluation. The interview questions centered on the teachers' perspectives on assessment literacy and their professional development requirements. The research's results indicated that mathematics teachers had a moderate degree of assessment literacy, with assessment evaluation having the highest level of literacy. Teachers' literacy levels were poorer in terms of assessment design and practices. The study also discovered a link between the teachers' assessment literacy levels and their years of experience as an educator experience. Furthermore, the survey found that teachers had limited chances for training in assessment literacy.

Ayvaci and Akkmak (2019) did a study to explore the assessment literacy of instructors of mathematics in Turkey. The survey included 80 mathematics teachers from various regions of Turkey. The employed a quantitative research method with a survey questionnaire created by the researchers. The questionnaire consisted of 42 items, which covered the assessment literacy components such as assessment purpose, assessment methods, assessment validity and reliability, grading, feedback and reporting, and assessment ethics. The outcome of the research indicated that the assessment literacy of the mathematics educators was moderate, with the highest level of assessment literacy observed in the grading component, followed by the feedback and reporting component. The lowest level of assessment literacy was observed in the assessment validity and reliability component. The study also discovered that the amount of education and teaching experience of the teachers had a favorable link with their assessment literacy. The authors suggested that teacher education programs focus on improving teachers' assessment literacy to enhance their assessment practices in mathematics instruction.

Okoli and Asiegbu (2020) did a comparison study to analyze mathematics instructors' evaluation literacy in secondary schools in the public and private sector in Anambra State, Nigeria. A descriptive research method was utilized in the study, and a representative group of 120 instructors in mathematics was chosen using a multi-stage selection technique. The researchers created and validated a 20-item questionnaire to collect data on mathematics teachers' assessment literacy. The data was examine using the mean, standard deviation, t-test, and ANOVA. The findings revealed that public as well as private mathematics instructors in secondary schools lacked

assessment literacy when it came to devising assessments and offering feedback. Private school mathematics teachers, conversely, had a better degree of assessment literacy in the area of perception of assessment practices versus their public-school counterparts. The study suggests that mathematics teachers be trained and given ongoing professional development chances to improve their assessment literacy skills.

The studies primarily assess teachers' literacy levels in terms of assessment design, perception, and practices, but there is a research gap in the depth of exploration of assessment practices. Further research could delve into specific assessment practices employed by teachers, examining the alignment between intended and implemented assessment strategies. The existing studies provide a snapshot of teachers' assessment literacy at a specific point in time. A research gap exists in the absence of longitudinal studies that track changes in assessment literacy over an extended period. Longitudinal research could offer insights into the impact of professional development initiatives and teaching experience on the development of assessment literacy. The studies involve surveys and interviews to assess assessment literacy levels, but there is a research gap in understanding teachers' perspectives on their own assessment literacy. Qualitative research that explores teachers' beliefs, attitudes, and challenges related to assessment literacy could provide a more holistic understanding.

Examine the relationship between the teachers' quality variables and students' core mathematics performance.

Darling-Hammond, L. (2000) undertook a review of empirical evidence on the correlation between teacher quality and achievement among learners, particularly in the setting of state policy. The author analyses a number of

research and determines there is a substantial and consistent correlation between teacher quality and student mathematics achievement. The study identifies teacher knowledge, skills, and experience as key factors in this relationship, and suggests that teacher preparation, ongoing professional development, and equitable distribution of qualified teachers are important policy considerations. The author also emphasizes the importance of more study in order to comprehend the exact mechanisms through which teacher quality influences student accomplishment.

Rivkin, Hanushek, and Kain conducted a study in 2005 to find out how students' performance in mathematical concepts and other topics was impacted by their teachers' qualities. To study a sizable dataset combining Texas pupils as well as educators, the researchers used a value-added modelling approach. Their objective was to assess the effect of certain teachers on pupil achievement. The findings show that pupil success is considerably influenced by teacher quality, and that disparities in teacher quality play a significant role in the observed variances in achievement among pupils. The study also showed that, in contrast to other academic topics, the quality of the teacher had a more significant impact on students' progress in mathematics. The study also looked at a variety of aspects of teacher quality, including certification, educational background, and experience, and found a connection between each of these elements and students' academic progress. The researchers further discovered that teacher absenteeism and turnover had a negative impact on student accomplishment, highlighting the significance of keeping a steady teaching team to improve student learning.

A cross-subject analysis including student fixed effects was performed in 2020 by Guinocor et al., to investigate the link between credentials of teachers

and high school achievement among students. According to the survey, high school pupils taught by teachers with advanced degrees in their subject areas topped those taught by teachers without advanced degrees. However, the favourable impact of teacher credentials on student achievement was found to be moderate and varied across topics. Furthermore, the study discovered that instructor experience, certification, and training were not consistently associated with student accomplishment.

The relationship between teacher preparation, teacher effectiveness, and student achievement was researched by Wong and Cheng (2018). The authors found that teachers with advanced degrees and those who had graduated from prestigious institutions or colleges were associated with higher student accomplishment based on data obtained from Florida public schools. However, the authors did not find evidence that completing a traditional teacher education program leads to higher student achievement. Instead, they found that alternatively certified teachers are just as effective, and sometimes more effective, than traditionally certified teachers. The authors recommend that educator quality is more essential than educator education, and that strategies targeted at boosting teacher quality ought to concentrate on attracting and maintaining high-quality teachers.

The studies provide insights into the correlation between teacher quality and student achievement at a specific point in time. A research gap exists in the absence of longitudinal studies that track the long-term impact of teacher quality on student outcomes. Longitudinal analysis could help discern the sustained effects of high-quality teaching on students' academic progress. The studies provide insights into teacher quality in general, but there is a research gap in

understanding how teacher quality manifests in diverse educational settings (e.g., urban, rural, socioeconomically diverse). Research could explore variations in the impact of teacher quality across different school environments. The studies primarily rely on quantitative data, and there is a research gap in incorporating qualitative perspectives. Qualitative research could provide deeper insights into the experiences, beliefs, and practices of teachers that contribute to their perceived quality and effectiveness in the classroom.

Examine the relationship between teachers' assessment literacy variables and students' core mathematics performance.

The performance of pupils in mathematics and instructors' assessment literacy were found to be positively correlated by Wong and Cheng (2018) in Hong Kong. The investigation involved a sample of 144 mathematics educators and 2,710 secondary school students and used both self-report measures of teachers' assessment literacy and students' mathematics performance data from standardized tests. The outcomes showed a correlation between students' mathematics performance and instructors' estimation of their knowledge. This suggests that teachers are better able to support their students' growth and achievement in mathematics if they have a greater understanding of assessment methodologies.

Ayvaci and Akkmak (2019) studied Turkish mathematics teachers' evaluation literacy and its relationship to student achievement. According to the findings, instructors' assessment literacy showed a substantial beneficial link with kids' mathematical achievement. The study discovered that instructors' expertise of developing assessments, their judgements of assessment practices, and their feedback practices were all positively associated to students'

mathematics performance. The study suggests that improving teachers' assessment literacy could lead to better mathematics achievement among students.

Okoli and Asiegbu (2020) conducted research in Anambra State, Nigeria, comparing assessment literacy among mathematics instructors in both state and private secondary schools. The research additionally probed into the relationship between assessment literacy and students' mathematics achievement. Their study found that educators in private schools had greater levels of assessment literacy than those who worked in public schools. Furthermore, they discovered a link between assessment literacy and learners' mathematics performance. They discovered that assessment literacy was significantly predicted by a teacher's years of teaching, educational background, and training.

Wong and Cheng (2018) examined the joint contribution of teacher quality variables (teaching experience, academic qualifications, and professional development) and assessment literacy variables (knowledge of assessment, use of assessment, and interpretation and use of assessment results) to the prediction of students' mathematics performance in Hong Kong. They found that both teacher quality and assessment literacy variables had significant positive effects on students' mathematics performance, with assessment literacy variables having a slightly stronger effect. The authors suggested that a comprehensive approach that addresses both teacher quality and assessment literacy is necessary to improve students' mathematics performance.

According to a Darling-Hammond study published in 2000, there is a link between mathematics student achievement and teacher quality. While the

study did not directly evaluate the joint impact of teacher quality characteristics and assessment literacy variables, it did discover that teacher knowledge, abilities, and experience are important contributors in the association between teacher quality and student mathematical achievement. This shows that both teacher quality indicators and assessment literacy variables may be key predictors of students' core mathematics achievement.

Study by Rivkin, Hanushek, and Kain (2005) looked into the relationship between teacher quality variables (such as experience, certification, and degree level) and student achievement across a range of subjects, including mathematics. The authors found that teacher experience and certification had positive effects on student achievement in all subjects, including mathematics. However, they discovered that the impacts of teacher education level on student achievement were less consistent and varied by subject, with mathematics having a bigger effect than other subjects. Overall, the study suggests that teacher quality variables have a significant impact on student achievement in mathematics, with experience and certification being particularly important factors.

Assessment literacy encompasses various components, such as designing assessments, interpreting results, and providing feedback. There is a research gap in understanding which specific components of assessment literacy have a more significant impact on students' mathematics achievement. Differentiated analyses could provide targeted insights for educational interventions. While some studies separately examine teacher quality variables and assessment literacy, there is a research gap in exploring how these factors interact. Future research could investigate the synergistic or compensatory effects of teacher

quality variables and assessment literacy on students' mathematics performance. The studies primarily rely on quantitative data, and there is a research gap in incorporating qualitative perspectives. Qualitative research could explore teachers' beliefs, attitudes, and perceptions regarding assessment literacy, shedding light on the underlying factors influencing their practices and effectiveness in mathematics instruction.

Conceptual Framework

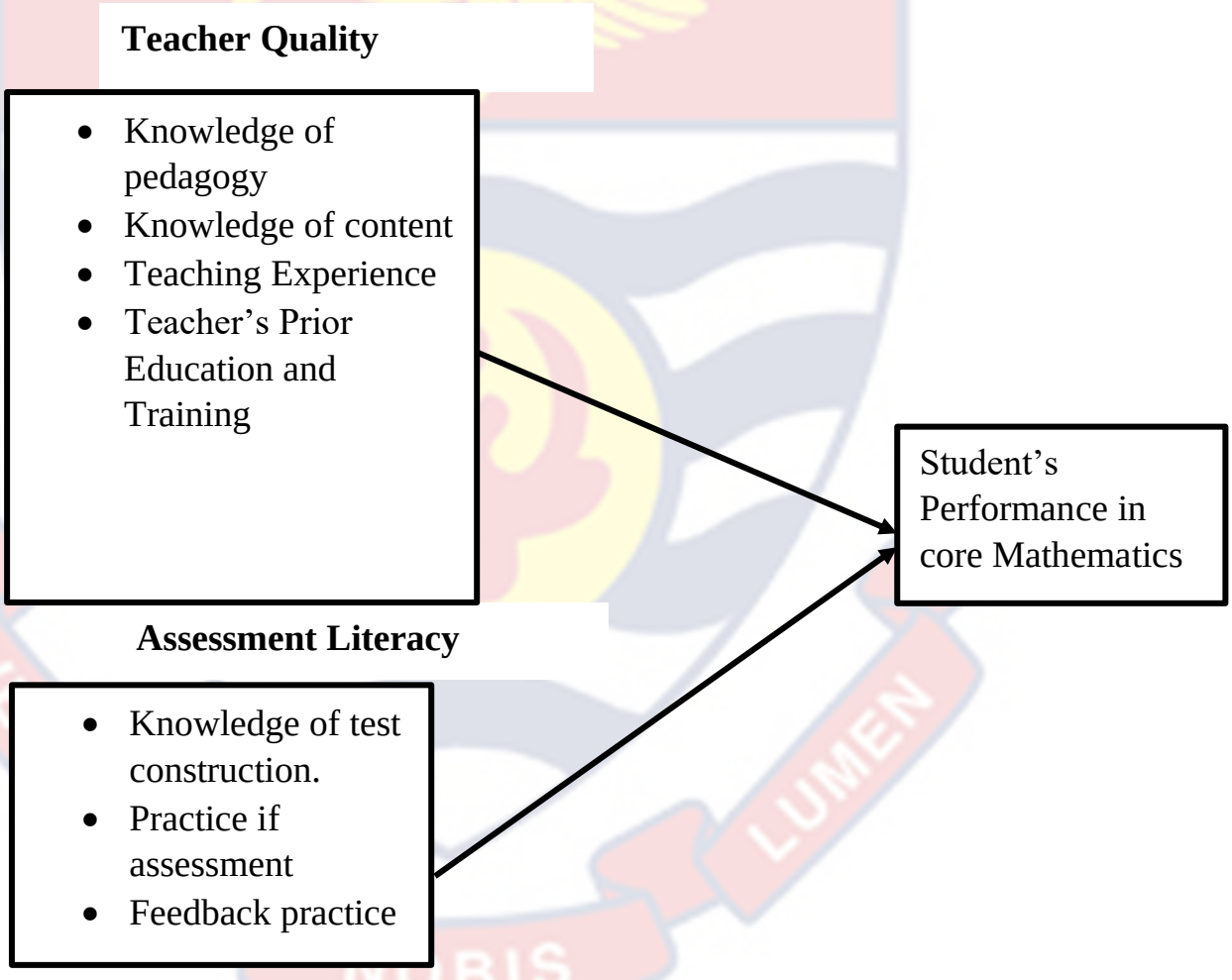

Figure 1: Conceptual Framework of Teacher Quality and Assessment Literacy on Student's Performance

Summary of Reviewed Literature

Teacher-related variables such as teacher quality variables (teachers' teaching experience, pedagogical content knowledge, prior education, and training) and assessment literacy variables (knowledge of designing assessment, perception of assessment, and feedback practices) on students' academic performance have been studied both locally and internationally. Based on the empirical studies examined, it was discovered that more investigations on the given issue have been undertaken worldwide than locally.

Given the deteriorating trajectory in core mathematics performance among Akuapem North Senior High School students and the existing research gap, it is critical to explore how teacher-related factors influence students' academic performance. Furthermore, it is critical to investigate whether teacher quality characteristics influence their assessment literacy variables.

CHAPTER THREE

RESEARCH METHODS

Introduction

The research sought to quantify the predictive potential of teacher quality, including teacher qualifications, teaching experience, pedagogical content knowledge, and assessment literacy, on student performance in core mathematics in Akuapem North Municipality. The research techniques used for this project are thoroughly described in this chapter. This chapter outlines an easy-to-follow procedure for gathering accurate and trustworthy data alongside how the data will be organized to meet the study's overall objective. These sections make up the chapter's divisions: research design, study area, population, sampling strategy, demographic characteristics of respondents, data collection instrument, pilot testing the instrument**,** validity and reliability of the instrument, ethical issues, data collection processes, and data processing and analysis.

Research Design

The study employed a descriptive survey approach to analyse the predicted effect of selected teacher traits and assessment literacy on students' performance in core mathematics in senior high schools located within Akuapem North Municipality. Descriptive survey design, defined by Fraenkel and Wallen (2008), describes an existing connection between variables and includes gathering information from a sizable population. Descriptive studies also focus on acquiring information rather than manipulating factors (Bannan-Ritland, 2003). According to Mugenda and Mugenda (2008), the study's design was deemed appropriate because it involved gathering information from the community to assess its status with reference to one or more factors. In this

sense, the descriptive questionnaire format is deemed appropriate for achieving the study's main goal of establishing the predictive power of selected teacher qualities and assessment literacy on students' performance in core mathematics in senior secondary educational institutions in the Akuapem North Municipality. Descriptive surveys aim to provide an accurate and detailed portrayal of a particular phenomenon. If the primary goal of the research is to describe the characteristics, behaviours, attitudes, or opinions of a population, a descriptive survey is an appropriate choice (Leedy and Ormrod, 2005). Descriptive surveys are suitable for investigating the prevalence and distribution of certain variables within a population. This can be particularly useful in health-related studies, market research, or social sciences. Researchers often use descriptive surveys to establish baseline information about a phenomenon. This baseline can serve as a foundation for future research or interventions (Leedy and Ormrod, 2005).

However, descriptive studies have important limitations. Tuckman (1972) contends that sampling error might occur due to the random selection of different persons. According to Osuala (2001), the descriptive study may have an issue with low rates of responses, which might have an undesirable effect on the survey results. According to Leedy and Ormrod (2005), bias abounds in descriptive surveys, particularly when questionnaires are utilized. To lessen how biased descriptive surveys can be, the following strategies will be used: Answers to questions will be precise and honest, and efforts will be made to encourage respondents to be forthcoming.

Study Area

One of the thirty-three districts of Ghana's Eastern Region is Akuapem North Municipal. Akuapem North District, which was formed in 1988 from the

former Akuapem District Council, began as an ordinary district assembly until being promoted to municipal district assembly status on March 15, 2012, when it became Akuapem North Municipal District. Akuapem North Municipal District has been preserved as the remaining portion of the district following the 15 March 2018 separation of the northeastern portion to form Okere District. The municipality's capital city is Akropong, which is situated in Eastern Region's southeast.

Population

Population was described by Ary, Jacobs, and Razavieh (2002) as all individuals who fall into a specific category of elements, such as individuals who are interested in a particular person, event, or individual object. In the Eastern region's Akuapem North Municipality, all public senior high school mathematics teachers will be the study's target group. A total of 129 teachers makes up the population demographic. All 129 Mathematics teachers in the municipality's public senior high schools make up the accessible population for

the study. Because they are individuals who can aid in reaching the study's objectives, these types of teachers will be used in the study. Furthermore, it appears that little to no research has been done on students' performance in Core Mathematics, therefore selecting a group of teachers for the study is acceptable because they are thought to have a better grasp of learners' performance in Core Mathematics. While students were involved, the study's major focus, in accordance with its aims, was on core mathematics educators.

Sampling Sample and Procedure

Essentially, sampling is the method a researcher uses to select a sample from an entire population for a study. It is appropriate to include a portion of the population that the researcher can manage easily because it is typically challenging to include every person in the study's population. Sampling refers to the process that will be used to choose the sample.

The census method was applied in the research endeavour, which is a statistical strategy that involves gathering data from every element or subdivision of the population. This kind of technique is additionally referred to as "complete enumeration," "100% enumeration," and "complete survey." It is useful when performing case-intensive analysis or when the topic matter is restricted in scope. The participants in this study were core mathematics educators from the municipality of Akuapem North.

Table 2: *Sample Distribution Table*

Name of school	Number of teachers
Okuapeman S.H. S	21
H Mount.Sinai SHS	18
Methodist Girls' S.H.S,Mamfe	19
Benkum SHS	21

Larteh PSHTS	11
Mampong Presbyterian S.H. S	18
Mangoase S.H. S	14
Secondary Technical School for the Deaf,Mampong	7
Total	129

Source: Education Management Information System (EMIS). (2023). Senior High School Core Mathematics Performance Data for Akuapem North Municipality, 2023.

Demographic Characteristics of Respondents

Results for respondents are shown in this section based on demographic distribution. Table 1 provides a snapshot of demographic characteristics of math teachers in terms of gender, age, qualification, and years of teaching.

Table 3: *Demographic Data of Teachers*

Gender	**Frequency**	**Percent**
Male	51	40.8
Female	74	59.2
Total	125	100.0
Age of Mathematics teachers		
21-30	15	12.0
31-40	52	41.6
41-50	29	23.2
51-60	29	23.2
Total	125	100.0
Qualification of teachers		
Cert A	2	1.6
Diploma	20	16.0
Bachelor's Degree	38	30.4
Master's Degree	65	52.0
Years of teaching		
1-5	48	38.4
6-10	48	38.4
Above 10	29	23.2

Source: Field Survey (2023)

As elaborated in the table, out of the 125 mathematics teachers, 51 (40.8%) are male, while 74 (59.2%) are female. Most teachers fall within the 31-

40 (41.6%) and 41-50 (23.2%) age groups. Most mathematics teachers fall within the 31-40 age group. The qualification distribution of mathematics teachers is as follows, Cert A: 2 teachers (1.6%), Diploma, 20 teachers (16.0%), bachelor's degree: 38 teachers (30.4%), master's degree: 65 teachers (52.0%). The highest proportion of teachers hold a master's degree, followed by those with a bachelor's degree. The distribution of mathematics teachers based on years of experience in teaching is as follows, 1-5 years: 48 teachers (38.4%), 6-10 years: 48 teachers (38.4%), Above 10 years: 29 teachers (23.2%). There is a relatively equal distribution of teachers across the different experience levels. Overall, the table provides a snapshot of the demographic trait of mathematics teachers in terms of gender, age, qualification, and years of teaching.

Data Collection Instrument

A questionnaire was used to obtain information from the chosen teachers. This instrument was chosen based on Cohen et al.'s (2007) claim that it is effective for capturing survey data, organizing it in numerical manner, and can be delivered without the researcher's actual presence. The questionnaire used in this research effort is divided into three parts. Section A: Demographic Information - This segment gathered demographic information from participants, such as age, gender, years of instruction experience, and educational background.

Section B: Evaluation of Teachers' Assessment Literacy: Within this section, Teachers' Assessment Literacy was examined through three key dimensions: Teachers' Assessment Construction Skills, Teachers' Assessment Feedback, and Teachers' Assessment Design. These dimensions were adapted from two primary sources: Agu et al. (2013). The evaluation instruments utilized

were named "Test Construction and Assessment Feedback," sourced from Agu et al. (2013), and "TECCARSAAQ" from Agu et al., (2013). Through the use of these metrics, the study's instrument sought to develop a thorough picture of teachers' assessment literacy, including their knowledge of how to create exams, give feedback, and design efficient assessments. Section C: Teacher Quality - This section modified Raj (2018) measured different dimensions of teacher quality, such as pedagogical expertise, subject knowledge, classroom management, and instructional practices. The instructional practices element of section C was adopted from Raj (2018), while the pedagogical knowledge, content knowledge, and classroom management sections were adapted from Raj (2018), with the titles CMS scale and Content knowledge and pedagogical scale, respectively.

Pilot Testing the Instrument

The instrument was pilot tested at the Okyere District. The questionnaire is divided into three sections. Section A measure teachers biodata, section B measure "Teachers Assessment Literacy" which is made up of "Test Construction Skills of Teachers" constituting 24 items, "Teachers Assessment Feedback" which is made up of 12 items, "Teachers Assessment Design" which is made up of 19 items. Section C measure "Teachers Quality" which is made up of 28 items. 12 items measuring teachers' pedagogical knowledge and content knowledge while 16 items measure teacher's classroom management. The Cronbach alpha for section B "Assessment Literacy" is.927 which is made up of 55 items. Cronbach alpha for "Test Construction Skills of Teachers" is .891, Cronbach alpha for "Teachers Assessment Feedback" is .759, and Cronbach alpha for "Teachers Assessment Design" is .707. The Cronbach alpha

for section C “Teachers Quality” is .895 which is made up 28 items. In general, the overall items for the data collection are 83 items with a Cronbach alpha of .957.

The overall items for the data collection are 83 items with a Cronbach alpha of .957. The findings of this pilot test presuppose excellent internal consistency and reliability. It signifies a very high degree of consensus among the items, meaning that they have significant correlations and consistently evaluate the same underlying concept.

Validity and Reliability of the instrument

According to Gall, Borg, and Gall (2003), expert judgement improves the validity of an instrument. Subject-matter experts were consulted to assess the instrument's validity in terms of clarity, ambiguity, and generality. The validity of the items on the teachers' measure was evaluated using Cronbach's Alpha.

The accuracy of the questionnaire was verified by consulting the supervisor. The supervisor offered suggestions for changes that were later taken into account as part of the evaluation of the questionnaire's face validity and content. Two schools were included in the initial testing phase, which made it possible to spot and address any gaps in the study's subject matter and so increase the study's validity. An instrument is dependable if it consistently produces the same results when used repeatedly for data gathering. With the use of Cronbach's alpha, the consistency of the questionnaire was evaluated for reliability.

Ethical Issues

Given that social research uses data about specific individuals. I requested ethical clearance from the University of Cape Coast's Internal Review

Board in accordance with ethical guidelines. The ethical issues that arose during the investigation were handled with great care. An informed consent form was provided to respondents to peruse and sign, confirming their willingness to participate. Participants could rely on their information staying private and confidential during the whole study. No information regarding the participants' identities was revealed to other parties in terms of identity protection (anonymity).

Data collection Procedures

The Institutional Review Board of the University of Cape Coast granted its ethical approval prior to the start of data collection. The application was sent to the internal review board for consideration together with important files like the research plan and a letter introducing the department. Despite not hiring a research assistant after receiving approval from the Institutional Review Board to proceed with data collection, the researcher managed the data collecting procedure efficiently. Following that, authorization was obtained by delivering a copy of the ethical clearance to each of the selected schools' headmasters or headmistresses. All teachers were given a thorough briefing that explained the significance of the study at the time. The data collection period lasted two weeks, beginning on Monday, July 23, 2023, and ending on Monday, August 6, 2023.

Students' Performance Measure

The performance measure for the thesis utilized the average scores from the end-of-first-semester and end-of-second-semester core mathematics examinations for form two classes within the eight senior high schools in Akuapem North municipality. The pertinent data were sourced from the Students' Information System, an official database provided by the Ghana Education Service to

teachers to store student examination scores, to which every educator in the Akuapem North district is signed on.

This database efficiently provides access to students' examination scores. The research utilized the core mathematics scores for the academic year 2021/2022, encompassing two distinct components: the weighted means of scores from the first and second semesters.

The computation of core mathematics scores at the conclusion of the first and second semester examinations within a specific class involved the calculation of averages. This process was executed for all 125 educators who responded to the questionnaire. The form two classes under the purview of each teacher were identified, and subsequently, the core mathematics performance scores were aggregated. As an illustration, the average scores of classes; for example, 2A, 2B, and 2C were computed, followed by the summation of these averages.

The resultant value represented the weighted mean for that particular semester. This procedure was iterated for the second semester, yielding two distinct values for each of the classes. The overall averages for the two semesters were then attributed to each teacher as their corresponding performance score in core mathematics for that academic year. The ensuing illustrations elucidate the methodology employed in obtaining the requisite data.

Average Score Of A Class :

$$\frac{\textit{SUM OF ALL SCORES OBTAINED BY THE STUDENTS IN THE CLASS}}{\textit{SUM OF THE NUMBER STUDENTS IN THE CLASS}}$$

Semester 1 Average Score Assigned Teacher:

$$\frac{\textit{SUM OF ALL THE AVERAGE SCORES FROM THE TEACHER'S CLASSES eg;2A,2B,2C etc}}{\textit{THE TOTAL NUMBER OF CLASSES ASSIGNED TO THE TEACHER}}$$

Average Score for Each Teacher For 1 Academic Year: $\frac{AVERAGE\ SCORE\ FOR\ SEMESTER\ 1+AVERAGE\ SCORE\ FOR\ SEMESTER\ 2}{2}$.

The Table Below Shows the Average Score Sassigned to the 125 Core Mathematics Teachers Who Responded the Questionnaire.

NO. OF TEACHERS	SEMESTER 1 AND 2 AVERAGE
1.	77
2.	71
3.	83
4.	66
5.	68
6.	70
7.	81
8.	65
9.	69
10.	72
11.	78
12.	67
13.	76
14.	81
15.	83
16.	73
17.	66

18.	53
19.	80
20.	71
21.	61
22.	56
23.	72
24.	81
25.	77
26.	72
27.	71
28	67
29.	58
30.	62
31.	64
32.	73
33.	56
34.	83
35.	71
36.	65
37.	76
38.	61
39.	70
40.	66
41.	72

42.	79
43.	63
44.	59
45.	78
46.	66
47.	61
48.	60
49.	81
50.	81
51.	62
52.	66
53.	56
54.	72
55.	61
56.	72
57.	57
58.	78
59.	80
60.	59
61.	65
62.	60
63.	72
64.	65
65.	62

66.	73
67.	80
68.	57
69.	64
70.	59
71.	74
72.	67
73.	66
74.	75
75.	79
76.	65
77.	56
78.	75
79.	71
80.	66
81.	75
82.	52
83.	65
84.	71
85.	69
86.	54
87.	81
88.	61

Data Processing and Analysis

Descriptive statistics was used to summarize and present key features of the dataset. This includes measures such as mean, median, standard deviation, and frequency distributions. Descriptive statistics can provide an overview of the central tendencies and variabilities in teacher quality, assessment literacy, and students' performance.

Multiple regression analysis to assess the predictive power of teacher quality variables and assessment literacy variables on students' performance in core mathematics. This method allows researchers to identify which predictors (independent variables) significantly contribute to explaining the variance in the dependent variable (students' performance). This was used to analyse research questions one and two.

Correlation analyses was used to examine the relationships between teacher quality variables, assessment literacy variables, and students' performance in core mathematics. Pearson or Spearman correlation coefficients can be calculated to assess the strength and direction of these relationships. Research question three was analysed using this method.

Since the study involves comparing teacher quality and assessment literacy between different groups, t-tests or analysis of variance (ANOVA) for continuous variables and chi-square tests for categorical variables was employed. ANOVA was used to test for the significance between hypothesis one and two.

Chapter Summary

This research work's methodology was elaborated on in this chapter. It included an examination of the research design, study location, target population, sampling approach, demographic characteristics of participants, data collection tool, pilot testing of the tool, assessment of instrument validity and reliability, ethical considerations, data gathering procedures, and data processing and analysis. A descriptive survey research design was used to investigate the impact of teacher-related variables on student academic performance, such as teaching experience, pedagogical content knowledge, prior education, and training, as well as assessment literacy variables such as knowledge of assessment design, assessment perception, and feedback practices. Furthermore, the study looked into whether teacher quality characteristics influenced their assessment literacy variables in the Akuapem North region. The census approach was used to select all eligible teachers for research participation.

CHAPTER FOUR

RESULTS AND DISCUSSION

The research investigated the prediction power of mathematics teachers' quality and their assessment literacy on students' performance in core mathematics in Akuapem North Municipality**.** The descriptive survey design was employed in this research investigation. Data was collected from the participant through a questionnaire. 125 of the 129 questionnaires that were distributed were fully answered and returned. The result was a 90% response rate. Therefore, 125 respondents served as the foundation for all analyses in this chapter. The findings are presented in this chapter, along with a discussion of them. The study questions were provided first with respect to the results, and then hypotheses and a discussion of the outcomes were presented after that.

Results

This section entails the obtained findings from the respondents of the current study. Two research hypotheses as well as three research questions serve as the foundation for the study. The findings are presented in the subsequent paragraphs.

Research Question 1:

What is the assessment Quality of Mathematics Teachers in Akuapem North Municipality in terms of Teaching Experience, Pedagogical Knowledge, Subject-Matter Knowledge, Prior Education, and Training?

The analysis of regression was used to investigate the relationships among a number of independent variables and a dependent variable. It helps to determine the strength and nature of these relationships, which can be valuable in understanding the impact of one or more predictors on the outcome variable.

In this research, regression analysis was utilised to explore the relationship between several independent variables (Pedagogical Knowledge, Subject-Matter Knowledge, Teaching Experience, Prior Education, and Training) and the dependent variable (Assessment Quality). The goal was to assess how these independent variables collectively or individually contribute to explaining the variability in the dependent variable.

Table 4: *Descriptive Statistics*

	Mean	Std. Deviation
Assessment Quality	34.2800	6.81507
Pedagogical Knowledge	15.4640	3.01219
Subject-Matter Knowledge	20.7920	4.14319
Teaching Experience	1.8480	.77310
Prior Education, and Training	3.3280	.80097

Source: Field Survey (2023)

Table 4 provides descriptive statistics for various variables based on data collected in a field survey conducted in 2023. The table includes the mean (average) and standard deviation (a measure of the dispersion or variability) for each variable. On average, the assessment quality scores for the participants in the survey are around 34.28, with a degree of variability of approximately 6.82. The mean score for pedagogical knowledge is 15.46, suggesting the average level of pedagogical knowledge among the participants. The standard deviation of 3.01 reflects the variability in scores. The participants, on average, scored around 20.79 in subject-matter knowledge, with a standard deviation of 4.14 indicating variability in individual scores. The mean teaching experience is 1.85, suggesting an average teaching experience of approximately 1.85 years. The standard deviation of 0.77 indicates the spread or variability in teaching experience among the participants. The mean score for prior education and

training is 3.33, with a standard deviation of 0.80, indicating variability in the participants' levels of prior education and training.

Table 5: *Model Summary*[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.796[a]	.634	.631	4.14121	
2	.808[b]	.652	.646	4.05256	
3	.816[c]	.665	.657	3.99049	1.557

Source: Field Survey (2023)

Table 5, the Model Summary table, provides an overview of the statistical performance of different models. R Square is 0.665, indicating that approximately 66.5% of the variance in the dependent variable is explained by the independent variables. The Adjusted R Square is 0.657, adjusting for the number of predictors. The Std. Error of the Estimate is 3.99049, providing an estimate of the typical difference between the predicted and actual values. The Durbin-Watson statistic is 1.557, which may be used to check for autocorrelation in the residuals.

Table 6: *ANOVA*[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	3649.798	1	3649.798	212.821	.000[b]
	Residual	2109.402	123	17.150		
	Total	5759.200	124			
2	Regression	3755.561	2	1877.781	114.337	.000[c]
	Residual	2003.639	122	16.423		
	Total	5759.200	124			
3	Regression	3832.392	3	1277.464	80.222	.000[d]
	Residual	1926.808	121	15.924		
	Total	5759.200	124			

Source: Field Survey (2023)

The regression model with one predictor variable is statistically significant ($F(1, 123) = 212.821$, $p < 0.001$), explaining a significant amount of variance in the

dependent variable. The expanded regression model with two predictor variables is also highly significant (F (2, 122) = 114.337, p < 0.001), suggesting an improved explanatory power compared to Model 1. The most complex regression model with three predictor variables remains highly significant (F(3, 121) = 80.222, p < 0.001), indicating further improvement in explanatory power. he progressive increase in the number of predictors in the models is associated with a consistent improvement in their ability to explain variance in the dependent variable.

The low p-values (< 0.001) indicate strong evidence against the null hypothesis, supporting the conclusion that the regression models are statistically significant. The F statistics are substantial in all models, suggesting that the variation in the dependent variable is not merely due to chance. Overall, these results affirm the significance of the regression models and their effectiveness in explaining and predicting the dependent variable.

Table 7: *Coefficients*[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	7.054	1.903		3.707	.000
	Subject-Matter Knowledge	1.309	.090	.796	14.588	.000
2	(Constant)	4.503	2.116		2.128	.035
	Subject-Matter Knowledge	1.154	.107	.702	10.786	.000
	Pedagogical Knowledge	.374	.147	.165	2.538	.012
3	(Constant)	7.355	2.455		2.996	.003

Subject-Matter Knowledge	1.165	.105	.708	11.045	.000
Pedagogical Knowledge	.387	.145	.171	2.667	.009
Prior Education, and Training	-.987	.449	-.116	-2.197	.030

a. Dependent Variable: Assessment Literacy

Source: Field Survey (2023)

The focus the study was to examine the variables that affect Assessment Quality among core mathematics educators. Regression analysis was utilized to investigate the relationships between the dependent variable, Assessment Quality, and several independent variables, including Pedagogical Knowledge, Subject-Matter Knowledge, Teaching Experience, and Prior Education and Training. The collected data underwent rigorous analysis, and the resulting findings are presented in Tables 2 to 5.

Table 4 provides a descriptive overview of the variables under investigation. The standard deviation and mean for each group's variable offer insights into their central tendencies and degrees of dispersion. In Table 5, the Model Summary offers a perspective on the goodness of fit for the three regression models employed in the study. The coefficient of determination (R Square) shows how much variance in the dependent variable is explained by the independent variables in each model. R Square values are adjusted to account for the number of predictors in each model.

Table 6 presents the ANOVA outcomes for each regression model. The F-statistic assesses the overall significance of the regression models. As depicted by the p-values, all three models yield statistically significant results, suggesting that at least one independent variable significantly influences the dependent

variable. The F-values (212.821, 114.337, and 80.222) signify the extent of the variance explained by the regression models.

Table 7 displays the regression coefficients for the three models. The unstandardized coefficients highlight the change in the dependent variable corresponding to a one-unit alteration in the independent variable. The standardized coefficients (Beta) allow for a comparison of the relative impact of the predictors' effects. Within the context of this research, the standardized coefficients represent the change in Assessment Quality units for a one-unit shift in the respective independent variable while controlling for other predictors.

Overall, the outcomes of the regression analysis underscore the substantial influence of the independent variables on the prediction of Assessment Quality. Notably, the variables of Pedagogical Knowledge, Subject-Matter Knowledge, and Prior Education and Training emerged as influential predictors across different models (see Table 5). These findings underscore the significance of these factors in shaping the quality of assessments conducted by educators.

Research Question Two:

What is the level of mathematics teachers' assessment literacy in Akuapem North Municipality in terms of their knowledge of test construction, practice of assessment, and feedback practice?

Regression analysis was used to investigate the associations between one or more independent variables and a dependent variable. It aids in evaluating the strength and features of these interactions, providing insight into how one or more predictors influence the result variable. In the context of this study, regression analysis was used to evaluate the associations between various

independent factors, such as Knowledge of Test Construction, Assessment Practice, and Feedback Practice, and the dependent variable, Assessment Literacy. The primary aim was to ascertain how these independent variables, either collectively or separately, contribute to elucidating the variations observed in the dependent variable's values.

Table 8*: Descriptive Statistics*

	Mean	Std. Deviation
Assessment literacy	46.3468	8.06281
Knowledge of test construction	71.7097	11.64361
practice of assessment	34.3468	6.80154
feedback practice	20.8387	4.12682

Source: Field Survey (2023)

Table 9: *Model Summary*[d]

			Change Statistics					
Model	R	R Square	R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.928[a]	.862	.862	761.226	1	122	.000	
2	.954[b]	.910	.048	65.071	1	121	.000	
3	.970[c]	.941	.031	62.151	1	120	.000	1.984

Source: Field Survey (2023)

Table 10: *ANOVA*[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	6891.589	1	6891.589	761.226	.000[b]
	Residual	1104.499	122	9.053		
	Total	7996.089	123			
2	Regression	7277.844	2	3638.922	613.036	.000[c]
	Residual	718.244	121	5.936		
	Total	7996.089	123			
3	Regression	7522.913	3	2507.638	635.951	.000[d]
	Residual	473.176	120	3.943		
	Total	7996.089	123			

Source: Field Survey (2023)

Table 11: *Coefficients*[a]

	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	T	Sig.

1	(Constant)	8.547	1.396		6.121	.000
	Knowledge of test construction	1.101	.040	.928	27.590	.000
2	(Constant)	2.262	1.373		1.647	.102
	Knowledge of test construction	.675	.062	.569	10.906	.000
	practice of assessment	.292	.036	.421	8.067	.000
3	(Constant)	1.337	1.125		1.188	.237
	Knowledge of test construction	.749	.051	.632	14.600	.000
	practice of assessment	.479	.038	.691	12.653	.000
	feedback practice	-.721	.091	-.369	-7.884	.000

a. Dependent Variable: Assessment literacy

Source: Field Survey (2023)

In this study of assessment literacy among mathematics teachers in Akuapem North Municipality, a comprehensive analysis was conducted, as shown in Tables 6 to 9. Descriptive statistics (Table 6) revealed that the mean assessment literacy score was 46.35, with varying scores across its components, including knowledge of test construction (mean = 71.71), practice of assessment (mean = 34.35), and feedback practice (mean = 20.84). The regression analysis (Table 7) demonstrated a strong relationship between independent variables (knowledge of test construction, practice of assessment, and feedback practice) and the dependent variable, assessment literacy, with an adjusted R-squared value of 0.941. The ANOVA results (Table 8) confirmed the significance of the regression model, highlighting the influential role of these predictors. Finally, Table 9 presented the regression coefficients, showing both unstandardized and standardized coefficients for each predictor, underscoring the impact of

knowledge of test construction and practice of assessment-on-assessment literacy.

Research Question Three:

What is the influence of teacher assessment literacy factors on performance of students in core mathematics in Akuapem North Municipality?

The objective of this research question was to investigate the relationship between students' performance and teacher's assessment literacy factors. Assessment literacy is a critical aspect of education, as it relates to students' understanding of assessment methods, criteria, and their ability to engage effectively with assessments, ultimately influencing their academic success. Understanding whether there is a correlation between students' performance and their assessment literacy can provide valuable insights for educators and institutions to enhance teaching and learning strategies.

Table 12: *Examine the influence of teacher assessment literacy factors to performance of students in core mathematics in Akuapem North Municipality*

		Performance of Students	assessment literacy
Performance of Students	Pearson Correlation	1	.019
	Sig. (2-tailed)		.834
	N	124	124
assessment literacy	Pearson Correlation	.019	1
	Sig. (2-tailed)	.834	
	N	124	124

Source: Fieldwork (2023)

The Pearson correlation analysis revealed a negligible positive correlation of r = 0.019 between students' performance and assessment literacy. However, this correlation was not statistically significant (p = 0.834), indicating that there is meaningful relationship between these assessment literacies and

students' academic performance in core mathematics. The above findings suggest that while assessment literacy is undoubtedly important, it may not directly impact students' academic performance in this context. Further research may be needed to explore other potential factors that could influence student performance or to investigate specific aspects of assessment literacy that might have a more significant impact. These results have implications for educators and policymakers, emphasizing the importance of a well-rounded education that goes beyond assessment literacy alone to enhance students' overall academic achievements.

Hypothesis Testing

Hypothesis 1

H_o: There is no significant difference in test construction skills among teachers based on their highest qualification in Akuapem North Municipality.

H_A: There is a significant difference in test construction skills among teachers based on their highest qualification in Akuapem North Municipality.

Research hypotheses one aimed at examining the potential differences in test construction skills among teachers based on their highest qualification in the Akuapem North Municipality. The null hypothesis (Ho) states that there is no significant difference in test construction skills based on the highest qualification of teachers. The alternative hypothesis (HA) suggests that there is a significant difference in test construction skills based on teachers' highest qualification.

Table 13: *Test Construction Skills*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Cert A	2	74.5000	9.19239	6.50000	-8.0903	157.0903
Diploma	20	71.6500	12.89339	2.88305	65.6157	77.6843
Bachelor's Degree	38	69.7105	10.02405	1.62612	66.4157	73.0053
Master's Degree	65	72.7077	12.20108	1.51336	69.6844	75.7310
Total	125	71.6560	11.61208	1.03862	69.6003	73.7117

Source: Field Survey (2023)

Table 14: *Test of Homogeneity of Variances*

		Levene Statistic	df1	df2	Sig.
Test Construction Skills	Based on Mean	1.109	3	121	.348
	Based on Median	.904	3	121	.441
	Based on Median and with adjusted df	.904	3	116.175	.441
	Based on trimmed mean	1.082	3	121	.360

Source: Field Survey (2023)

Table 15: *ANOVA Table*

Test Construction Skills

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	231.896	3	77.299	.567	.638
Within Groups	16488.312	121	136.267		
Total	16720.208	124			

Source: Field Survey (2023)

An analysis of test construction skills among 125 participants in this research revealed no statistically significant difference in mean scores based on their highest level of education (Cert A, Diploma, Bachelor's Degree, or Master's

Degree). The ANOVA results indicated no significant variation in test construction skills across these education levels (F (3, 121) = 0.567, p = .638). The means and standard deviations for the education groups ranged from 69.71 (SD = 10.02) for those with Bachelor's Degrees to 74.50 (SD = 9.19) for participants with Cert A qualifications. A Levene test for homogeneity of variances further supported the lack of significant differences in test construction skills based on mean, median, trimmed mean, or median with adjusted degrees of freedom (p > .05 for all). These findings suggest that in the context of this study, participants' highest education level did not have a substantial impact on their test construction skills, highlighting a relatively consistent level of proficiency in this area across different educational backgrounds.

Hypothesis 2

H_o: There is no significant relationship between years of teaching core Mathematics and teachers' assessment feedback practices in Akuapem North Municipality.

H_A: There is a significant relationship between years of teaching in Mathematics and teachers' assessment feedback practices in Akuapem North Municipality.

Research hypothesis two focused on exploring the potential relationship between years of teaching core Mathematics and teachers' assessment feedback practices in the Akuapem North Municipality. The null hypothesis (Ho) states that there is no significant relationship between years of teaching in Mathematics and teachers' assessment feedback practices. The alternative hypothesis (HA) suggests that there is a significant relationship between years of teaching in Mathematics and teachers' assessment feedback practices.

Table 16: *Assessment Feedback*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	Upper Bound
1-5	48	35.5000	6.87889	.99288	33.5026	37.4974
6-10	48	33.3750	6.24542	.90145	31.5615	35.1885
Above 10	29	33.7586	7.51976	1.39638	30.8983	36.6190
Total	125	34.2800	6.81507	.60956	33.0735	35.4865

Source: Field Survey (2023)

Table 17: *Test of Homogeneity of Variances*

		Levene Statistic	df1	df2	Sig.
Assessment Feedback	Based on Mean	.655	2	122	.521
	Based on Median	.545	2	122	.581
	Based on Median and with adjusted df	.545	2	116.493	.581
	Based on trimmed mean	.631	2	122	.534

Source: Field Survey (2023)

Table 18: *ANOVA*

	Sum of Squares	Df	Mean Square	F	Sig.
between Groups	118.640	2	59.320	1.283	.281
Within Groups	5640.560	122	46.234		
Total	5759.200	124			

Source: Field Survey (2023)

In examining assessment feedback scores among 125 participants, categorized into three groups based on the number of assessments provided (1-5 assessments, 6-10 assessments, and above 10 assessments), the analysis

showed no statistically significant difference in mean assessment feedback scores among these groups. The ANOVA results indicated that there was no significant variation in assessment feedback scores across the three assessment frequency categories ($F(2, 122) = 1.283$, $p = .281$). The means and standard deviations for these groups ranged from 33.375 ($SD = 6.25$) for participants providing 6-10 assessments to 35.5 ($SD = 6.88$) for those providing 1-5 assessments. Additionally, a Levene test for homogeneity of variances based on mean, median, trimmed mean, or median with adjusted degrees of freedom confirmed the absence of significant differences in assessment feedback scores across these categories ($p > .05$ for all). These findings suggest that the frequency of assessments provided by participants did not have a substantial impact on their assessment feedback scores, highlighting relatively consistent feedback practices across different levels of assessment frequency.

Discussion of Results

This section analyses the findings in relation to the study's key objectives.

Assessment Quality of Mathematics Teachers in Akuapem North Municipality in terms of Teaching Experience, Pedagogical Knowledge, Subject-Matter Knowledge, Prior Education, and Training

The current study's findings are consistent with earlier studies in the field of education, emphasizing the critical role of teacher skill and preparation in impacting assessment quality. The regression study revealed that Pedagogical Knowledge, Subject-Matter Knowledge, and Prior Education and Training were significant predictors of Assessment Quality across many models. These findings are consistent with previous research demonstrating the importance of

these elements in moulding educators' assessment practices, as shown in studies by Hill, Rowan, and Ball (2005), Hill, Sleep, Lewis, and Ball (2007), and Wilson, Floden, and Ferrini-Mundy (2001).

These results underscore the notion that effective teaching extends beyond content knowledge alone; teachers' proficiency in pedagogical techniques and their prior educational experiences are also vital components that contribute to the quality of assessments.

Furthermore, the current findings resonate with Darling-Hammond's (2000) argument that teacher quality is a pivotal determinant of student success. The study reaffirms the significance of policies and practices that prioritize enhancing the quality of educators over mere quantity, aligning with the broader educational discourse on improving teaching effectiveness to ultimately enhance student learning outcomes (Darling-Hammond, 2000).

Additionally, this study supports Hiebert and Grouws' (2007) focus on the complexity of efficient mathematics training. The results highlight the importance of a thorough approach to teacher preparation that involves knowledge of both subject matter and pedagogical abilities. They also emphasise the need for ongoing professional development to keep improving teaching techniques. In conclusion, the results of this study add to the growing body of research that supports the crucial role that teacher preparation plays in influencing assessment quality, highlighting the need for customised teacher education programmes and policies that specifically address these crucial elements to enhance educational outcomes.

This finding is consistent with that of the study by Abubakar et al. (2021), which discovered that instructors showed a keen awareness of training

programmes. It also agrees with research by Olodude, Anuodo, and Owoeye, who found that newly qualified instructors had superior subject knowledge. Collectively, these studies show that newly qualified instructors have a tendency to have a deeper grasp of induction programmes, which may be influenced by a variety of circumstances, such as more demanding family obligations and full-time job, which might affect academic resilience.

The level of assessment literacy of mathematics teachers in Akuapem North Municipality in terms of knowledge of test construction, practice of assessment and feedback practice.

The current findings in Akuapem North Municipality regarding mathematics teachers' assessment literacy align with a broader body of research conducted in various regions, shedding light on the assessment literacy levels of educators. While the present study focused on knowledge of test construction, practice of assessment, and feedback practice, previous research in Hong Kong (Wong & Cheng, 2018) similarly found that teachers exhibited moderate levels of assessment literacy. This moderate level of assessment literacy was consistent with the results obtained in studies of mathematics teachers in Turkey (Yenilmez & Özdamar, 2018; Ayvaci & Çakmak, 2019), where assessment literacy levels were also moderate. These studies collectively suggest that educators often demonstrate a moderate level of assessment literacy.

Interestingly, the Hong Kong study (Wong & Cheng, 2018) revealed that teachers had a better understanding of designing assessments compared to other aspects of assessment. This confirms the latest study's findings that knowledge of test construction significantly contributes to explaining assessment literacy variation among mathematics teachers. Furthermore, the Turkish studies

(Yenilmez & Özdamar, 2018; Ayvaci & Çakmak, 2019) emphasized the importance of professional development and teaching experience in influencing assessment literacy levels, which aligns with the latest research findings, highlighting the role of pedagogical knowledge and experience.

However, the study conducted in Nigeria (Okoli & Asiegbu, 2020) offered a comparative perspective, indicating that both private and public-school mathematics teachers had relatively low assessment literacy levels in terms of designing assessments and providing feedback. This underscores the need for comprehensive teacher training and professional development opportunities to enhance assessment literacy skills, a recommendation also relevant to the current study's findings.

In conclusion, the regression analysis in this study underscores the significance of various factors, including knowledge of test construction, practice of assessment, and feedback practice, in explaining the variation in assessment literacy among mathematics teachers. While these findings are based in the local environment, they are consistent with larger trends in the field of education. They emphasise the importance of conducting targeted professional development programmes to improve instructors' assessment literacy, consequently enhancing assessment techniques and, ultimately, favourably influencing student learning results.

The individual influence of teacher assessment literacy factors to performance of students in core Mathematics in the Akuapem North Municipality

The current findings from the Pearson correlation analysis proffer insights into the relationship between students' core mathematics performance

in consonance with core mathematics teachers' assessment literacy. These findings appear to contradict the existing body of data on the relationship between teacher quality and student success in mathematics and other academic areas. Darling-Hammond's (2000) extensive analysis of empirical evidence, for example, substantially supports the notion that teacher quality, including knowledge and abilities, has a major impact on student achievement, particularly in mathematics.

Similarly, the study by Rivkin, Hanushek, and Kain (2005) provides substantial evidence indicating that teacher quality significantly influences student achievement, with a more pronounced impact in mathematics. Their research underscores the importance of teacher credentials, experience, and stability in achieving positive student learning outcomes.

In contrast, the current study's findings indicate that there is no statistically significant relationship between students' performance in core mathematics and their teachers' assessment literacy. While this outcome underscores the importance of a well-rounded education that encompasses various factors beyond assessment literacy, it's important to acknowledge potential nuances in the specific context of this study that may have led to these results.

To delve deeper into the reasons for the absence of a substantial correlation, further investigation is required, along with an examination of potential additional factors that could impact students' performance in core mathematics. It's possible that additional variables, such as teaching methods, classroom environment, or curriculum design, could be at play. These results should prompt educators and policymakers to consider a holistic approach to

improving student academic achievement that encompasses not only assessment literacy but also other critical elements that contribute to student success in mathematics and other subjects.

The differences in test construction skills among teachers in Akuapem North Municipality based on their highest qualification.

The result revealed that mean test construction skills scores and standard deviations for teachers in the Akuapem North Municipality, categorized by their highest qualification. The mean score for teachers with a Cert A qualification is 74.50 (SD = 9.19), with only two teachers in this category. For teachers with a Diploma qualification, the mean score is 71.65 (SD = 12.89), with 20 teachers. Teachers with a bachelor's degree have a mean score of 69.71 (SD = 10.02), with 38 teachers. Lastly, teachers with a master's degree have a mean score of 72.71 (SD = 12.20), with 65 teachers. The overall mean score for all teachers is 71.66 (SD = 11.61). In conclusion, the analysis indicates that there is no significant difference in test construction skills among teachers based on their highest qualification in the Akuapem North Municipality. This suggests that the qualification level of teachers does not significantly influence their performance in test construction skills.

The study findings are consistent with several studies such as (Oyoo, Mwaura & Kinai, 2018; Romano et al., 2021). Educational level did not play a significant role with respect to teacher's development program. Thus, as newly trained teachers. Again, the study findings corroborated with studies from (Bahrami, Amiri & Abdollahi, 2017; Lee, 2019) who also found out that educational level significantly predicted academic burnout and moreover, a negative correlation existed between academic resilience and academic burnout.

As opposed to Trigueros et al. (2020), whose findings showed a substantial positive link between educational attainment and involvement in teachers' development programmes, this study's findings were different. When comparing educational attainment to teachers' participation in professional development programmes, their research found a positive association rather than a negative one. This mismatch between the results of this investigation and the current study could be attributed to the use of a non-probabilistic sampling technique in the study by Trigueros et al. (2020).

Relationship between years of teaching in Mathematics and teachers' assessment feedback practices in Akuapem North Municipality.

The results of the analysis suggest that there is no statistically significant relationship between the number of years of teaching experience in Mathematics and teachers' assessment feedback practices in the Akuapem North Municipality. The mean scores for assessment feedback practices among educators with diverse lengths of teaching tenure in Mathematics were 35.50 for 1-5 years, 33.38 for 6-10 years, and 33.76 for above 10 years.

These results do not provide enough evidence to disprove the null hypothesis (Ho), which states that there is no significant relationship between the length of mathematics teaching experience and the feedback practices of instructors in the Akuapem North Municipality. This suggests that the cumulative years of experience in teaching Mathematics do not exert a significant influence on the quality or effectiveness of assessment feedback provided by teachers in the municipality.

The findings of this study align with those of Farooq and Shahzadi's (2006) investigation into the effects of professionally educated and

inexperienced teachers on mathematics students' performance. Their research demonstrated that students who were taught mathematics by qualified instructors had greater outcomes, highlighting the significance of teacher preparation for students' academic achievement. The question of whether certified teachers are often more effective than non-certified teachers was also investigated by Darling-Hammond, Holtzman, Gatlin, and Heilig in 2005.They discovered that, on average, certified teachers outperformed non-certified teachers in terms of student achievement increases. According to their research, Darling-Hammond et al. (2005) came to the conclusion that teachers' quality was closely related to their level of preparation for teaching.

In a different study, Brown (2018) looked at the characteristics of teacher certification and how they related to mathematics achievement among pupils. According to Brown, teachers' professional credentials enabled them to assist their students in applying their mathematical skills. As a result, teachers' prior knowledge and training impacted how they instructed their students which eventually enhanced their performance.

The results of this study and earlier studies have a lot in common, which suggests that teacher preparation and education have a big impact on students' academic progress regardless of the location. Therefore, it is impossible to overestimate the value of teacher education and training in raising student achievement.

Chapter Summary

In conclusion, the study findings shed light on various aspects related to the test construction skills of teachers, levels of core mathematics teachers' feedback practices, the relationship between teachers' quality and assessment

feedback practices, differences in test construction skills based on the highest qualification of teachers, and the relationship between years of teaching in Mathematics and assessment feedback practices.

Regarding test construction skills, the study identified both strengths and areas for improvement among teachers in Akuapem North Municipality. While some aspects showed a high level of proficiency, further attention is needed to enhance test development.

The study also revealed that teachers' quality, as measured by their pedagogical knowledge, content knowledge, and classroom management, significantly influenced their assessment feedback practices. This underscores the significance of providing professional development and support in these domains to improve the efficacy of assessment feedback.

Additionally, the data showed that teachers' highest degrees did not significantly affect how well they constructed tests. This suggests that the qualification level of teachers does not significantly influence their performance in test construction skills.

In conclusion, the research uncovered no notable correlation between the duration of teaching experience in Mathematics and assessment feedback practices. This shows that the number of years of mathematics teaching experience has little to no bearing on the quality or efficacy of instructors' assessment feedback.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter includes a summary of the research, as well as its results, conclusions, and recommendations for further study that are all based on the study's findings.

Summary

Overview of the study

The primary goals of this research in Akuapem North Municipality were to evaluate teachers' test construction abilities as well as their use of assessment feedback practises in core mathematics instruction. Furthermore, the study looked into the relationships between instructor quality, teaching experience, and the methods used to provide feedback on student performance.

Regarding research question 1, the study assessed teachers' skill in test construction using a 4-point Likert-type scale with 24 items. For each test construction skill item, mean scores and standard deviations were calculated to determine the average ratings and the range of responses. The findings revealed that, on average, teachers demonstrated a moderate level of competence in test construction skills. Some areas of strength were identified, including giving clear instructions, ensuring that both high-achieving and low-achieving students understood the test and ascribing scores to each test item. However, there were also areas that needed improvement, such as providing detailed answers after each assessment task and seeking validation of test items from higher authorities.

Research question 2 explored the level of assessment feedback practices employed by core mathematics teachers in the municipality. To examine the

amount of feedback practices, a 4-point Likert-type scale with 12 items was employed. The mean scores and standard deviations were analyzed to determine the average ratings and dispersion of responses for each item. The results indicated that, on average, core mathematics teachers exhibited a moderate level of assessment feedback practices. The teachers excelled at delivering descriptive feedback that focused on the process and outcome of learning, judgmental evaluation on students' work, and spoken feedback to students in groups. However, there was room for improvement in providing detailed correct answers after each assessment task, conducting individual conferences with students for feedback, and giving oral feedback to the entire class.

In the context of study question 3, the investigation looked into the relationship between instructors' quality, as measured by their pedagogical expertise, content knowledge, and classroom management abilities, and their assessment feedback practices. The results from correlation and regression analyses revealed significant positive associations between assessment feedback practices and all three aspects of teachers' quality. Classroom management demonstrated the strongest relationship with assessment feedback, followed by content knowledge and pedagogical knowledge. This suggests that teachers' overall quality significantly influences their assessment feedback practices.

Concerning hypothesis testing, the initial hypothesis sought to establish whether there was a significant difference in test construction skills among teachers based on their highest degree of education. The ANOVA test findings revealed that there was no significant difference in test construction skills connected with teachers' highest qualifications.

Hypothesis 2 aimed to examine the relationship between years of teaching experience in Mathematics and teachers' assessment feedback practices. The results from ANOVA analysis showed that there was no significant relationship between years of teaching experience and assessment feedback practices.

To summarise, this study provided useful insights into instructors' test construction skills and assessment feedback practises in the Akuapem North Municipality. It has revealed areas of strength as well as areas for improvement in both of these aspects of teaching. Furthermore, the research has highlighted the importance of teachers' overall quality in affecting their assessment feedback approaches. These findings can be utilised to lay the groundwork for the implementation of targeted professional development initiatives and the improvement of assessment practises, resulting in improved learning outcomes for students in the region.

Key findings

The investigation discovered the following findings:

1. The study revealed that Pedagogical Knowledge, Subject-Matter Knowledge, and Prior Education and Training are significant predictors of Assessment Quality among educators, emphasizing their substantial influence on the quality of assessments conducted by educators.
2. The conclusions of the investigation revealed that knowledge of test construction, practice of assessment, and feedback practice significantly contribute to explaining the variation in assessment

literacy among mathematics teachers in Akuapem North Municipality.

3. The study's findings show that there is no statistically significant relationship between instructors' assessment literacy and students' core mathematics performance in the Akuapem North Municipality.
4. Qualification and Test Construction Skills: The study found no significant difference in test construction skills among teachers based on their highest qualification. This suggests that teachers' test construction skills were not significantly influenced by their academic qualifications.
5. Teaching Experience Duration and Assessment Feedback Practises: The study revealed that there is no statistically significant relationship between the number of years of mathematics teaching experience and the way in which teachers provide assessment feedback. This means that the length of teaching experience has no bearing on the quality or usefulness of assessment feedback supplied by municipal teachers.

In summary, the study highlighted areas of strength and areas for improvement in test construction skills and assessment feedback practices among teachers in Akuapem North Municipality. It emphasized the importance of teachers' overall quality in shaping their assessment feedback practices and shed light on the need for targeted professional development to enhance assessment practices for the benefit of students' learning outcomes.

Conclusions

In summary, this extensive investigation into assessment quality among educators and assessment literacy among mathematics teachers in Akuapem North Municipality revealed significant predictors of Assessment Quality, including Pedagogical Knowledge, Subject-Matter Knowledge, and Prior Education and Training. The study also highlighted the substantial influence of knowledge of test construction, practice of assessment, and feedback practice on assessment literacy among mathematics teachers. While no statistically significant relationship was found between teacher assessment literacy and students' performance in core math, the study identified that academic qualifications did not significantly impact teachers' test construction skills, and teaching experience did not significantly affect the quality of assessment feedback. These findings underscore the multifaceted nature of assessment practices and underscore the importance of continuous professional development for enhancing both assessment quality and assessment literacy among educators and teachers.

Recommendations

Given the study's results and conclusions, the following recommendations are designed to help guide the development of policies and practises:

1. Given the study's findings, there should be implementation of professional development programs for educators focusing on enhancing Pedagogical Knowledge, Subject-Matter Knowledge, and Prior Education and Training. These programs can include workshops,

seminars, and training sessions to strengthen these essential predictors of assessment quality.

2. Additionally, there should be provision of specific training to mathematics teachers on test construction, assessment practices, and effective feedback methods. This targeted training can contribute to improving assessment literacy among mathematics teachers in the Akuapem North Municipality.
3. It is also recommended that school management should incorporate elements related to assessment literacy, including knowledge of test construction, assessment practices, and feedback strategies, into the curriculum of teacher education programs. This can ensure that future educators are well-prepared in these areas from the outset.
4. The Ministry of Education should support establish a system for ongoing professional development opportunities, encouraging educators to stay updated on current assessment practices and pedagogical approaches. This could involve mentorship programs, peer collaboration, or participation in professional learning communities.
5. Additionally, it is advised that school administrators and the Ministry of Education work together to increase awareness among educators about the importance of assessment literacy. Promote the understanding that proficiency in test construction, assessment practices, and feedback methods directly contributes to effective teaching and improved student outcomes.

Suggestion for Further Research

1. Longitudinal Study: Conduct a longitudinal study to examine the development of test construction skills and assessment feedback practices over an extended period. This will allow researchers to track changes in teachers' practices and identify factors that contribute to improvement or stagnation over time.
2. Comparative Study: Conduct a comparative study to assess test construction skills and assessment feedback practices among teachers in different regions or educational systems. This would help identify regional variations and the impact of different educational policies on assessment practices.
3. Mixed-Methods Approach: Integrate both quantitative and qualitative research methods to get a deeper, more thorough comprehension of test construction skills and assessment feedback practices. Qualitative data can provide insights into teachers' perspectives, experiences, and challenges related to assessment practices.
4. Student Perspectives: Include students' perspectives on assessment feedback in future research. Investigating students' perspectives and the significance they place on feedback can provide useful insights into the efficacy of existing approaches and suggest areas that may require improvement.

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APPENDICES

APPENDIX A

UNIVERSITY OF CAPE COAST

DEPARTMENT OF EDUCATION AND PSYCHOLOGY

QUESTIONNAIRE FOR SENIOR HIGH SCHOOLS TEACHERS

Dear Respondent,

I would very much appreciate if you could spend a few moments to complete this questionnaire, as this would be quite helpful in adding to this research. Your participation is critical to carrying out your professional responsibilities in this study. The major goal of this questionnaire is to collect data for a research study titled "The Influence of Teacher Quality and Assessment Literacy on Student Performance in Fundamental Mathematics Within the Akuapem North Municipality." I would be appreciative if you could take the time to complete the survey, as it could prove quite helpful in assisting to this research. Your participation is critical to carrying out your duties as a professional in this study. The major goal of this questionnaire is to collect information for a research study titled "The Influence of Teacher Quality and Assessment Literacy on Student Performance in Fundamental Mathematics within the Akuapem North Municipality."

The details that you supply in the above survey is exclusively for academic purposes. All information provided will be aggregated to ensure that no individual is associated with any specific responses. It is critical to stress that engaging in the present investigation is entirely optional. Your feedback will be

treated with complete anonymity and confidentiality. We ask that you respond the questions as honestly as possible.

Instruction: Please check (√) or write where necessary.

SECTION A – Demographic Information

Gender

a. Male [ ]

b. Female [ ]

Age

a. 21 – 30 years [ ]

b. 31 – 40 years [ ]

c. 41 – 50 years [ ]

d. 51 – 60 years [ ]

e. Above 60 years [ ]

Highest Qualification

a. Cert A [ ]

b. Diploma [ ]

c. Bachelor's Degree [ ]

d. Master Degree [ ]

Years of teaching in Mathematics

a. 1 – 5 years [ ]

b. 6 – 10 years [ ]

c. Above 10 years [ ]

SECTION B: Test Construction Skills of Teachers

Consider each statement carefully and describe how it applies to your own personal experience. Please use the supplied instructions to mark the box that best indicates your level of agreement: Strongly Disagree (SD), Disagree (D), Agree (A), or Strongly Agree (SA) to express the degree to which each item applies to you.

S/N	STATEMENTS	SD	D	A	SA
	I take the following steps in constructing tests for my class;				
1	Give clear instructions to guide the test takers				
2	Write test so that both high and low achievers can understand.				
3	Avoid gender stereotypes in the test items.				
4	Ascribe scores for each test item				
5	Avoid too long questions or phrases in item writing.				
6	Outline the content covered for the term before setting test from them.				
7	Add enough test items to cover all the requisite levels of cognitive domain.				
8	Ensure that the items are measuring the determined objectives.				
9	Set essay items that elicit creative and imaginative answers from the students.				

10	Prepare a marking guide while constructing the test.				
11	Add sufficient items to cover the appropriate instructional units.				
12	Limit essay tests to high level objectives.				
13	Organize test items in a logical manner.				
14	Set tests with due regard to the time available for testing				
15	Avoid the use of clues in multiple choice questions.				
16	Avoid the use of overlapping items.				
17	Avoid overlapping alternatives in writing objective tests.				
18	Prepare a test blueprint as a guide in the test construction.				
19	Consult standard text books in the subject for guide.				
20	Keep a resource bank of questions that can be used to when setting tests				
21	Consider the age of learners during item writing.				
22	Submit items for vetting to the Head of Department or the principal				
23	Submit tests meant for promotional examinations for expert editing on time				

24	Review draft of the test at least twice in two days before administering.				

SECTION C: Teachers Assessment Feedback

Examine each statement carefully and determine its applicability to your specific situation. Please use the supplied instructions to select a box that best indicates your level of agreement: Strongly Disagree (SD), Disagree (D), Agree (A), or Strongly Agree (SA) to indicate the extent to which each item applies to you.

S/N	STATEMENTS	SD	D	A	SA
1	I provide feedback in the form of grades or marks on students' mark				
2	I give oral feedback to the entire students of a class				
3	I give general written comments on students' response papers				
4	I provide feedback that identifies students' strengths and weaknesses				
5	I provide judgmental feedback on students work				
6	I provide oral feedback to students in groups				
7	I conference with individual students to give them feedback and also provide teacher-student dialogue to give feedback				
8	I use praises to express my approval for satisfactory performance				
9	My feedback suggests to students how to improve their learning.				

10	I provide detailed correct answers after each assessment task				
11	I give descriptive feedback that focuses in the process and product of learning				
12	I link feedback to learning intentions and success criteria/assessment rubric				

SECTION D: Teachers Assessment Design

Examine each statement carefully to see if it applies to your practises. To indicate the amount of your use, please use the following instructions to mark a box that best indicates the frequency with which you apply these assessment designs when producing tests: Very Often (VO), Often (O), Not Often (NO), or Never (N).

S/N	STATEMENTS	VO	O	NO	N
	Alignment				
1	I share learning intentions and success criteria with my students				
2	I clearly communicate learning intentions and objectives to my students at the start of every lesson				
3	I refer to the learning intentions and success criteria throughout my lesson delivery				
4	I assess using rubrics aligned explicitly with learning intentions				
	Rigor				
5	I involve students in the development and use of rubrics				
6	I share rubrics with students prior to assessment				
7	I provide examples of quality work that shows the standards required during assessment				

8	I give opportunities for students to study criteria by which their work will be evaluated				
9	My students use success criteria to judge one another's work				
	Precision				
10	I plan, design questions and questioning practice for my lessons				
11	I allow long waiting time during questioning to engage every student in answering				
12	I use follow-up questions to ensure students understanding of concepts				
13	I ask questions to determine how well students have understood a material				
14	I encourage every student to ask questions				
15	I call upon individual at random to answer questions				
16	I allow reflection on questions and students' answers				
17	I use closed questions to assess my students' learning				
18	I use open questions to assess my students' learning				
19	I use mixed questions type in my classroom				

Teacher Quality

SECTION E: Pedagogical Knowledge of Teachers

Review each statement thoroughly and examine its applicability to your particular experiences. To indicate the degree to which each statement pertains to you, please use the accompanying instructions to select a box that best indicates your level of agreement: Strongly Disagree (SD), Disagree (D), Agree (A), or Strongly Agree (SA).

S/N	STATEMENTS	SD	D	A	SA
	Pedagogical Knowledge				
1	I can adapt my teaching style to different learners				
2	I know how to organize and maintain classroom management				
3	I use student centred method to achieve specific objective of my lesson.				
4	I mostly use problem solving and discovery learning during instructional period.				
5	I know how to assess student performance in a classroom.				
	Content Knowledge				
6	I know about various examples of how mathematics applies in the real world				
7	I have unique professional knowledge base in mathematics				

8	My students often times challenge my concepts explanation				
9	I demonstrate subject matter knowledge when teaching				
10	I have the ability to analyse subject content structure and its significance				
11	I have knowledge in explaining mathematics concept				
12	I have a requisite knowledge in treating specific content topics with relevant examples				
	Classroom Management				

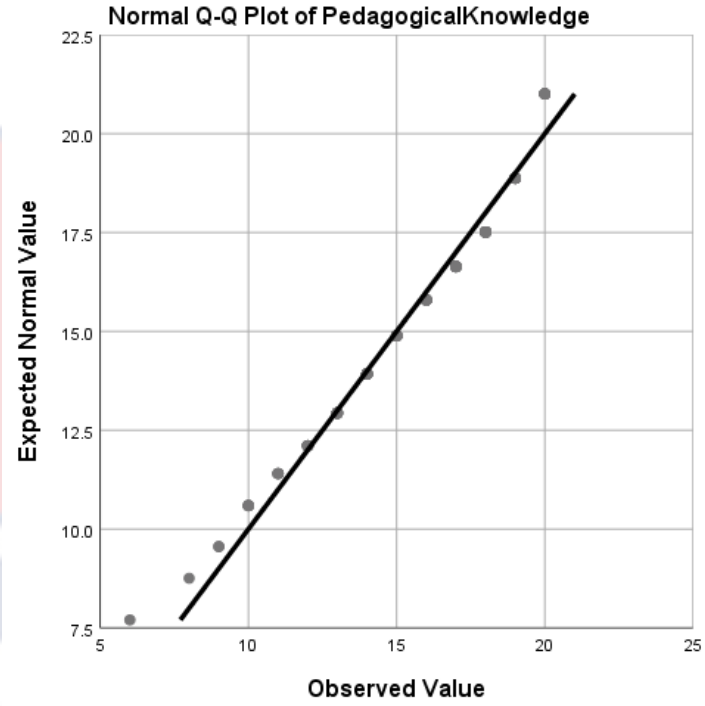
Management of Planning

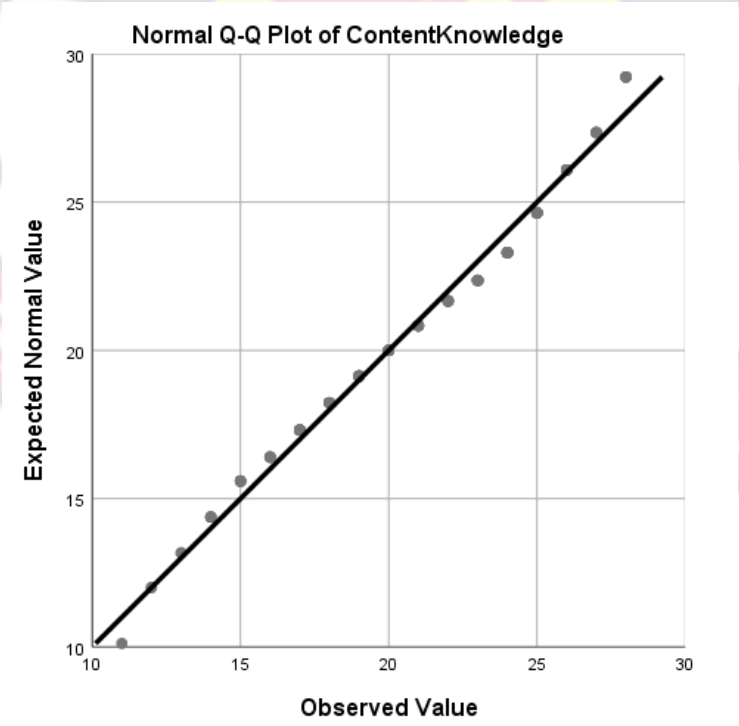
13	I plan to rectify previous year feedback received from students in the present academic year.				
14	I plan to choose the best teaching method for each topic in my classroom teaching.				
15	I plan to identify and give remedial measures to the slow learners in my classroom.				
16	I discuss with the subject experts for clear understanding of my subject.				
	Management of Teaching Learning Resources				

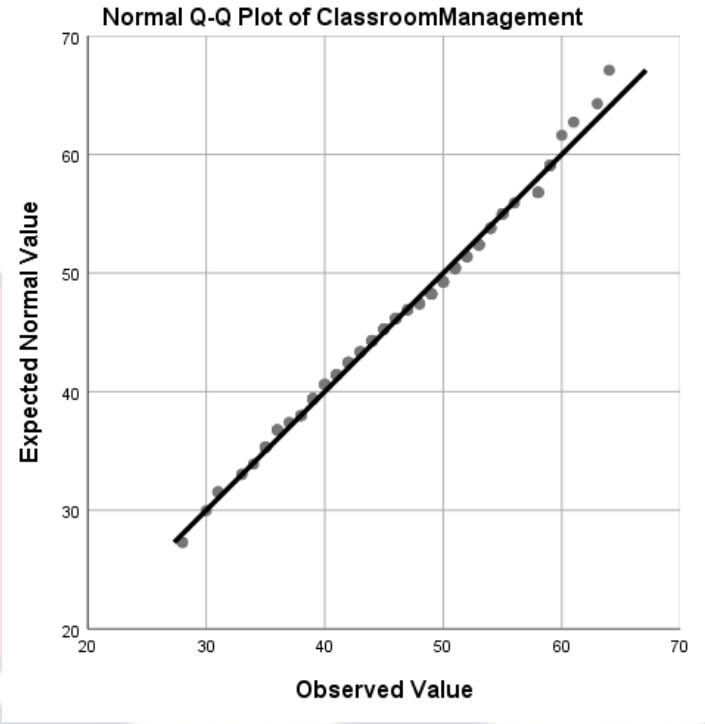
17	I prepare my own teaching materials for my teaching.				
18	I motivate my students also to prepare needed learning materials.				
19	My teaching aids are visible to all students.				
20	My teaching aids are apt for teaching given lessons.				
	Management of Self-Discipline				
21	I finish my teaching in time.				
22	I come to school in time.				
23	I have a good code of conduct				
24	I dress neatly every day				
	Management of Student Behaviour				
25	I am not affected by the prejudiced behaviour of my students.				
26	When the rules do not work in my class. I replace them with the new ones based on my experience.				
27	I avoid unnecessary discussion during the class.				
28	I have no favourite student.				

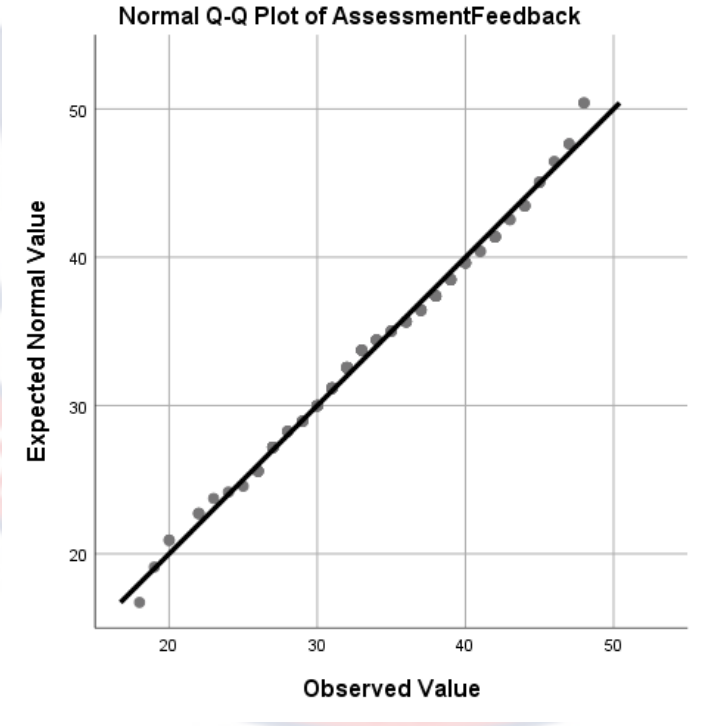
APPENDIX B

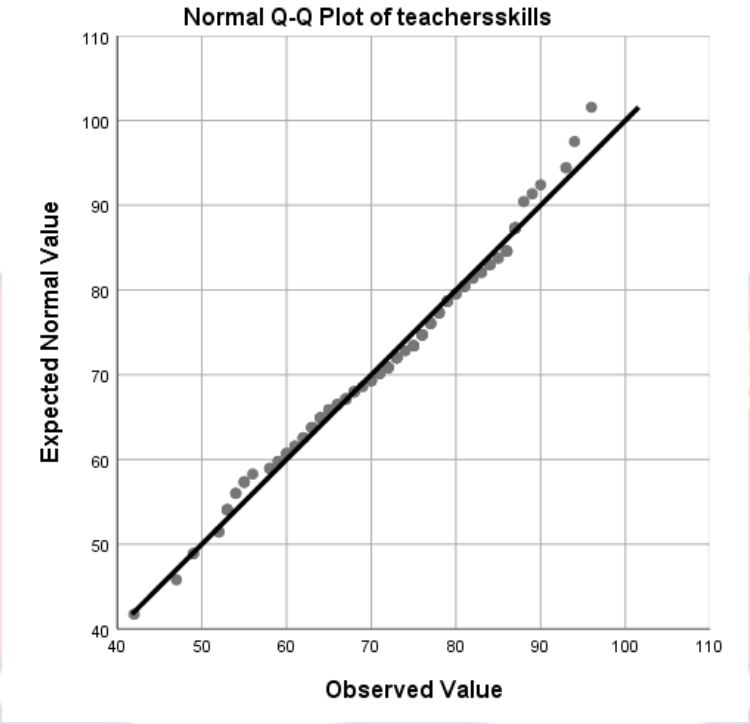
GRAPHICAL REPRESENTATION OF NORMALITY TEST RESULTS

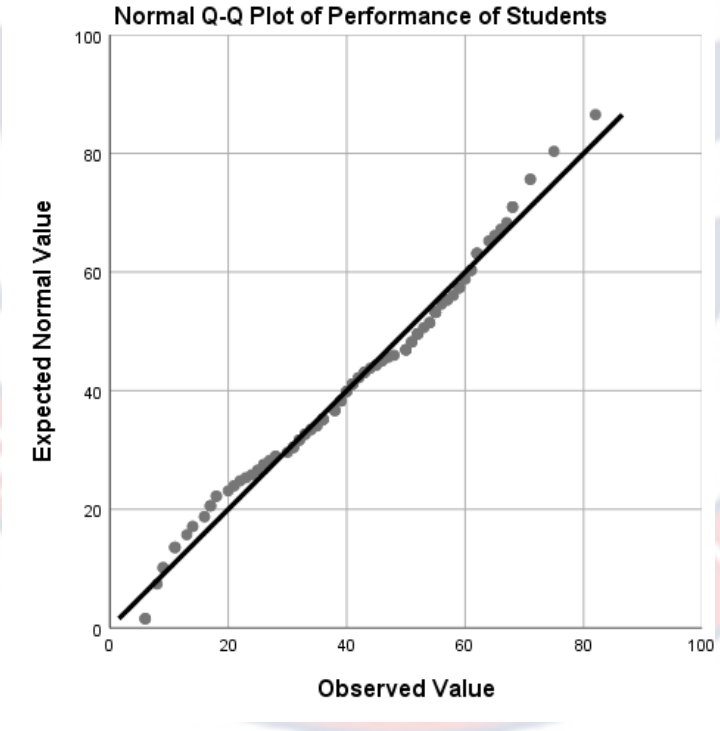






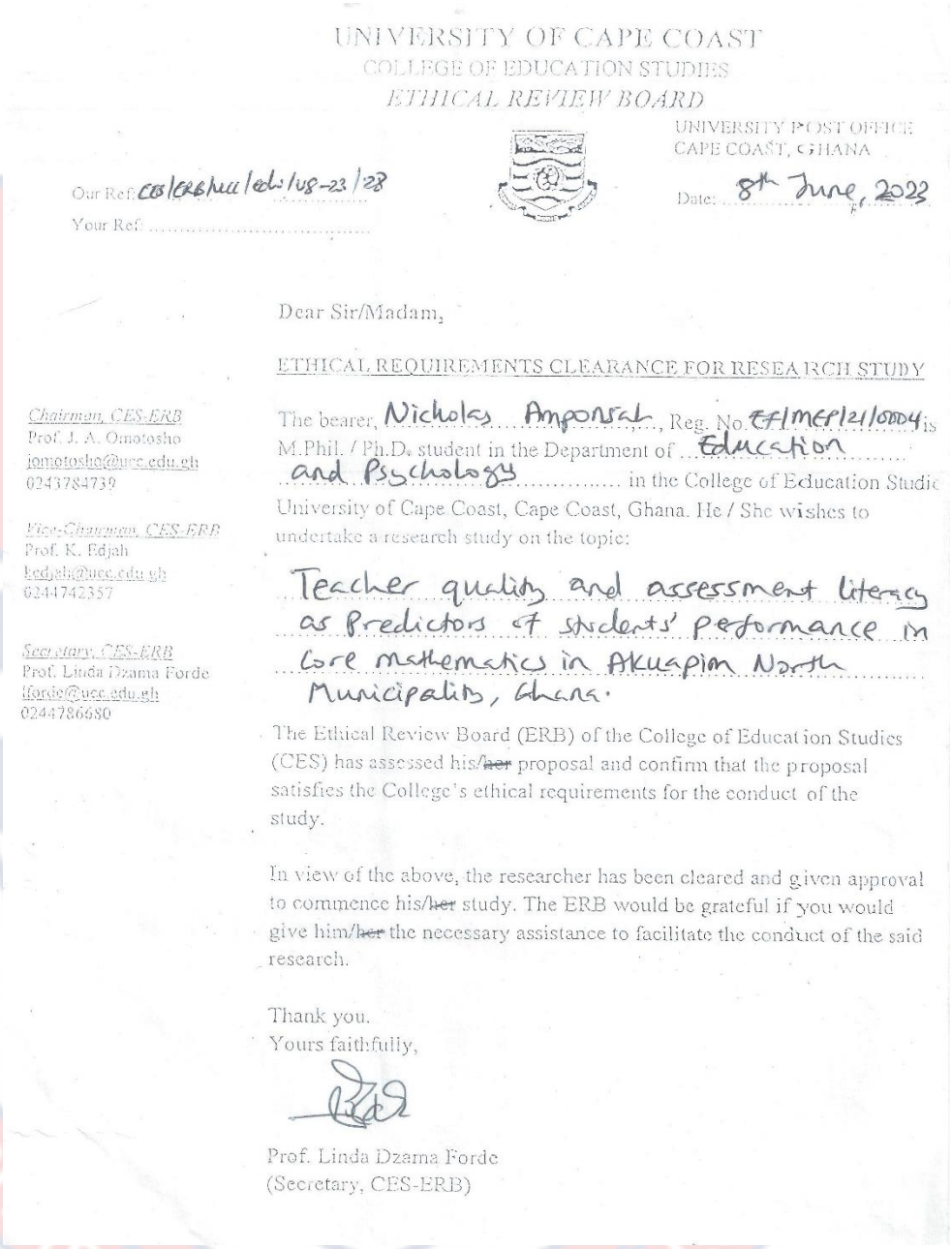






APPENDIX C

ETHICAL CLEARANCE



UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
ETHICAL REVIEW BOARD

UNIVERSITY POST OFFICE
CAPE COAST, GHANA

Our Ref: CES/ERB/UCC/edu/108-23/28
Your Ref: .....
Date: 8th June, 2023

Chairman, CES-ERB
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Prof. K. Edjah
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Secretary, CES-ERB
Prof. Linda Dzama Forde
lforde@ucc.edu.gh
0244786680

Dear Sir/Madam,

ETHICAL REQUIREMENTS CLEARANCE FOR RESEARCH STUDY

The bearer, Nicholas Amponsah, Reg. No. EF/MEP/21/0004 is M.Phil. / Ph.D. student in the Department of Education and Psychology in the College of Education Studies, University of Cape Coast, Cape Coast, Ghana. He / She wishes to undertake a research study on the topic:

Teacher quality and assessment literacy as predictors of students' performance in core mathematics in Akuapim North Municipality, Ghana.

The Ethical Review Board (ERB) of the College of Education Studies (CES) has assessed his/~~her~~ proposal and confirm that the proposal satisfies the College's ethical requirements for the conduct of the study.

In view of the above, the researcher has been cleared and given approval to commence his/~~her~~ study. The ERB would be grateful if you would give him/~~her~~ the necessary assistance to facilitate the conduct of the said research.

Thank you.
Yours faithfully,

Prof. Linda Dzama Forde
(Secretary, CES-ERB)