UNIVERSITY OF CAPE COAST

FORMATIVE ASSESSMENT PRACTICES AMONG MATHEMATICS TEACHERS: IMPLICATION ON STUDENTS' LEARNING OUTCOMES

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2023

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BY

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Thesis submitted to the Department of Education and Psychology of the Faculty of Educational Foundation, College of Education Studies, University of Cape Coast, in partial fulfilment of the requirements for the award of Master of Philosophy degree in Measurement and Evaluation

DECEMBER, 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: ……..

Supervisors' Declaration

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

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

Name: ……..

ABSTRACT

This study investigates how mathematics teachers in the Sagnerigu Municipality employ formative assessment and how their pupils interpret the feedback they get. Effective instruction requires frequent checks for understanding, and numerous studies have shown that formative assessment enhances student learning. A descriptive survey design involving a quantitative approach was employed to investigate the research questions. The participants of the study entail all the J.H.S 3 students in 14 purposively selected schools and the mathematics teachers who were involved in the study. The study found that QCD and FB were established formative assessment practices among math teachers in the municipality, while LISC and PSA were emerging practices. Students rated the feedback they received from their teachers as moderately useful, and their mathematics learning outcomes were at the "attaining proficiency" level. The study revealed that students combined perception of feeding up, feeding back, and feeding forward differed significantly between students of high-performing schools and low-performing schools. The study recommends that teachers should engage students in the learning process and participate in routine training programmes to enhance the effective utilisation of feedback information.

KEYWORDS

Formative Assessment

Feedback

Peer and Self-assessment

Feeding up

Feeding back

Feeding forward

ACKNOWLEDGMENTS

I extend my heartfelt appreciation to Prof. Eric Anane and Dr. Ruth Anan Brew for their exceptional intellectual support and guidance throughout the course of this study. Despite their demanding schedules, they generously provided invaluable assistance and advice. Their patience and willingness to allocate time for me are sincerely acknowledged and deeply appreciated.

DEDICATION

I would like to dedicate this thesis to my parents, whose enduring love, support, and selflessness have served as the driving force behind my academic journey. Their unwavering belief in my capabilities and encouragement has propelled me to surpass my own boundaries and attain my aspirations. Additionally, I dedicate this work to my siblings, whose constant support and motivation have fortified me along the way. Their unwavering faith in my abilities has been a source of inspiration, and I am immensely grateful for their steadfast backing. Lastly, I extend this dedication to my friends and colleagues, whose encouragement, support, and constructive feedback have played an indispensable role in shaping my ideas and enhancing the quality of my work.

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AA – Authentic Assessment

AaL – Assessment as Learning

AfL- Assessment for Learning

AfLMi – Assessment for learning Measurement instrument

AoL – Assessment of Learning

AVE – Average Variance Extracted

CAT – Class Assessment Task

CCP – Common Core Program

ETES - End-of-term examination scores

FA – Formative Assessment

FAP - Formative Assessment Practice

FB – Feedback

GES – Ghana Education Service

IAS - Internal assessment scores

INSERT – Inservice Education and Training

IRB – Institutional Review Board

KLT - Keep Learning on Track

LISC – Learning Intentions and Success Criteria

NaCCA – National Council for Curriculum and Assessment

PSA -Peer and Self-Assessment

QCD – Questioning and Classroom Discussion

SBA – School-Based Assessment

SFPQ – Student Feedback Perception Questionnaire

ESP - Education Strategic Plan

SDG - Sustainable Development Goal

CHAPTER ONE

INTRODUCTION

Background to the Study

The seminal work by Black and Wiliam (1998b), Inside the Black Box, the first major work published in England, explicitly emphasises the relevance of formative assessment in enhancing learning outcomes. Their study indicates that teachers may teach effectively and obtain high test results if they employ effective questioning strategies, provide feedback devoid of grades, facilitate peer reviews, encourage self-assessment, and utilise summative assessments in a formative manner (Black & Wiliam, 1998a; Black & Wiliam, 2004). Fundamentally, it is incumbent upon teachers to cultivate educational environments wherein students and educators collectively serve as discerning appraisers, critically assessing the multitude of instructional approaches implemented within the classroom.

Stiggins (2005) urged alternative ways of assessment in the United States, stating that over-dependence on summative assessment systems makes it practically impossible for teachers to adapt their instruction and learning to fit the requirements of each student. According to him, formative and traditional learning assessments must be balanced for teachers to provide students with information that helps them learn more effectively. Earl (2013), building on the work of Stiggins, advocated for collaboration between formative assessment and summative assessment in Canada.

Numerous investigations have been carried out in various nations to examine formative assessment methods, such as in the United States (Stiggins, 2005), the United Kingdom (Black & Wiliam, 1998b) and Canada (Earl,

2013). The findings of these studies indicate that the utilisation of formative assessment techniques has a favourable effect on students' academic performance. Nonetheless, there is an insufficient investigation of the efficacy of formative assessment methods in Ghana (Akyina & Oduro-okyireh, 2019; Amoako, Asamoah, & Bortey, 2019; Asare, 2020).

In Ghana, formative assessment practices have been incorporated into the national education system to improve learning outcomes (Ghana Education Service, 2020). Adopting formative assessment practices in Ghana aligns with the global trend of incorporating assessment practices that support learning rather than simply measuring it (Wiliam & Thompson, 2017). The aspiration to enhance the standard of education and guarantee that students are sufficiently equipped for the labour market has prompted the adoption of formative assessment procedures in Ghana. Over the years, the Ghanaian government has substantially invested in education to expand access to excellent education for all learners.

Formative assessment practices encompass a range of techniques and strategies employed to assess students' progress and offer constructive feedback to facilitate their learning. The primary objective of these practices is to augment students' comprehension of the course material, identify areas requiring improvement, and inform instructional decision-making (Leahy, Lyon, Thompson, & Wiliam, 2005). Despite the increasing adoption of formative assessment practices in Ghana, there is limited research on the effectiveness of these practices in improving learning outcomes. A study by Akyina and Oduro-okyireh (2019) which examined the assessment practices employed by senior high school teachers in the Mampong Municipality of

Ghana, the study revealed that a significant proportion of teachers, exceeding 50%, lacked familiarity with the concept of formative assessment. This revelation instigates inquiries into the degree of implementation of formative assessment practices within the classroom setting and the effectiveness of teachers in employing this methodology to evaluate students' advancement and furnish them with constructive feedback to bolster their learning experience.

Similarly, a study by Asare (2020) shows that teachers lack the skills to engage effectively in classroom assessment practices. Akyina and Oduro-okyireh's study uncovered a prevailing practice in Ghanaian schools, wherein assessments predominantly rely on the norm-referenced approach. In this approach, individual student performance is evaluated by comparing it to the collective performance of the entire class, serving as a basis for instructional management decisions. Unfortunately, this assessment practice primarily serves the purpose of ranking students rather than providing comprehensive insights for effective instruction.

Despite the expectation for teachers to regularly incorporate formative assessment into their instructional practices, this approach is not widely adopted (Lau, 2016; Wiliam, 2010). In many educational settings, including Ghana, the utilisation of formative assessment techniques does not receive the attention and emphasis it deserves. Consequently, opportunities to gather timely and meaningful feedback on student progress, identify areas of improvement, and adjust instructional methods are often missed. The reasons for this lack of implementation can vary, ranging from a lack of awareness and understanding of formative assessment practices to constraints in time, resources, and institutional support. As a result, the full potential of formative

assessment in promoting effective teaching and enhancing student learning outcomes remains untapped in many educational contexts.

In the specific context of the Sagnerigu Municipality in Ghana, it is uncertain whether teachers effectively incorporate emerging formative assessment strategies within their instructional practices. Empirical observations suggest that some teachers use assessment to induce heightened anxiety among students, utilising tactics such as imminent final examinations, impromptu quizzes, or the potential consequences of receiving low grades on report cards to motivate student performance. However, it is crucial to acknowledge that these practices may deviate from the intended purpose of formative assessment, which is to offer constructive feedback and facilitate students' learning progression.

Throughout the years, Ghana's educational system has undergone numerous modifications to improve the quality of education and promote equal access to educational opportunities for all students. The Education Strategic Plan (ESP) was introduced in 2010 to improve learning outcomes by embracing different initiatives, such as introducing formative assessment procedures (Ministry of Education, 2010). The ESP demonstrated a profound understanding of the pivotal role played by formative assessment approaches in fostering students' learning. Consequently, the ESP put forth a recommendation emphasising the imperative integration of these approaches into the national education system.

Formative assessment practices have been widely recognised as an effective approach to improving student learning outcomes in different parts of the world. Formative assessment involves using different strategies and

techniques to evaluate student learning progress and provide feedback that can support student learning. The meta-analysis of research results by Black and Wiliam (1998b) marked a crucial turning point in developing formative assessment as an explicit field of practice. Too frequently, people associate "formative assessment" with a quiz or examination. Still, it is a method educators use to get student and teacher feedback to alter how teachers instruct and how their pupils learn (Brooks, Carroll, Gillies, & Hattie, 2019).

Assessment is not a one-way process but a collaborative activity between teachers and students, involving shared participation in activities to achieve learning objectives. Formative assessment is a two-way process where teachers and students respond to ongoing evidence of learning daily or minute-by-minute, providing support and guidance as needed (Leahy et al., 2005). In Ghana, traditional summative assessment methods such as end-of-term examinations are still commonly used by many teachers to evaluate students' learning. This can lead to a focus on rote memorisation rather than deep understanding and fails to provide students with the feedback necessary for improvement. However, there is widespread dissatisfaction with these conventional assessment methods, leading educators worldwide to focus more on the daily assessments carried out in the classroom as a potent tool for raising student achievement (Wei, 2010). In the search for alternative assessment approaches educators and practitioners are increasingly turning to formative assessment (FA), which is solely meant for developing purposes and not intended for comparison or selection (Wei, 2010). FA emphasises student development, recognises learner diversity, and maximises learner potential.

The notion that frequent "understanding checks" are required for effective instruction has persisted for a long time. However, a generation ago, several researchers and teachers started to recognise this process of "checking for understanding" as a type of assessment (Wiliam, 2014). Assessment can be considered as establishing a link between instruction and student progress; this can only be achieved through some assessment to determine whether an instructional strategy is effective. This assessment can be carried out at the end of the instruction programme. However, assessments have grown in popularity in recent years as they have been used to improve the education process rather than merely evaluate its outcomes.

A plethora of empirical research studies have substantiated the efficacy of formative assessment in cultivating substantial enhancements in students' learning outcomes. Black and Wiliam (1998b) reviewed 250 journal articles to establish whether FA enhances academic standards in the classroom. Their findings indicate that efforts to improve FA result in substantial learning improvements. Mathematics educators are expected to benefit significantly from these findings. Each year, a significant proportion of students perform poorly in mathematics, and the findings of this study may assist teachers in improving their students' performance in the subject. If formative assessment holds the potential to foster academic progress among students, conducting a comprehensive study to assess teachers' proficiency in implementing formative assessment practices and gauge students' responses to feedback regarding their learning outcomes would be immensely valuable.

Formative assessment has considerable potential as the next chance to encourage improvements in student performance. The primary objective of

formative assessment is to facilitate students' learning with enhanced effectiveness and efficiency (Brookhart, 2010). Teachers and students collaborate on procedures to identify students' learning styles, identify their strengths and areas for improvement, and generate data that teachers can use to plan lessons and help students to enhance their comprehension and performance (Wiliam, 2010). It emphasises the significance of involving students in the assessment process (Black & Wiliam, 2009). It is crucial to let the teacher know if the lesson's objective was met and if the students are gaining mastery of the material.

Formative assessments come in a wide variety of formats. Teachers can collect formative assessment data in various ways, including observation, classroom discussion, group work, peer assessment, oral questioning, projects, portfolios, and self-assessment (Cizek, 2010). Formative assessments are distinguished from other assessments because, regardless of the format in which they are administered, their primary purpose is to collect information that can be used to better adjust instructional strategies to each student's unique set of short- and long-term objectives. This sets formative assessments apart from other types of assessments. An all-inclusive theoretical framework was used in this thesis study to ensure that all effective assessment methods were considered when examining the purpose of formative assessment. This thesis presents an empirical research defining formative assessment as a five-key foundational principle of effective teaching and learning (Wiliam, 2010).

Formative feedback is crucial to classroom assessment since it facilitates student learning (Hattie & Timperley, 2007). Despite the widespread recognition of feedback's constructive influence on learning

outcomes, there is ongoing debate regarding what qualifies as "good feedback." This includes differing views on the most effective source, format, content, frequency, and feedback timing (Shute, 2008). In addition, there is a dearth of knowledge regarding how students perceive their role in feedback situations. While it has been acknowledged that students react to, respond to, and potentially use feedback (Peterson & Irving, 2008), the cognitive mechanisms underlying students' interpretation of feedback remain obscure. The present study aims to investigate students' comprehension and interpretation of feedback within a mathematics classroom.

The significance of feedback to the intellectual development of schoolchildren and, by extension, their future opportunities cannot be overstated. In many nations, including Ghana, proficiency in feedback evaluation practice is crucial in how far one might advance academically and the future academic possibilities one receives. Therefore, a solid understanding of quality feedback is the key to developing quality human resources required to improve the nation's economy. However, the quality of teacher feedback is contingent on their assessment techniques.

Hattie and Timperley (2007) define feedback as information given by someone that pertains to an individual's performance or comprehension and works towards minimising the difference between what is currently understood and what is intended to be understood. Adopting a conceptual framework of feedback necessitates three critical questions for students to think about for feedback to be effective: Where am I going? Where am I? and What am I doing next?

Hattie and Timperley (2007) suggest that the integration of these queries as feedback can be undertaken across four hierarchical tiers, encompassing the dimensions of the task itself, the procedural aspects involved, the facilitation of self-regulatory mechanisms, and the reflective evaluation at the individual level. Feedback can be helpful when employed at the first three levels but less valuable when aimed at the self. Feedback on tasks may include instructions and revisions. It also refers to the degree to which answers are given for tasks that have been completed, or comments are made regarding completing the task by identifying correct and incorrect responses, learning more diverse information, and expanding on surface knowledge. This level of feedback is more valuable when it comes from a wrong understanding rather than from not having enough information. Processing feedback depends on the steps to finish or work on a task. At the process level, information about the method, practice procedure, or process used to complete a task or make a product. This feedback acts as a reminder, which helps people find and use information and tasks more effectively.

An inherent advantage of this type of feedback lies in its connection to students' error-detection strategies. Feedback that operates at the level of self-regulation encompasses the provision of information pertaining to a task or performance, which contributes to the development of enhanced self-evaluation capabilities. Furthermore, it nurtures the confidence necessary to engage in more challenging tasks or achieve a profound understanding of a given task. During the journey of self-regulated learning, students engage in proactive efforts to acquire feedback from diverse channels, such as academic resources, educators, peers, and supplementary references. The fundamental

aim across all three modes of feedback is to diminish the disparity that exists between students' present comprehension and their intended attainment of knowledge (Hattie & Timperley, 2007). It is noteworthy that these forms of feedback serve two primary purposes: directive and facilitative (Black & Wiliam, 1998a). Directive feedback specifically provides students with explicit guidance regarding areas requiring correction or revision.

In contrast, facilitative feedback entails providing comments and recommendations that aid students in the process of revising and refining their own work, promoting deeper conceptualisation and understanding (Gamlem & Smith, 2013). Facilitative feedback helps high achievers learn more than it does beginners. In school, students are expected to gain knowledge and learn how to use feedback to improve their performances.

Even though there has been a significant amount of research on how to provide feedback, little is known about how feedback influences learning (Shute, 2008). According to Wiliam (2013), feedback research has focused more on how feedback is provided than how it is received. He argues that it is illogical to question, "What type of feedback is most effective?" because one type of feedback may motivate one student to work harder while discouraging another from continuing.

The strength and use of formative assessment reside in its non-evaluative nature and its emphasis on giving students timely, detailed, remedial feedback and actively involving them in beneficial learning experiences (Wiliam, 2010). Their effectiveness will be jeopardised if formative assessments become merely quizzes or assignments. Designing, implementing, and delivering comprehensive and relevant formative

assessments necessitate a significant investment of time and effort on the part of educators.

Teachers are responsible for designing high-quality assessments aligned with learning outcomes. Teachers are regarded as the best qualified to evaluate students and have the most comprehensive knowledge of the context in which the subject matter is discussed (Ghazali, 2016). This allows teachers to keep track of their student's progress, provide critical feedback, and help them improve their learning skills (Clark, 2011). The assessment outcome will allow teachers to decide whether they will move to a different subject or engage students in remedial classes if they are not proficient enough academically to move on to the next level.

Indirectly, teachers must design an appropriate assessment technique to help pupils of various capacities learn better. In this manner, students can study at their own speed, allowing those with higher ability to grow more rapidly and those with less to take their time.

Statement of the Problem

Schools are intended to be environments conducive to nurturing students' skills and knowledge, with an emphasis on ensuring that no student falls behind the others and that all students meet predetermined standards, rather than places where students are sorted and ranked according to their achievement (Stiggins, 2005). Educators ought to employ assessment practices to discern both the existing knowledge base of their students and, more significantly, the areas in which knowledge gaps persist. By doing so, teachers can more effectively cater to the individualised educational requirements of their students (Lawrence, 2019). Through classroom assessment, teachers can

identify whether there is a mismatch between what is being taught and what is being learnt (Amua-sekyi, 2016). Formative assessment assumes a vital role in fostering the active and independent learning of students. It empowers them to take ownership of their educational journey by facilitating the process of setting and co-constructing learning goals and success criteria in a collaborative manner. Through formative assessment, students receive descriptive feedback that guides their learning process, allowing them to make effective use of this feedback to enhance their understanding. In addition, formative assessment serves as a catalyst for the facilitation of peer and self-assessment, affording students the opportunity to critically evaluate their own trajectory of growth and provide constructive appraisals to their fellow learners. Moreover, the utilisation of formative assessment significantly contributes to the cultivation of metacognitive prowess, empowering students to engage in profound introspection regarding their learning strategies and effectuate adaptive modifications as deemed necessary for optimal educational advancement (Earl, 2013; Shepard, 2017). Given the assessment's substantial impact on instruction, any limitation imposed on the former inevitably entails a corresponding limitation.

Formative assessment has been an essential aspect of classroom instruction in many educational settings. Extensive research has consistently demonstrated that formative assessment serves as a highly effective instructional practice, leading to improved learning outcomes across diverse subject areas, including mathematics. Research findings have illuminated the positive impact of integrating formative assessment methodologies within the domain of mathematics education (Black & Wiliam, 1998a; Hattie &

Timperley, 2007). Such practices encompass the utilisation of effective questioning techniques, the provision of prompt and constructive feedback, and the creation of opportunities for students to engage in self-assessment. Through the application of these strategies, students' learning experiences in mathematics are substantially enriched, yielding improved outcomes. The implementation of these practices assumes a pivotal role in fostering students' comprehension of mathematical concepts, honing their problem-solving aptitude, and ultimately bolstering their overall academic performance in the domain of mathematics.

Formative assessment is a continual and dynamic process that encompasses the collection of data regarding student learning and employing this information to adapt and refine teaching strategies in order to enhance student outcomes. It involves regularly monitoring and evaluating student progress, identifying areas of strength and areas that require further development, and making necessary adjustments in instructional approaches to optimise student learning. The primary aim of formative assessment is to offer timely and customised support to students, thereby ensuring the fulfillment of their individualised educational requirements and fostering a continuous trajectory of improvement throughout their learning journey (Heritage, 2010). In the present era, there has been a noticeable surge in the recognition among mathematics educators regarding the profound significance ascribed to the integration of formative assessment practices within their instructional methodologies (Boaler, 2016).

Mathematics teachers can use several formative assessment practices to improve student outcomes in mathematics. One such practice is

questioning. Questioning is a powerful formative assessment tool that can probe students' understanding of mathematical concepts (Dweck, 2017). Feedback serves as a vital instrument within the realm of formative assessment, enabling students to receive prompt and tailored evaluative input on their performance (Hattie & Timperley, 2007). Self-assessment assumes a paramount role as a highly efficacious formative assessment tool, fostering the growth of students as self-aware and introspective learners. Through active participation in self-assessment, students gain the ability to evaluate their own progress, discern their strengths and areas in need of enhancement, and engage in thoughtful contemplation of their learning approaches and strategies. The process of self-assessment engenders a greater sense of ownership over learning, as students actively participate in the monitoring and evaluation of their own performance. Through self-assessment, students are empowered to establish goals, make informed decisions, and assume responsibility for their own learning, leading to a profound enhancement in their overall academic growth and development (Boud & Falchikov, 2006; Han & Fan, 2020).

Despite the evident advantages of formative assessment practices, numerous mathematics teachers encounter challenges in effectively implementing these practices. Factors such as inadequate knowledge and training, time limitations, and insufficient support from administrators and colleagues can hinder the optimal utilisation of formative assessment techniques (Chappuis, Stiggins, Chappuis, & Arter, 2012). As a consequence, many students may not fully benefit from the potential advantages that formative assessment practices offer.

Even though formative assessment is crucial to student success in the classroom, there is little proof that teachers integrate it into their instructional practices. Incorporating formative assessment into their lessons is crucial for teachers to enhance student learning. Significant research has been done regarding the formative assessment practices of teachers (Adobah, 2020a; Akyina & Oduro-okyireh, 2019; Amoako, 2018; Amoako et al., 2019; Anhwere, 2009; Asamoah & Derkye, 2019; Bordoh, Bassaw, & Eshun, 2013; Ntim, 2021; Songnalle, 2019), but very limited studies focus on how the assessment practices are embedded in the instructional practices of junior high school mathematics teachers. For example, according to Ntim (2021) study, educators are acquainted with formative assessment. However, the link between teachers' knowledge and their actual use of formative assessment was quite weak. Contrary to the findings of Ntim, the study by Akyina and Oduro-okyireh (2019) and Amoako et al. (2019) showed that teachers in senior high schools have a limited understanding of formative assessment practices.

The existing body of literature on formative assessment in Ghana has predominantly focused on secondary and tertiary educational settings, as evidenced by studies conducted by Adobah (2020b), Akyina and Oduro-okyireh (2019), Amoako (2018), Amoako et al. (2019), Anhwere (2009), Asamoah and Derkye (2019), Bordoh et al. (2013), Ntim (2021), and Songnalle (2019). Consequently, there exists a noteworthy gap within this domain that the present study endeavours to address by investigating the formative assessment practices of mathematics teachers in junior high schools within the Sagnerigu Municipality.

Limited scholarly investigations have been carried out at the junior high school level, explicitly exploring teachers' perceptions and understanding of formative assessment, as evident in Asare (2020) and Nyantakyiwaa (2021) works. Insufficient data currently exists to ascertain the frequency with which teachers employ formative assessment techniques. Consequently, this study endeavours to ascertain whether and how frequently mathematics teachers within the Sagnerigu Municipality integrate formative assessment practices within their instructional environments.

While the advantages of implementing formative assessment in mathematics education are widely acknowledged, a paucity of research exists regarding the extent to which mathematics teachers in the Sagnerigu Municipality engage in formative assessment practices and the implications of such practices on students' learning outcomes in mathematics. Despite the National Pre-tertiary Education Curriculum in Ghana promoting formative assessment (Ministry of Education, 2018), most Ghanaian teachers still prioritise summative assessment over formative assessment, and the formative use of assessment is not a routine practice in classrooms (Lau, 2016). This limits the potential for students to achieve their educational goals, as teachers are unable to effectively identify students' learning needs and cater to their distinct learning trajectories. Additionally, there is limited research on the students' perceptions of the usefulness of the various types and levels of feedback provided by their mathematics teachers. Students often view assessment as a tool for the teacher to determine their successes and failures rather than a learning tool (Kwapong, 2021). This research gap highlights the

need for further research in this area to inform policy and practice in mathematics education.

This research endeavors to bridge the existing research gap by investigating the formative assessment methodologies employed by mathematics teachers at the Junior High School level in the Sagnerigu Municipality, with a particular focus on the consequential impact of such practices on students' learning achievements in mathematics. The study aims to analyse the extent to which mathematics teachers in the Sagnerigu Municipality implement formative assessment strategies within their instructional settings, while also examining the efficacy of these practices in enhancing students' learning outcomes in mathematics. Additionally, the study intends to explore students' perceptions regarding the usefulness of different types and levels of feedback provided by their mathematics teachers. Through this comprehensive investigation, the research will contribute to the current understanding of formative assessment practices in mathematics education within the Sagnerigu Municipality, offering valuable insights into how such practices can be effectively employed to enhance students' learning outcomes in mathematics.

Purpose of the Study

This study aims to examine the formative assessment practices implemented by mathematics teachers and evaluate their impact on students' learning outcomes. Understanding how mathematics teachers employ formative assessment strategies is essential for improving mathematics instruction and optimising students' academic achievements.

Specifically, the research seeks to accomplish the following objectives:

1. Identify the extent to which teachers employ formative assessment strategies in the classroom.
2. Find out students' perceptions of the usefulness of the various types of feedback.
3. Investigate how the use of formative assessment strategies relates to students' achievement in mathematics.

Research Questions

1. What are the formative assessment strategies employed by Junior High School mathematics teachers in the Sagnerigu Municipality in the classroom?
2. What are students' perceptions of the usefulness of the various types of feedback?
3. How does the use of formative assessment strategies relate to students' achievement in mathematics?

Hypothesis

The following research hypothesis guided the study:

1. H_0: School performance has no statistically significant influence on students' perception of feedback

Significance of the Study

The study's findings provide valuable information about current formative assessment practices used by teachers. This information can help directors and head teachers make informed decisions about targeted interventions to enhance overall assessment practices within the district.

By understanding the current state of formative assessment and the factors influencing its implementation, this research can contribute to the

development of effective policies and programs to support teachers and improve student learning outcomes.

The study provides teachers with a deeper understanding of effective formative assessment strategies and how to incorporate them into their teaching practices. This knowledge will help them improve student learning by providing ongoing feedback and adapting instruction based on student needs.

The findings can equip teachers with assessment techniques that cater to individual student needs. This allows for better monitoring of student progress and timely interventions for improvement.

Delimitations

The study specifically centres on the junior high school level, encompassing third-year students. By narrowing the scope to this specific educational level, the research aims to understand the formative assessment strategies employed and their potential effects on students' academic achievements and learning outcomes in mathematics.

The geographical scope of this study is limited to the Sagnerigu Municipality, providing a micro-level examination of the formative assessment practices within this particular context. This enables an in-depth exploration of local nuances, educational policies, and contextual factors that may influence the implementation of formative assessment strategies and subsequently impact students' learning outcomes.

It is crucial to acknowledge that this study primarily concentrates on understanding the formative assessment practices among mathematics teachers

and their influence on students' learning outcomes. It does not extensively delve into other aspects of mathematics education, such as curriculum development or teaching methodologies unrelated to formative assessment.

Limitations

This study focuses on mathematics teachers in the Sagnerigu Municipality, Ghana. While the findings might be valuable in this context, the specific population and educational system may limit the generalizability of results to other regions or countries.

Although anonymous surveys were used, social desirability bias can still occur. Teachers may be hesitant to report on practices they perceive as less effective or require more time. This could lead to an overrepresentation of positive responses regarding formative assessment use, potentially inflating its perceived effectiveness.

The study relies on self-reported data from teachers about their use of formative assessment practices. Additionally, student achievement is measured through assessments or standardized tests. Both methods may be susceptible to bias or error. Teachers might overestimate their use of strategies, and test scores might not fully capture the impact of formative assessment on all aspects of learning.

Organisation of the Study

The study is divided into five primary parts. The first chapter's introductory section encompasses the study's background, problem statement, research objectives, questions, hypothesis, significance, delimitation and limitations. The next section, which is the second chapter, discusses the theoretical and empirical foundations of the research questions and hypothesis.

Chapter three provides an overview of the research methods, including the study's design, population, sample, sampling technique, and data collection and analysis methods. The fourth chapter reports and analyses the study's findings. Lastly, the fifth chapter provides a summary of the research, its conclusions, recommendations and suggestions for future research.

CHAPTER TWO

LITERATURE REVIEW

This chapter delves into the theoretical foundations of the study, focusing on a conceptual review of the following topics: the definition and characteristics of formative assessment, various types of formative assessment, assessment practices within the school-based assessment (SBA) system, ensuring high-quality assessment, new and emerging perspectives on assessment, providing feedback to students, sharing learning objectives and success criteria, questioning as a formative assessment strategy, formative feedback, and a framework for effective classroom questioning. Additionally, an empirical review of the existing literature is presented, covering the following areas: teachers' formative assessment practices, student perceptions of feedback in the learning process, mathematics learning outcomes of students, and factors influencing differences in students' perception of feedback.

Theoretical Framework

A theory provides direction regarding where, what, and how to look. (Jonker & Pennink, 2010). It is impossible to observe any part of reality, phenomenon, or issue without first conceptualising some theory. Three theories provided the foundational guidelines on which this study was conducted: Sadler (1989) formative assessment theory; Leahy et al. (2005) model of formative assessment; Hattie and Timperley (2007) formative feedback model.

Sadler's (1989) Formative Assessment Theory

Sadler's (1989) theory of formative assessment emphasises the importance of incorporating ongoing assessments throughout the learning process to support student learning and achievement. According to Sadler, formative assessment should be utilised to provide feedback to students that helps them better understand their learning progress and identify areas for improvement. By using formative assessment in this way, students are better able to take ownership of their own learning and develop greater self-efficacy. Sadler's theory also emphasises the need for formative assessment to be integrated into the teaching and learning process rather than simply being added as an afterthought. Sadler's theory of formative assessment emphasises the importance of ongoing feedback and student-centred learning to support the achievement of learning goals.

In the basic model of formative assessment that Royce Sadler developed, feedback was regarded by Sadler as the essential component for facilitating learning (Sadler, 1989). Initially, Sadler conceptualised formative assessment as a mechanism for providing feedback to help narrow the disparity between the learner's present condition and the intended objectives. He stated that information is not feedback until it is actively employed "to bridge the gap" (Sadler, 1989, p. 121). In Sadler's approach, the teacher uses evidence from formative assessments to inform pedagogical decisions and give constructive remarks (feedback) on how students might enhance their learning. The feedback meant to enhance learning is most successful if it is task-focused and provides the student with hints or clues rather than being presented as praise or remarks regarding performance (Heritage, 2010).

This theory emphasises the shift from feedback to self-monitoring, in which students can identify their strengths and engage in continuous practice to reinforce them. Feedback and monitoring also assist students in identifying their weaknesses and making the necessary adjustments to overcome them. Students should be assisted in enhancing their ability to evaluate the quality of their work and regulate their actions to achieve the desired learning outcomes. It is especially useful when there are multiple ways to evaluate the quality of a student's response. According to Sadler (1989), providing information from teachers to students to close the gap between students' actual performance and the desired outcome constitutes feedback. If the information regarding altering the gap originates from the learner, it is termed self-monitoring.

Giving feedback generally refers to providing information to students regarding the quality of their performance (knowledge of the results). However, in several academic and training programmes, students produce works that cannot be considered correct or inaccurate. The direct subjective evaluation determines the quality of work. The theory suggests a more appropriate understanding of feedback that the traditional definition does not encompass. It requires knowledge of standards or goals, skills, the ability to make multicriteria comparisons, and the formation of techniques and procedures to reduce discrepancies between actual student performance and target learning outcomes. Improvement can happen if teachers provide detailed correction or remediation advice and students follow through. However, this retains the dependence of the students on teachers. Sadler's alternative approach focuses on developing skills in assessing students' work quality, especially in the learning process.

The shift from teachers giving feedback to learners monitoring their own progress is not a process that happens automatically. To achieve desired learning outcomes, it is essential for the teaching system to establish clear measures for students to attain evaluative proficiency on their own. Students cannot rely solely on the teacher's assessments and must take ownership of their own learning journey to reach their full potential (Sadler, 1989). Sadler's formative assessment philosophy is based on the fundamental premise that students must be capable of monitoring the calibre of their learning progress to enhance their overall performance. To produce work that meets the required standard, students must understand what high-quality work is, possess the necessary evaluative skills to assess their work's quality objectively and create a repertoire of techniques or moves to better their work. These abilities can be improved by presenting students with a direct authentic evaluative experience (Sadler, 1989). Only when learning requirements are explicitly established can the move from feedback to self-monitoring be made. Students should be informed about the standard, a benchmark against which their work will be measured. According to Sadler (1989), standards are predetermined performance and excellence levels. It becomes a goal when it transforms into a cherished desire or an ambitious aspiration. The goal may be external or internal. External goals are those assigned by the teacher, whereas the students form internal goals. Except for a coercive situation, a learner can ignore an external goal that can negatively impact his achievement. The active ownership of a goal is crucial for it to hold significance in the self-regulation of one's performance.

Sadler's Formative Assessment Theory (1989) holds significant relevance in guiding the present study, which investigates formative assessment practices among mathematics teachers in the Sagnerigu Municipality. This theory emphasises the critical role of ongoing assessment and timely feedback in fostering student learning. Within the context of this study, Sadler's theory serves as a conceptual framework that directs the exploration of formative assessment strategies implemented by Junior High School mathematics teachers.

By incorporating Sadler's theory, the study endeavors to discern the assessment methods and techniques utilised by teachers in monitoring students' progress, delivering prompt feedback, and effectively guiding their learning process. The theory illuminates the indispensable nature of continuous assessment practices employed by educators, wherein they gather pertinent information regarding students' understanding, identify areas for improvement, and provide tailored feedback to address individual learning gaps.

The primary objective of this research is to unveil the specific formative assessment strategies employed by mathematics teachers in the Sagnerigu Municipality. This necessitates an examination of diverse assessment techniques employed in classrooms, including questioning techniques, observational assessments, quizzes, and diagnostic assessments. Furthermore, the study seeks to gain insights into how teachers employ these strategies to deliver timely and meaningful feedback, fostering enhanced learning outcomes for their students. By incorporating Sadler's theory, the study aims to deepen understanding of how mathematics teachers in the

municipality effectively integrate ongoing assessment and feedback mechanisms to optimise student learning and achievement in the domain of mathematics.

In essence, Sadler's Formative Assessment Theory guides the study by underscoring the significance of continuous assessment and timely feedback within the classroom setting. This theoretical framework shapes the research focus, facilitating the identification and examination of formative assessment strategies implemented by mathematics teachers in the Sagnerigu Municipality. By shedding light on these practices, the study aims to advance knowledge on how such strategies contribute to promoting student learning and achievement in the field of mathematics.

Leahy, Lyon, Thompson, and William (2005) Model of FA

Leahy, Lyon, Thompson, and William (2005) proposed a model of formative assessment that emphasises five key strategies for effective implementation. The first strategy is clarifying and sharing learning intentions and success criteria with students to ensure they understand what they are expected to learn and how they will be assessed. The second strategy is providing ongoing feedback focused on specific learning goals and helping students to understand where they stand in relation to those goals. The third strategy is encouraging student self-assessment and reflection to foster metacognition and promote greater ownership of learning. The fourth strategy involves students in peer assessment and feedback, which can help to foster a collaborative learning environment and provide additional perspectives on student progress. Finally, the fifth strategy is promoting teacher questioning

and feedback, which can help to diagnose student misconceptions and support their ongoing learning.

Leahy et al. (2005) state that formative assessment can be five "key strategies." These "key strategies" are the result of the interaction of three processes (where the student is going, where the student is now, and how to get there) with three types of classroom agents (teacher, peer, learner).

Table 1: Five "key strategies" of formative assessment

<table>
<tr><td></td><td>Where the Learner is Going</td><td>Where the learner is now</td><td>How to get there</td></tr>
<tr><td>Teacher</td><td rowspan="3">Clarifying, sharing and understanding learning intentions and success criteria</td><td>Engineering effective discussions, tasks, and activities that elicit evidence of learning.</td><td>Providing feedback that moves learning forward</td></tr>
<tr><td>Peer</td><td colspan="2">Activating students as learning resources for one another</td></tr>
<tr><td>Learner</td><td colspan="2">Activating students as owners of their learning</td></tr>
</table>

Source: Leahy et al. (2005)

Leahy, Lyon, Thompson, and William (2005) proposed five key strategies for implementing formative assessment:

1. Clarifying and sharing learning intentions and success criteria: To ensure effective learning outcomes, teachers must establish well-defined student goals and expectations and effectively communicate this information to them. Students should also understand what success looks like regarding learning goals. Several studies have examined the impact of clarifying learning intentions and criteria for success on student achievement. Black and Wiliam (1998a) found that when teachers clearly articulated learning objectives and criteria for success,

students were more likely to comprehend what they needed to learn and achieve the desired learning outcomes.

2. Providing feedback that moves learners forward should be timely, specific, and actionable. The focus of formative assessment should be on the learning objectives, which should help students comprehend how they can enhance their performance. Various studies have explored the effects of offering feedback as a formative assessment technique. Hattie and Timperley (2007) found that feedback can significantly impact student achievement when it is timely, specific, and focused on improving learning.
3. Activating students as instructional resources for one another: Teachers should encourage students to work collaboratively and provide peer feedback. This can help students better understand the learning goals and how to achieve them. Several studies have explored the impact of activating students as instructional resources for one another. For example, Topping (2010) found that peer assessment can be an effective form of formative assessment that promotes learning and helps students develop critical thinking skills.
4. Activating students as owners of their own learning: Students should be involved in setting their learning goals and tracking their progress. This can help them take ownership of their learning and become more self-directed. Several studies have explored the impact of activating students as owners of their own learning. For example, Zimmerman and Schunk (2001) found that self-regulated learning can significantly

impact student achievement when students are provided with the skills and tools they need to take ownership of their learning.

5. Engineering effective classroom discussions, activities, and tasks that elicit evidence of learning: In order to accurately assess students' knowledge, comprehension, and abilities, educators should employ a variety of tactics to collect evidential data. This may include questioning, observation, discussion, and work samples. Several studies have explored the impact of using classroom discussions, activities, and tasks as formative assessment strategies. For example, Darling-hammond and Bransford (2007) found that classroom discussions and activities can effectively elicit evidence of student learning and identify areas where students need additional support. Teachers can learn a lot from their students. By observing and listening to their students, teachers can gain insights into what students understand, what they still need to learn, and how they learn best. This can help teachers adjust their instruction and better support their students.

The five key formative assessment strategies identified by Leahy et al (2005) can effectively improve student learning outcomes. However, effective implementation requires careful planning and attention to detail, as well as ongoing monitoring and adjustment to ensure that the strategies have the intended impact on student learning.

Even though the five strategies are not the only important parts of teaching, they are valuable ways to look at practice and help teachers deal with more significant pedagogical and curriculum problems. According to Bennett

(2011), formative assessment employs five strategies to keep learning on track (KLT): shared learning expectations, questioning, feedback, self-assessment, and peer assessment. According to Bennett, students share their learning intents and experiences as examples of shared learning expectations.

The inclusion of Leahy et al's and Wiliam's Model of Formative Assessment (2005) in the study establishes a valuable connection between the model's framework and the investigation of formative assessment practices among mathematics teachers in the Sagnerigu Municipality. This model provides a comprehensive structure that revolves around five key strategies crucial for effective formative assessment: clarifying learning goals, eliciting evidence, providing feedback, activating learners as instructional resources, and promoting learner self-regulation.

By incorporating this model into the study, researcher's aim to assess how mathematics teachers in the Sagnerigu Municipality implement these strategies within their classrooms. The model serves as a lens through which the practices of teachers are evaluated, shedding light on the extent to which they align their formative assessment techniques with established best practices. It offers a framework that allows researchers to examine how teachers clarify learning goals and communicate them effectively to students, gather evidence of student understanding, provide meaningful and timely feedback, engage students in the learning process as active resources, and foster self-regulation among learners.

The application of Leahy et al.'s model in the study provides a structured approach to investigate the implementation of these strategies by mathematics teachers. It helps researchers assess the degree of alignment

between teachers' formative assessment practices and the recommended best practices outlined in the model. This evaluation of alignment offers insights into the effectiveness of formative assessment strategies employed by teachers in the Sagnerigu Municipality, as well as their potential impact on students' learning outcomes.

By incorporating the model's framework, the study gains a comprehensive understanding of how mathematics teachers in the Sagnerigu Municipality utilise the five key strategies. It allows for a nuanced analysis of the extent to which teachers integrate these practices in their classrooms, ultimately contributing to the evaluation of formative assessment practices' influence on students' learning outcomes. Moreover, the model serves as a valuable tool for identifying areas where teachers can enhance their implementation of formative assessment strategies to maximise students' learning potential in mathematics.

A Model of Feedback by Hattie and Timperley (2007)

Hattie and Timperley (2007) proposed a model of feedback that emphasises three key questions to guide effective feedback practices. The first question, "Where am I going?" focuses on clarifying students' learning intentions and success criteria. This question helps students to understand what they are expected to learn and how they will be assessed. The second question is "How am I going?" which focuses on providing feedback that helps students understand their current progress concerning learning goals. This question allows students to identify areas where they are doing well and areas where they need to improve. The third question, "Where to next?" focuses on providing specific guidance and suggestions for enhancing students' learning.

This question helps students identify concrete steps they can take to move forward and progress towards their learning goals. Hattie and Timperley's model emphasises the importance of providing timely and specific feedback focused on learning goals and supporting student self-regulation and improvement.

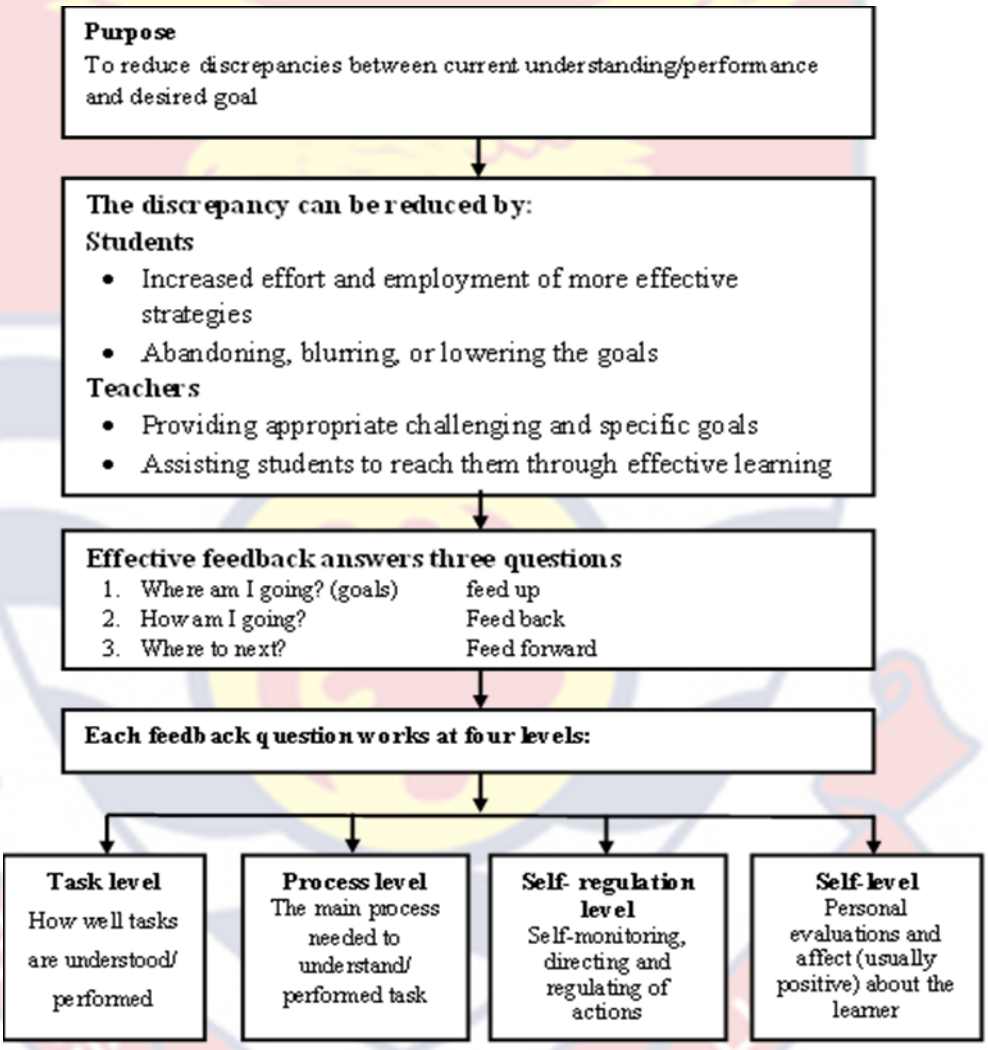

Figure 1: Hattie and Timperley's (2007) Model of Feedback

The model developed by Hattie and Timperley (2007) contains three distinct feedback questions from the learner's standpoint. These questions are as follows: Where am I going? (Feeding up): How am I going? (Feeding back); and what comes next? (Feeding forward) The learner is expected to respond to these questions for the provided feedback to be useful.

In addition, Hattie and Timperley (2007) model is based on the concepts of visible learning (Hattie, 2008). According to Hattie, visible learning involves providing students with an explanation of the learning purpose, objectives, and success criteria to be considered active participants in the learning process. The model developed by Hattie and Timperley uses feedback questions such as "Where am I going?" so that students' learning intentions and success criteria may be explicitly defined. These feedback questions help to provide the foundation for pupils to develop habits of self-regulation in their educational pursuits. Visible learning occurs when teachers use students' work samples and responses to gauge student progress toward the learning target and their instructional efficacy. This feedback helps teachers improve their instructional practices.

Research has demonstrated that the most effective feedback is when it is delivered from the student to the instructor (Hattie, 2012). This kind of feedback provides concrete evidence for teachers to evaluate their influence on students' learning and encourages them to modify their instruction and feedback methods. Hattie and Timperley (2007) feedback model offers various levels of feedback that can be tailored to meet the specific needs of each student. There are four levels of feedback available for each question, which is as follows: task, process, self-regulation, and self-level. Feedback at the task level focuses on the learning outcomes, particular task needs, and the specific requirements of the task. Feedback at the process level focuses on the procedures, skills, methods, and reasoning the student needs to execute the task. Self-regulatory level feedback requires the learner to use deep learning concepts, such as relational thinking and self-monitoring, to evaluate and

change their work according to the standards they ask for. Because there is evidence that it hinders learning (Hattie, 2008), feedback to the self-level, often linked with praise, was excluded from this study.

The feedback model developed by Hattie and Timperley (2007) provides a comprehensive framework for delivering effective feedback to learners. The model emphasises the importance of setting clear learning goals and expectations, providing specific and actionable feedback, and helping learners take responsibility for their learning. By using this model, teachers can give meaningful and relevant feedback to learners, leading to improved learning outcomes.

The incorporation of Hattie and Timperley's Formative Feedback Model (2007) into the study establishes a crucial link between the model's framework and the investigation of formative assessment practices among mathematics teachers in the Sagnerigu Municipality. This model places significant emphasis on the provision of effective feedback to students, highlighting three fundamental questions that should guide feedback practices: "Where am I going?", "How am I going?", and "Where to next?"

By considering this model, the study aims to delve into students' perceptions regarding the usefulness of different types of feedback. It seeks to understand how students perceive the feedback provided by their mathematics teachers and how it influences their overall learning experience and academic growth. By exploring this aspect of the study, researchers contribute to the understanding of the impact of feedback on students' motivation, engagement, and achievement in the realm of mathematics.

The study recognises the significance of feedback in formative assessment practices and acknowledges Hattie and Timperley's model as a guiding framework to investigate this aspect. By integrating this model into the study, researchers gain insights into students' perspectives on the feedback they receive from their mathematics teachers. The model's three guiding questions provide a lens through which researchers can examine how feedback is designed and delivered in the classroom. It helps researchers explore whether students perceive the feedback as clear and informative regarding their learning progress (i.e., "Where am I going?"), whether they can assess their current level of understanding and performance (i.e., "How am I going?"), and whether they receive guidance on how to improve and move forward in their learning (i.e., "Where to next?").

The incorporation of Hattie and Timperley's Formative Feedback Model contributes to the study's understanding of the role of feedback in students' learning outcomes. By exploring students' perceptions of the usefulness of feedback, the study sheds light on how feedback impacts their motivation, engagement, and achievement in mathematics. It provides valuable insights into the effectiveness of different types of feedback and informs recommendations for mathematics teachers in the Sagnerigu Municipality on how to enhance their feedback practices to optimise student learning and growth.

Overall, by considering Hattie and Timperley's Formative Feedback Model, the study investigates students' perceptions of feedback in the context of formative assessment practices among mathematics teachers. It explores the impact of feedback on students' motivation, engagement, and achievement,

ultimately contributing to the understanding of how feedback can be effectively utilised to enhance students' learning outcomes in mathematics.

Conceptual Review

The conceptual review conducted as part of this study aimed to aid in a deeper comprehension of the study's concepts and to encourage wider adoption of various formative assessment techniques in educational settings. A thorough understanding will enable teachers to put formative assessment into practice and advance their practices rather than simply thinking about it.

Meaning and Nature of Formative Assessment

Bennett (2011) defines "formative assessment" as an instrument like a diagnostic test or an item bank used to create tests. However, other educators and researchers disagree and assert that formative assessment is a process, not just an instrument. Popham (2008) defines formative assessment as a deliberate process in which teachers use evidence of students' progress to adapt their instruction or students use it to adjust their learning strategies.

According to this perspective, the method offers a qualitative insight into the student's degree of comprehension rather than a numerical score (Wiliam, Thompson, & Dwyer, 2008). According to Bennett (2011), formative assessment is best understood neither as a test nor a process but rather as a conscious combination of procedure and purposefully planned technique. Assessment for learning is another word used virtually interchangeably with formative assessment. Black and Wiliam (2003) contend that formative assessment occurs solely when information is utilised to adapt instruction to improve learning outcomes. Many people mistake "diagnostic assessment" with "formative assessment" or use them interchangeably. When an

assessment offers information about what is wrong, it is termed diagnostic, and when it advises what action to take, it is considered formative (Wiliam & Thompson, 2017). It's also worth mentioning that not all diagnostic tests can be used for instructive purposes.

Formative assessment, a method aimed at boosting students' learning, takes place within the framework of teaching, according to Darling-hammond and Bransford (2007). While it is possible to perform formative assessments post-testing, most educators prefer to utilise it in real-time during instruction, allowing them to recognise students' misconceptions and knowledge gaps immediately (Cauley & McMillan, 2010).

One way to consistently assess students' progress is by casually observing and asking them questions throughout instruction and content review. By paying attention to their responses, teachers can obtain valuable insights that can help improve their teaching strategies and students' academic achievements. By integrating seamlessly with instruction, formative assessment ensures that students are continuously assessed and educated.

Black and Wiliam (2003) definition suggests that formative assessment serves two purposes: to aid student learning and to provide teachers with valuable information to adapt their teaching methods. It involves using assessments to enhance the learning process and inform instructional decisions. From this functional perspective, it is evident that the learning strategy and instructors' knowledge, skills, and strategies for implementing complex pedagogical processes are crucial to the success of formative assessment in the classroom (Webb & Jones, 2009). Several studies (Dylan, Lee, Harrison, & Black, 2004; Marshall & Mary, 2006) have demonstrated

that formative assessment is advantageous but difficult for teachers to implement.

According to Leahy et al. (2005), for learning to be effective, the learner must have answers to the following fundamental questions: Where am I going? Where am I currently? and How can I fill the void? Students become invested in their own learning improvement when they have a clearer picture of what they hope to learn, are able to accurately assess their current skill level, and are willing to assume responsibility for achieving those goals. In light of these questions, it is essential to establish assessment implementation principles in order to advance learning.

According to Bordoh et al. (2013), formative assessment acts as a vital link between assessment and teaching, empowering students to become autonomous and reflective learners who can evaluate their growth. Consequently, students can consolidate newly acquired knowledge and regulate their learning journey while the teacher can guide them as and when required. This allows students to integrate new information and control their learning while the teacher can offer support when necessary or appropriate.

Types of Formative Assessment

Cowie and Bell (1999) distinguished two types of formative assessment - planned and interactive - based on the concepts they represent. The phases of formative assessment are often produced by the teacher when formative assessment is planned. All students participate in a recursive elicitation, interpretation, and action cycle grounded on the teachers' domain expertise. In contrast, the teacher uses the students' comments and inquiries as data in an interactive formative assessment. Typically, it involves a few pupils

at a time or small groups. Ruiz-primo (2011) uses Cowie's ideas about formative assessment and builds on them. However, they use both informal and formal formative assessment terms. Formative assessment encompasses a spectrum that spans from formal to informal assessment. In a formal formative assessment, teachers often create an activity focusing on a specific learning area. The objective of the activity is to gauge students' comprehension, allowing teachers to plan subsequent lessons and promote students' development. Conversely, an informal formative assessment aims to collect evidence of students' learning through natural, everyday learning activities in diverse formats.

William (2006) bases his ideas of formative assessment on cycles of time (long, medium, and short cycles) according to the responsiveness of the feedback system. That is the time required for the system to utilise the collected data. When describing the continuum, he also includes the formal-informal element. William introduces other agents than the teacher and other forums than classrooms. Using results from standardised tests as a basis for planning a teacher's professional development session is an example of a long-cycle formative assessment (William, 2006). An example of a formative assessment with a medium time period (one to four weeks) would be a teacher using a pre-test to modify instruction for a student or class before the real test (Wiliam et al., 2008). Day-by-day or minute-by-minute feedback is used to define short-cycle formative assessment. Daily formative assessment occurs when the material is responsively used for up to two days between lessons. This allows the teachers to use the information obtained when preparing the following lesson. When the feedback system is immediate during lessons, this

is considered a formative assessment minute-by-minute. The assessment might be either planned or spontaneous in Wiliam's description.

School Based Assessment System

For teachers to be able to evaluate their students, they need to have a certain level of skill at doing so. Since teachers know the most about the subject and their students, the SBA system puts the responsibility of making good assessments on their shoulders (Ghazali, 2016). With this, teachers may closely monitor their student's progress toward learning goals and give constructive feedback to help them develop as learners (Clark, 2011). Based on the assessment results, teachers can decide whether to move on to a new topic or send the students struggling the most to remedial sessions to help them catch up. Indirectly, this means that teachers must develop several good ways to assess students to help students of varying abilities learn more. But this way, students can move forward at their own pace, depending on how well they are doing. Stronger students move forward faster, while weaker students are given more time to meet the learning goals.

In order to track a student's progress over time, school-level actors (learners, teachers, and head teachers) can use school-based assessments (SBA), which include AfL, AaL, and AoL (see Table 2). The most important parts of SBA are collecting and tracking data (Ghana Education Service, 2020)

Table 2: Modes of Assessment in SBA

Assessment for learning	Assessment of learning	Assessment as learning
Class exercises	Class Assessment Task (CAT)	Portfolio
Quizzes	End of term	Project work
Class tests (written, oral, aural and/or practical)	End of year	Questionnaire
Class Assessment Task (CAT)		

Source: Ministry of Education (2020)

The conduct of assessments in schools is heavily reliant on school-based assessments. Group projects, homework, in-class tests, in-class exercises, portfolios, rubrics, and homework are just some ways that students' knowledge is assessed in this system. In accordance with Ghana Education Service, the SBA essentially encompasses all internal forms/modes of assessment that can be completed by any actor operating at the school level (student, teacher, or headteacher) (Ghana Education Service, 2020). Therefore, SBA incorporates diagnostic tests, formative assessments, and summative assessments that students can take right there at the school. Internal assessment scores (IAS) and end-of-term examination scores (ETES) must be generated and combined (i.e., added) to provide an overview of a student's performance upon completion of a term, grade level, or program. The Internal Assessment Score (IAS) will be a cumulative grade from four (4) individual tests taken at various points throughout a term. The IAS will account for 30% of the description of the student's accomplishments, while final examinations and other external (national level) assessments will account for 70%. It gives schools a chance to make sure that a student's academic progress is measured in the context of their educational experience. To get a full picture of a student's growth and accomplishments across the curriculum, they must be put through a diverse array of both structured and unstructured assessment scenarios that tap into various domains and levels of competence.

Classroom assessments should not be complicated for students to complete. They should also be based on learner-centred principles and practices. Teachers are tasked with eliciting valid and reliable data on students' proficiency in core areas of knowledge and skills. The information obtained

regarding the progress and achievements of the learners should be utilised to provide constructive feedback on their strengths and weaknesses, where they are succeeding and why, and where they need to improve and how. Parents should be kept informed of their children's progress. Parents are given encouragement and suggestions for how they can aid their children's educational endeavours, including the suggestion that they recognise and reward their children for accomplishments. The updated SBA now includes instructions for conducting classroom assessments, detailing the steps teachers should take to develop and implement these assessments (Ghana Education Service, 2020). The National Council for Curriculum and Assessment (NaCCA) coordinates efforts to help classroom teachers improve their internal assessment methods, while the GES is responsible for delivering assessment-related professional development.

Higher-order thinking abilities are emphasised in authentic assessment (AA) because they help students concentrate on what matters in learning, such as developing a product, service, or solution to a social problem. This student evaluation strategy includes projects and other evaluation methods, such as practicals and peer assessments. Authentic assessment is known to be practical and focused on real-world occurrences. Through project work, AA provides students with skills that enhance their understanding of course material and may be applicable in other contexts.

Projects are learning activities that allow students to put together and use what they have learned in the real world. Independent or collaborative skill demonstration is an important learning outcome, and projects should provide circumstances where students can practice these outcomes. Projects

enable students to discover new avenues for learning. A well-managed project teaches students to plan carefully, utilise their ideas, assume responsibility, and effectively present their results. Project participation increases students' ability to think critically and creatively about a topic. They also make connections between topics from different fields so that students can see knowledge as a whole and not just as a collection of facts. Participation in meaningful projects can improve the ability to take responsibility for one's education and the capacity to adapt to a knowledge-based, high-tech society. It aids in developing critical thinking, creativity, learning and planning. The ability of the learner to collaborate with peers, as well as teamwork and group skills, will be developed through projects. Projects typically focus on finding solutions to the classroom, school, community, and wider world issues. They encourage students' capacity for originality and creativity, as well as their capacity for critical thought and collaborative problem-solving. While participating in project-based learning activities, students enjoy imaginatively building their knowledge. The teacher guides the aspirations and activities of the students in the role of a coach or facilitator. The performance of an individual is evaluated based on how well they met objectives, comprehended the material, and played a part in the accomplishment of the project.

Common Core Programe (CCP)

Assessment in the context of CCP encompasses not only “assessment for learning” but also “assessment of learning” and “assessment as learning”. The goal of assessment for learning (AfL) is to assist students and instructors in determining the current level of knowledge and skills, the desired level of knowledge and skills, and the most effective means of achieving the desired

level. One of the most efficient methods to raise educational quality is through AfL (Black & Wiliam, 1998b). Assessment for learning encompasses any effort made by teachers or students that provides information that can be used to inform instructional or academic changes. AfL can be done by sharing criteria with learners, asking them good questions, and giving feedback. So, AfL provides prompt feedback to assist students throughout the teaching and learning process. It utilises diverse methods and assessment instruments to measure the level of learning. It is a continual activity that occurs at all phases of the teaching process to check on a student's progress, give them feedback, or change how they are being taught to meet the lesson's performance standards.

The CCP strongly focuses on creative, inclusive pedagogies built on genuine and inquiry-based learning, cooperative and collaborative, differentiated, holistic, and cross-disciplinary (Ministry of Education, 2020). The CCP employs a criterion-referenced model to present and report school-based assessment results.

The curriculum is driven by assessments, leading to the development of assessment tasks based on curricular standards (Ghana Education Service, 2020). When this is done, it is possible to determine the status of the learners and their progress toward the standards, and this information is then used to inform training. The test results will be more meaningful indicators of how well students learn if they reflect the curriculum standards.

Ensuring Quality Assessment

Before conducting an assessment, internal and external assessors must consider the assessment's quality and the data it will yield (Ghana Education

Service, 2020). A good assessment will either inform the assessor of something they were unaware of or verify the presence of previously unavailable information, such as a student's achieved level of performance. When performing an assessment, it is the obligation of the assessor to ensure that the assessment is valid, reliable, and fair so that the obtained data may be relied upon. Assessments must examine the expected knowledge and skills to draw meaningful inferences (judgements) about, for example, what a learner understands and is capable of doing.

Time is of utmost importance in determining what learners may generate as evidence of learning under assessment settings, particularly when considering the uniqueness of learners. Others are steady or slow-moving in academic activities and learning in general, in contrast to those who are swift. A valid and fair evaluation should consider what learners can perform on their own and the pace of their learning permitted by their skills and other circumstances. The scheduling of assessments involving assessments of learning and assessment for learning should be such that, while assessments should be completed within the allotted time, learners who require additional time should have access to it.

The New Emerging Perspective of Assessment

Assessment practices are seen from two perspectives (Lau, 2016), the traditional, prevailing perspective and the new emergent view of assessment. Grading and providing students with regular feedback on their progress have long been the main functions of traditional assessment. It views intelligence as an innate and fixed trait measured in relation to other individuals. The role of education and the focus of assessment under this view involves the selection

of the best 'norm-referencing' judgements underpins this view of assessment. The conventional assessment model is designed to discover and report what has been learned about classroom activities (Amua-sekyi, 2016). Research has shown that providing students with appropriate assessment feedback improves learning outcomes (Onuka & Oludipe, 2006). However, the nature of feedback under the traditional view does not include interactive (regulatory activities during learning) and retroactive (regulatory activities at the end of an instructional unit) to foster academic growth among students. Recently, assessment has evolved to include approaches that provide educators with a more accurate depiction of the level of students' understanding and reasoning, enhance students' learning skills, and enhance instruction.

Under the emerging view, assessment is a Criterion reference in nature. Students' performance is judged based on absolute standards termed as learning outcomes. The focus of this emerging view is not to measure students' innate intelligence but rather on the process and product of education. Although these assessment methods may be used to assign a grade that is not the primary focus, they may also be used to teach students how to perform better on activities they are now performing or will perform in the future.

These newer assessment methods better capture, during or after instruction, how students think, reason, and use what they have learned instead of telling the teacher what they have learned or showing that they can do calculations or procedures correctly. The concept underlying the emerging view of assessment is to offer students feedback, indicating what they have learned and need to learn better by offering "corrective activities" to students. After students have finished the corrective activities, a second formative

assessment should be given to them. This second formative assessment should cover the same learning unit as the first formative assessment, but it should feature somewhat different questions (Bloom, 1971). This second formative assessment has two purposes: first, it helps teachers evaluate the efficacy of their assessment efforts; second, it encourages students to try again and succeed where they may have previously struggled (Guskey, 2005)

Providing Feedback to Students

Shute (2008) and Hattie and Timperley (2007) both emphasise the interactive and constructive nature of formative feedback. They view feedback as a process that involves the learner and the teacher working together to identify and address gaps in understanding. This process is designed to help learners improve their thinking and behaviour, leading to a deeper understanding of the subject matter.

Shute (2008) defines formative feedback as "information communicated to the learner that is intended to modify his or her thinking or behaviour to improve learning." This definition highlights the importance of feedback in helping learners to identify and correct their mistakes. Hattie and Timperley (2007) define formative feedback as "information about the gap between a learner's current state and the desired goal, and suggestions for how to close the gap." This definition highlights the importance of feedback in helping learners to set goals and to develop strategies for achieving those goals.

Both definitions emphasise the importance of feedback in helping learners to improve their understanding of the subject matter. However, they differ in their focus. Shute's definition focuses on the learner's thinking and

behavior, while Hattie and Timperley's definition focuses on the learner's progress towards a specific goal. In practice, both of these aspects of feedback are important. Feedback that helps learners to identify and correct their mistakes can help them to improve their thinking and behaviour. Feedback that helps learners to set goals and to develop strategies for achieving those goals can help them to make progress towards their desired outcomes.

Black and Wiliam (2009) argue that feedback plays a crucial role in the classroom and should be treated as critical moments in teaching, referred to as "moments of contingency." These moments of contingency are like turning points in instruction where assessment shapes the direction of learning, leading to better student outcomes.

The utility of feedback is contingent on the temporal and contextual factors of its provision and reception (Andrade, 2010; Hattie & Gan, 2011). In other words, the usefulness of feedback depends on when and how it is given, as well as when and how it is received. For example, feedback that is given too late may not be helpful, and feedback that is given in a harsh or critical manner may be counterproductive. Similarly, feedback that is received when the recipient is not open to receiving it may not be effective. As such, these studies have helped broaden the view of feedback in the world today. Scholars such as Black and Wiliam (2003), Brookhart (2011), and (Hattie & Timperley, 2007) view feedback as a fundamental aspect of the collaborative relationship between teachers and students, aimed at facilitating deeper learning and understanding. It is viewed as an indispensable tool that enables teachers to guide and support students, leading to better educational outcomes. It may be time to stop thinking of the teacher as the one who provides feedback and the

student as the one who receives it in the classroom. As an alternative, it may be important to think about the classroom's social dynamics and how students give and receive feedback (Hattie & Gan, 2011). In order to learn effectively, students need to appreciate the value of self-assessment and feedback from teachers and peers (Andrade, 2010; Black & Wiliam, 2009).

Feedback goes beyond merely highlighting students' correct and incorrect responses (Ankomah & Oduro, 2004). This is succinctly illustrated in the works of Ramaprasad (1983, p. 8) “The information about the gap, by itself, is not feedback. The information can be called feedback only if, and when, the information is used to alter the gap”. It involves remedial interactions to help identify student learning problems and works towards improving learning (Darling-hammond & Bransford, 2007). Students can realise what they need to do to maximise their performance if they are shown the specific misconceptions or mistakes that regularly arise in a certain topic area or skill set and how they can modify their approach to the assignment. Students derive hope and positive expectation from receiving feedback on their progress in learning.

To promote students' mastery of instructional learning outcomes, feedback from teachers should avoid making social comparisons and instead focus on students' progress toward meeting learning objectives. For instance, a teacher may say to a student who is struggling, "That is okay; we are only beginning this topic", "You will get it as we work with it more", or "You are almost there. Keep working on it".

The literature has conflicting views on feedback timing and its effects on students' learning outcomes. The timing of feedback is a complex issue

with no easy answers. Some experts believe that feedback should be given immediately after a student has completed a task, while others believe that it can be more effective to delay feedback for a period of time. Immediate feedback has the advantage of being timely and relevant. It can help students to identify and correct their mistakes right away, which can help them to improve their learning. However, immediate feedback can also be overwhelming, especially for students who are struggling. It can also be difficult for teachers to give immediate feedback on complex tasks. Delayed feedback has the advantage of giving students time to reflect on their work and to make their own corrections. It can also be more comprehensive, as teachers have more time to consider the student's work in detail. However, delayed feedback can be less effective than immediate feedback, as students may have forgotten what they did or why they did it.

Some researchers have said that immediate feedback is the best way to stop mistakes from being stored in memory, while others have said that delayed feedback reduces proactive interference, which lets the first mistake be forgotten, and the correct information be stored without any problems (Shute, 2008). Other researchers believe feedback should be given as soon as possible to help students learn more effectively when the evaluated work is still fresh in the learners' minds (Ankomah & Oduro, 2004). They believe feedback is most helpful when it is immediate. However, certain forms of feedback may be best suited to various types of learning. Cauley and McMillan (2010) opine that high-achieving students benefit from delayed feedback, whereas low-achieving students demand detailed and quick feedback. Similar to Cauley et al. opinion is that of Shute (2008), who

purports that procedural learning benefits more from instant feedback, whereas higher-order outcomes could do better with delayed feedback. The best timing for feedback will vary depending on the individual student and the task at hand. For some students, immediate feedback may be the most effective, while for others, delayed feedback may be better. It is important to experiment with different timing strategies to find what works best for each student.

In providing feedback, teachers must create an atmosphere of trust and set classroom norms that allow for constructive criticism. Negative feedback can undermine students' willingness to make subsequent efforts to improve their learning (Darling-hammond & Bransford, 2007). They opine that feedback is most useful when it is about students' performance against established criteria, identifies strengths as well as weaknesses, and provides support or guidance about what to do to improve. Students learn nothing from a numerical score or grade; hence, a chance to increase their learning is missed. A commitment to improving comments initially necessitates more work, as teachers must focus on the quality of the comments they write on students' work. Sharing examples of excellent statements through teacher collaboration may be quite beneficial.

Students who believe their accomplishments are primarily attributable to their effort and talent will be more motivated and perseverant in completing difficult tasks (Cauley & McMillan, 2010). Teachers should link results to student efforts when offering feedback for formative assessment tasks and explore instruction and learning task changes. This suggests that a student's lack of success may also be due to something they can change. Students may

feel hopeless if the formative assessment does not acknowledge their effort or explore instruction modifications.

Sharing learning Intentions and Success Criteria

Sadler (1989) stated learning goals are thought to be a tool that allows pupils to observe how their performance changes and how quickly they advance. The first step of the formative assessment procedure requires a crystal-clear definition of learning objectives and an explicit statement of success criteria. According to Torrance (2012), defining standards does not occur solely at the beginning of a lesson. This is a crucial point to remember. Instead, it occurs via a literal or figurative "drafting" process through discussion. When learners are given chances to improve on their first attempts at a task, their learning experiences are better. This also makes it easy to keep making the criteria clear.

The effectiveness of many teaching strategies is contingent on the clarity and sharing of learning intentions between teachers and students. For instance, when a teacher poses questions or assigns students tasks, the learning objective should be crystal clear. Otherwise, the teacher may not obtain pertinent and necessary information regarding the student's learning. The same applies to feedback. If the teacher's feedback is directed toward a specific learning objective, the student can take the next step in their learning more effectively.

Framework for Effective Classroom Questioning

Walsh and Sattes (2015), in their book "Questioning for Classroom Discussion: Purposeful Speaking, Engaged Listening, Deep Thinking", provide useful insights into effective classroom questioning. They propose a

framework for effective questioning that includes four key elements: purpose, planning, process, and evaluation.

The purpose of questioning is to support student learning and understanding. Teachers should be clear on the purpose of their questions, such as assessing prior knowledge, promoting critical thinking, or reviewing content.

Planning involves designing questions that align with learning objectives and promote higher-order thinking. Walsh and Sattes (2015) suggest that teachers should use a mix of questions, including lower-order and higher-order questions and open-ended questions and prompts.

The process of questioning involves the delivery of questions and feedback to students. Walsh and Sattes (2015) recommend that teachers use a range of questioning strategies, such as whole-class, small-group, and individual questioning, as well as providing wait-time and follow-up questions to deepen student understanding.

Evaluation involves assessing the effectiveness of questioning and using feedback to improve future questioning. Teachers can use student responses and feedback to identify areas where students may need additional support and adjust their questioning accordingly.

Walsh and Sattes (2015) emphasise that effective questioning requires skillful implementation and ongoing reflection and evaluation. By using purposeful planning, various questioning techniques, and ongoing evaluation, teachers can use questioning to promote student learning and understanding.

Effective classroom questioning is essential for formative assessment and instructional practice. It is a strategy teachers use to elicit student thinking,

promote discussion, and encourage reflection on learning. One key element of effective questioning is to use open-ended questions. Open-ended questions allow students to provide more detailed responses and allow teachers to assess students' understanding more accurately (Johnson & Johnson, 1975). They can also promote higher-order thinking and encourage students to develop critical thinking skills.

A crucial component of successful questioning is to incorporate a pause period following the inquiry. This pause, commonly referred to as "wait-time," denotes the duration during which an educator remains patient and allows ample time for a pupil to formulate their response. Research has shown that longer wait times increase student responses' quality and quantity (Rowe, 1974). It also allows students who may require more time to process the question to formulate an answer.

Effective classroom questioning also involves using a variety of questioning techniques. Teachers can use different types of questions, such as factual, analytical, and evaluative questions, to assess different levels of understanding (Bloom, 1956). Teachers can also use prompts to encourage deeper thinking, such as asking students to provide evidence to support their answers or to explain their reasoning.

In addition to the type of questions used, effective classroom questioning also involves effective feedback. Feedback can inform students about their understanding and how to improve their thinking. Research has shown that effective feedback should be specific, timely, and focused on improvement rather than just providing a grade (Hattie & Timperley, 2007).

In order to achieve fruitful classroom questioning, it is essential to establish a welcoming atmosphere where students are at ease to express their perspectives and suggestions. Teachers can foster a secure and encouraging classroom ambience by encouraging active student involvement, attentively hearing them out, and responding courteously (Loughran, Mulhall, & Berry, 2012).

Questioning as a Formative Assessment Strategy

Teacher questioning, a common way to teach, can help students learn by letting teachers find out important information about how they are doing. The Initiation-Response-Feedback (IRF) model is a common pattern of interaction in classrooms. The teacher initiates the interaction by asking a question, the student responds, and then the teacher provides feedback on the student's response (Jiang, 2014). It is important to remember that asking questions may not always be a good way to judge something. Questioning is a teaching method, not an assessment tool, when it is used to get students interested instead of to see what they know. Another example is that even if the goal of a question is to figure out how well someone is learning if no actions are taken afterwards to help the person learn, it would not be right to call it a formative assessment strategy.

So, if you want to use questions as a tool for formative assessment, you need to go beyond the standard IRF. First, the questions should be important for helping students understand (Black & Wiliam, 2003). Second, the answers should show what students think so that teachers can decide what to do next. teachers should not only provide feedback to students, but they should also take steps to help students apply that feedback and make progress towards

their goals. This could involve providing additional resources, offering extra help, or simply checking in with students to see how they are doing (Hill & McNamara, 2012). In short, to look at questions as a tool for assessment, we need to look at the whole questioning process and ensure that each step helps the learning goal.

By asking questions and having classroom discussions, teachers can find out what students understand and how well they understand it. Some activities that fall into this category are oral inquiry, one-on-one conversations in groups, observing and giving feedback on how children perform, and student contact with the teacher or peers. It also has worksheets, assignments from the textbook, and tests made by the teacher.

When a teacher poses a question to pupils, it is only to elicit responses that further the learning process. Students become more involved and cognizant of the fact that success in school may depend less on memorising and more on the capacity to communicate and defend one's ideas in class. Teachers' roles also shift from content presenters to leaders of idea exploration and development in which all students participate. Some teachers fail to organise or encourage classroom conversations that are student-centred. Research has shown that many teachers do not give pupils more than a second to react to a question before moving on to another or answering it themselves (Black, Harrison, Lee, Marshall, & Wiliam, 2004). Because teachers often do not give students enough time to think about their answers, the only questions that "work" are those that can be answered quickly and without thinking. This leads to superficial conversations, as students are not given the opportunity to engage in deep thinking or discussion.

The issue can be resolved by extending the waiting period. This is difficult for many teachers since it demands them to abandon old practices. Their students' expectations are challenged when they shift. Increasing the wait time can encourage more students to join in on the discussion. Another way to get more students involved is to give them two or three minutes, maybe in pairs, to come up with ideas before the teacher asks for input. Overall, these changes will allow teachers to gain a better understanding of their students' prior knowledge and any gaps or misconceptions in that knowledge. This will help teachers to better meet the real needs of their students and to ensure that they are prepared for their next steps.

To make these changes possible, we need to move away from the traditional focus on memorising facts and instead focus on asking high-quality questions in the classroom. This means using open-ended questions or problem-solving tasks that can lead to deeper discussions and more meaningful learning. For this strategy to be effective, teachers need to anticipate the possible responses that students may have to the task and have a plan for how to follow up on those responses. Once students begin working on the task, effective questioning is a critical component of the unplanned interventions that teachers make. Simple questions, such as "Why do you think that?" or "How might you describe that?" can be used to expand students' thinking and provide quick feedback on their work.

Formative assessment is an assessment to determine what a learner needs and how to meet those needs. It does this by asking the right questions. By asking the right questions, you can find out how the students feel about the subject matter. In a typical classroom, where the focus is on the product of

learning (what students can do) rather than the process of learning (how students think), the teacher might only care about whether the student's answer is correct rather than how the student arrived at that answer. Initiative-Response Evaluation (IRE) is the name for this kind of dialogue (Mehan, 1979). In these dialogues, most of the teachers ask about facts they already know. In a classroom where answers are only marked as right or wrong, students who give incorrect answers are not given the opportunity to explain their thinking or to receive feedback. Instead, the question is simply passed on to another student.

When a teacher uses formative assessment to ask questions and understand their student's thought processes, this type of dialogue is known as Initiative-Response-Follow up (IRF). Both IRE and IRF dialogues have been criticized for limiting the conversation to what the teacher wants to talk about. This is because these dialogues typically involve the teacher asking a question, the student providing an answer, and the teacher providing feedback. This pattern of interaction can discourage students from sharing their own ideas or from asking questions. To overcome this, formative assessment can be incorporated into instructional dialogues aimed at teaching and learning. The key to successful instructional dialogues is voluntary student participation, where information is gathered to effectively meet learning needs. This type of interaction can be described as Eliciting-Response-Interpretation-Use (Ruiz-primo & Furtak, 2006), where the student may initiate the discussion by posing a question or making a comment. The teacher then elicits a response from the student, interprets the response, and uses the response to further the discussion.

The information obtained can be used by the student, a classmate, or the teacher to expand the learning experience. Even silent students can benefit from their peers' contributions by presenting a counterargument or expanding on a peer's response.

Formative Feedback

One of the most important steps in providing constructive feedback is ensuring learners understand what is expected of them (Boud & Molloy, 2013; Hattie & Timperley, 2007). Clarifying success criteria at the outset learning cycle or during lesson delivery directs learners toward activities that enable them to fulfil or achieve the learning outcomes (Hattie & Timperley, 2007). Feedback concerning expectations and standards after the learning cycle is conclusive and is of little value, partly because the learner is not provided additional opportunities to incorporate the feedback (William, 2011). Feedback can become more effective when the intent of a task and its success criteria are aligned with challenging learning goals (Hattie & Timperley, 2007).

During the learning process, students have the opportunity to receive feedback from their instructor as well as from their peers. Self-feedback is also considered a form of feedback. When students clearly understand the learning objectives and success criteria, they can easily comprehend and apply the feedback they receive. Moreover, they can easily provide relevant feedback to their instructor, peers, and themselves.

The concept of effective feedback involves incorporating feed-forward opportunities to complete the feedback loop (Boud & Molloy, 2013; Hattie & Timperley, 2007; Hounsell, McCune, Hounsell, & Litjens, 2008; Nicol &

Macfarlane-dick, 2006). The closure of the feedback loop is critical as it necessitates students to take action based on prior feedback received or self-generated (Sadler, 2010). The evaluation of feedback's efficacy can be determined by its influence on student behaviour (Nicol & Macfarlane-dick, 2006). Regrettably, the availability of feed-forward opportunities is often overlooked due to delayed feedback or misinterpretation of feedback content (Hounsell et al., 2008). To facilitate feed-forward, it is essential to establish clear standards, provide ongoing opportunities for focused feedback, and encourage self-assessment practices, all of which are essential elements for successful feedback. Nicol and Macfarlane-dick (2006) propose that teachers should adopt a feedback cycle encompassing task, performance, feedback, and resubmission to offer feed-forward opportunities. Similarly, Hattie and Timperley (2007) suggest that educators should integrate feed-forward within their teaching and learning cycles. As tasks become more challenging, the significance of feed-forward opportunities increases in assisting students' learning (Boud & Molloy, 2013).

Self and Peer Assessment

Nicol and Macfarlane-dick (2006) posit that self-assessment and peer assessment are both formative evaluation methods that empower students to take charge of their own learning. Self-assessment involves students evaluating their own work against predetermined criteria set by their teacher. This approach helps students recognise their areas of difficulty and collaborate with their teacher to resolve them. On the other hand, peer assessment entails students assessing each other's work using specific criteria. As a result, students act as valuable educational resources for each other, providing

feedback and assistance to improve their peers' work. Topping (2010) emphasises the importance of peer assessment as a valuable tool for enhancing student learning.

Self-assessment is an indispensable aspect of an effective feedback model (Boud & Molloy, 2013; Hattie & Timperley, 2007; Nicol & Macfarlane-dick, 2006). Boud and Molloy (2013) define self-assessment as a process in which learners use predetermined standards or criteria to evaluate their work and judge the degree to which they have met those standards. They argue that prioritizing the establishment and application of criteria is crucial for motivating learners and promoting tangible progress.

According to Nicol and Macfarlane-dick (2006), developing self-assessment abilities is a continuous process that requires learners to engage in activities and assignments that encourage reflection. They stress the significance of receiving feedback from peers to enhance self-assessment skills. Hounsell et al. (2008) similarly highlight the benefits of incorporating calibration mechanisms such as self-review test questions, models, and exemplars to enable students to evaluate their performance against predetermined criteria and identify areas that need improvement. Self-assessment is critical to self-regulation, as it empowers students to establish goals, devise plans, and monitor their progress toward achieving those goals (Hattie & Timperley, 2007). Along with actively participating in the self-assessment process, students engage in peer assessment, in which they evaluate their peers' learning progress against predetermined criteria.

Peer feedback is a valuable experience for both the feedback provider and the recipient. By engaging in this process, students are prompted to engage

in self-reflection, ultimately leading to greater comprehension. Moreover, the feedback provider benefits from the exercise by internalizing the learning objectives and success criteria when evaluating another's work. Such peer feedback can also serve as an essential component of formative assessment for educators, as it offers insights into students' grasp of the learning objectives, success criteria, and critical thinking ability. As Heritage (2010) notes, students' feedback on their peers' work can provide useful indicators of their understanding of the learning objectives and success criteria and the extent of their thinking on the matter at hand.

Teachers must provide support to their students, especially those who struggle, to develop the skill of self-assessment, which requires time and practice (Black & Wiliam, 2004). One practical method for students to self-assess is to use "traffic light" icons, indicating their level of understanding by labelling their work as green, yellow, or red for excellent, partial, or limited understanding. This process allows students to easily communicate their self-assessment, which can be further developed by justifying their judgementss to their peers. The connection between self-assessment and peer assessment aids in the development of necessary skills and objectivity for effective self-assessment. Teachers can also facilitate peer-group work by linking students with similar self-assessments, using the "traffic light" icons to identify strengths and weaknesses. This approach can guide students' problem-solving and group interaction skills, such as listening and turn-taking.

Self-assessment is a valuable tool for formative purposes. Peer assessment can make it even better because it allows students to assess each other for formative purposes (Bekoe, Eshun, & Bordoh, 2013). Feedback

should go in three directions during this learning process: from instructor to student, student to teacher, and student to student (Mensah, Bassaw, Bordoh, & Eshun, 2014).

Principles of Formative Assessment

According to Leahy et al. (2005), for learning to be successful, the learner must have answers to the following fundamental questions: Where am I going? Where am I now? and How can I close the gap? As students gain a clearer understanding of their learning objectives, recognise their current level of proficiency in relation to those objectives, and take accountability for achieving them, they become active collaborators in advancing their learning. Establishing guiding principles is essential to ensure effective assessment that fosters learning.

This shows that "formative assessment provides the teacher with a bridge between assessment and teaching as it is an essential way of creating independent, reflective learners who can plan and assess their progress" (Bordoh et al., 2013, p. 9). This allows students to integrate new information and control their learning while the teacher can offer support when necessary or appropriate.

Ways of Improving Formative Assessment Practices

Formative assessment is a critical tool in modern education, enabling teachers to continuously evaluate student learning progress. This assessment method offers real-time feedback on student performance, identifies areas that require improvement, and promotes student involvement in the learning process. However, not all formative assessments are effective and can sometimes do more harm than good. Therefore, educators must strive to

develop and implement effective formative assessment practices to promote student learning.

One effective way of improving formative assessment practices is by providing students with clear learning goals and objectives (Black & Wiliam, 1998b). This approach enables students to understand what is expected of them and what they should focus on in their studies. Teachers can communicate these learning goals through written assignments, verbal instructions, or visual aids such as mind maps, flow charts, and concept maps. Learning objectives define what students should know and be able to do by the end of a lesson or unit. Success criteria describe what success looks like and provide students with clear guidelines for meeting the learning objectives. When learning objectives and success criteria are well-defined, designing formative assessment activities that align with them becomes easier. For example, if the learning objective is for students to identify the main idea in a text, a formative assessment activity could be to have students summarise the text in their own words (Black & Wiliam, 1998b).

Another effective strategy for improving formative assessment practices is Varied Formative Assessment Activities. Varied formative assessment activities can help engage all students and provide a more accurate picture of their learning progress. Some effective formative assessment activities include:

1. Exit Tickets: Quick, informal assessments at the end of a lesson or unit that can provide insight into what students have learned (Heritage, 2013).

2. Peer Feedback: Students can provide feedback to each other on their work, which promotes a growth mindset and allows students to learn from each other (Topping, 2010).
3. Self-Assessment: Students can assess their learning progress, promoting metacognition and self-reflection (Sadler, 1989).

By using varied formative assessment activities, teachers can better understand students' learning progress and needs.

Timely and Actionable Feedback is an effective strategy for improving formative assessment practices. Formative assessment is only effective when feedback is timely and actionable. Teachers should aim to provide feedback as soon as possible after an assessment activity, and the feedback should be specific and related to the learning objectives and success criteria (Hattie & Timperley, 2007). Timely and actionable feedback allows students to see the connection between their efforts and their learning progress. It also allows teachers to adjust their instruction to better meet the needs of their students.

Effective formative assessment practices require ongoing professional development for teachers. Teachers should be trained on how to design and implement formative assessments, provide timely and actionable feedback, and use technology to enhance formative assessment practices. Professional development can take many forms, including workshops, conferences, and online courses. It is important for teachers to have access to ongoing professional development opportunities to ensure that they are implementing effective formative assessment practices (Darling-hammond, Wei, Andree, Richardson, & Orphanos, 2009). With the rapid advances in educational technology, there are now more options available than ever before for teachers

to engage in meaningful professional development that can help them enhance their knowledge and skills in formative assessment. For example, Kahoot! offers a variety of interactive online games and quizzes that can help teachers assess their students' learning in real-time and identify areas where additional instruction may be necessary (Kahoot, 2022). Additionally, Google Workspace provides a suite of tools that can be used for formative assessment, such as Google Forms, which allows teachers to create and administer quizzes and surveys to their students (Google-workspace, 2022). Another tool that can be used for formative assessment is Flipgrid, which allows students to create and share videos to demonstrate their understanding of a particular topic (Flipgrid, 2022). By leveraging these and other educational technologies, teachers can engage their students in new and exciting ways and gather valuable insights into their learning progress, enabling them to tailor their instruction to better meet their students' needs.

Empirical Review

The empirical review analyses and synthesizers empirical evidence based on the study's objectives. This review explores and synthesizers existing research on formative assessment practices to identify effective implementation strategies. By examining the current state of research on formative assessment, this review will provide insights and recommendations for teachers and educators to effectively incorporate these practices into their classrooms and improve student learning outcomes.

Formative Assessment Practices of Teachers

Formative assessment practices have gained increasing attention in recent years due to their potential to enhance teaching and learning outcomes

in mathematics education. In Ghana, where mathematics achievement levels remain low, there is a growing interest in the use of formative assessment practices to improve student learning outcomes.

The empirical literature on teacher assessment has indicated that most teachers do not have sufficient knowledge of assessment (Datnow & Hubbard, 2015). According to (Fluckiger, 2010), most teachers cannot use assessment results to make informed decisions in their teaching and learning processes. Studies of teachers' use of interim assessment to guide instruction found that these tests were not used as much as they could have been because of time constraints caused by remediation pressures and requirements for content coverage (Abrams, Varier, & Jackson, 2016).

One study conducted by Enu and Ngcobo (2022) found that while there was a general awareness of the importance of formative assessment practices among teachers in Ghana, there was a lack of understanding of how to effectively implement these practices. The study also found that teachers relied on summative assessments, such as end-of-term examinations, to evaluate student learning rather than ongoing formative assessments.

The study by Ntim (2021), which employed a descriptive survey design in the Kumasi Metropolis to investigate the familiarity and use of formative assessment among Senior High School teachers, revealed that the teachers were conversant with formative assessment. However, the relationship between teachers' knowledge of formative assessment and their use of it in the classroom was not strong. The study's results show that even if teachers understand formative assessment, they might not use it when evaluating students in the classroom. Summative assessment has long held a

dominant position in education, despite the positive effects of formative assessment on enhancing teaching and learning (Houston & Thompson, 2017). Contrary to Ntim (2021) findings, the study by Akyina and Oduro-okyireh (2019) in the Mampong Municipality of Ghana involving S.H.S teachers revealed that about half of the teachers have a poor understanding of formative assessment.

According to Vingsle (2015), teachers lacked adequate training in the classroom application of formative assessment. The study's main result shows that the formative assessment practice is a complex, demanding, and difficult task for the teacher in several ways. Amoako et al. (2019), examined the level of formative assessment knowledge among secondary school mathematics teachers. A descriptive cross-sectional survey methodology was used for the study. The study's target population comprised 148 mathematics teachers from the 13 public SHSs in the Cape Coast Metropolitan Area. It was discovered that Cape Coast's Metropolis mathematics teachers had limited experience with formative assessment techniques.

Formative assessment strategies used by social studies college tutors in Ghana's Central region were investigated as part of a research project by Bekoe et al. (2013). According to the findings, the two most common forms of formative assessment that teachers use are student self-assessment and peer assessment.

Asare (2020) conducted a survey to examine the perceptions and practices of public basic school teachers regarding formative assessment in the Cape Coast Metropolis of Ghana. The research revealed that common practices among basic school teachers included discussing feedback with

students, utilising question-and-answer techniques during instruction, using formative assessments, assigning homework, and involving students in activities like role-playing.

The review of literature on the formative assessment practices of mathematics teachers in Ghana reveals that there is a growing recognition of the importance of these practices in enhancing teaching and learning outcomes in mathematics. However, the extent to which mathematics teachers in Ghana are effectively implementing formative assessment practices remains unclear.

There is a need for more research to determine the specific formative assessment practices that are most effective in the Ghanaian context, particularly in mathematics education. Moreover, there is a pressing need for teacher training and resources to support the effective implementation of formative assessment practices, as many mathematics teachers lack the necessary knowledge, skills, and resources to use these practices effectively.

Understanding the extent of the formative assessment practices of mathematics teachers in Ghana is important because it can provide insights into the factors that hinder effective implementation and identify potential strategies for promoting these practices. By improving the formative assessment practices of mathematics teachers in Ghana, we can create a more conducive learning environment for students and improve their academic achievement in mathematics.

Students' Perception of Feedback Usefulness in the Learning Process

Feedback is an integral part of the learning process and plays a crucial role in improving student learning outcomes. Literature has explored feedback from various perspectives, including the teacher's, institutional, and student

perspectives. The present review focuses on the literature that explores students' perspectives on feedback. The review aims to identify common themes and patterns in the literature and highlights the factors influencing students' perceptions of feedback.

One common theme that emerged from the literature is that students value timely, specific, and actionable feedback. According to Hattie and Timperley (2007), effective feedback should provide information on how to improve performance and should focus on learning goals. Students prefer feedback that is related to their specific learning goals and provides clear guidance on improving their work (Higgins, Hartley, & Skelton, 2002). Additionally, students appreciate feedback acknowledging their effort and highlighting their strengths (Carless & Boud, 2018).

Another common theme in the literature is that students value feedback that is given in a supportive and non-judgmental manner. Research has shown that students are more likely to engage with feedback when they perceive it as constructive and helpful (Carless & Boud, 2018). Feedback delivered in a critical or negative tone can be demotivating and discourage students from seeking feedback in the future (Higgins et al., 2002).

The literature also highlights the importance of students' involvement in the feedback process. Students appreciate opportunities to engage with feedback and to reflect on their learning (Carless & Boud, 2018). According to Careless and Boud, feedback should be a dialogic process that involves both the teacher and the student. Students value the opportunity to discuss their work with their teacher and receive feedback tailored to their individual needs.

Factors that influence students' perceptions of feedback include the context in which feedback is given, the type of feedback, and the teacher's feedback practices. For example, students are more likely to engage with feedback when they perceive it as relevant to their learning goals and when it is timely (Carless & Boud, 2018). Additionally, students' perceptions of feedback can be influenced by their prior experiences with feedback and by their cultural background (Higgins et al., 2002).

For formative assessment to help learning, knowing how students understand and respond to feedback is important. This includes both psychological states and perceptions. Students will only learn better from feedback if they change the way they think (Sadler, 2010). This includes both psychological states and perceptions. Most current research on feedback focuses on improving teachers' feedback practices. Less is known about how students receive, absorb, and use feedback. This study addresses this gap.

In the study by Peterson and Irving (2008), students in New Zealand's 9th and 10th grades said their teachers often gave them encouragement and positive feedback. Most students, though, wanted honest and helpful feedback. They pointed out that feedback often told them what they needed to improve but not how to make those changes. Students acknowledged dismissing criticism, especially when a grade accompanied it, since they perceived the grade to be more transparent and honest than the accompanying comments. Nonetheless, minority viewpoints were expressed in the focus groups, with some students opting for high marks and positive comments regardless of the quality of their work. Even though, the students in the focus groups talked

about what they wanted and needed from feedback, there was no evidence that they used feedback information to set goals or control themselves.

Some of the few studies that look at how students feel about the feedback given in the classroom to help them learn to show that a lot of this information is poorly received and rarely used when revising work. It can be challenging for students to use teacher feedback to enhance their learning since it is sometimes imprecise and unreasonable (Mayer & Alexander, 2011). Contrarily, the findings of Cobbinah and Annan-brew (2020) on "students' perceptions of classroom feedback on teacher assessment practices in the Central Region of Ghana" revealed that students have a good opinion of feedback. According to the findings of their study, the most common level at which teachers provide students with feedback is the process level. This feedback serves as a cue, guiding learners to a more efficient information search and use of task strategies.

Carnell (2004) interviewed 14 seventh- through eleventh-grade students on their perceptions of the usefulness of dialogue, cooperative learning, and teacher-to-student feedback. The teacher was seen as the expert and explained tasks to the students supported them in comprehending the objectives, pointed out their faults, and provided direction. Occasionally, feedback was used to assist students in comprehending and advancing their thinking. The teacher was in charge of the feedback from teacher to student (e.g. timing and content). Still, the students liked working with others because they could talk about the work and help each other when they got stuck (Carnell, 2004).

Students perceive assessment for learning (AfL) as incorporated in and facilitated by interactions with peers and teachers (Cowie, 2005). Cowie discovered that 7th to 10th-grade students who focused on learning goals perceived AfL as a shared duty between instructor and student. When attempting to comprehend concepts, students preferred instructor feedback in the form of recommendations because it allowed them to keep an active involvement in the process. Students with performance objectives regarded assessment as the primary duty of the instructor and did not perceive any role for themselves in seeking assistance to expand their learning. They preferred comments on how to perform the assignment and saw instructor efforts to elicit information about their thoughts as ineffective since they took time away from completing the task (Cowie, 2005)

The atmosphere in the classroom could change how students understand and use feedback. If there is a lack of trust and mutual respect in a classroom, students might be less likely to answer questions that reveal what they are thinking out of fear of getting hurt (Cowie, 2005). Hattie and Timperley (2007, p. 100) say, "The climate of the classroom is important, especially if students are to welcome and use negative and corrective feedback at any level". According to Cowie's study, students who participate in interactions with teachers and peers in the classroom experience these interactions as having: multiple and frequently competing cognitive/academic, affective, and social relationship purposes and consequences that they experience as inextricably intertwined (Cowie, 2005).

Students prefer classrooms where peers assist and support one another, involvement is encouraged, and teachers provide aid (Waldrip, Fisher, &

Dorman, 2009). Considered to be the best sources of support are well-intentioned peers and reliable instructors. According to the students, appraisal influences how they are perceived and treated as students and experts in the classroom. In addition, appraisal influences how individuals regard themselves as learners and experts and the ideas and activities they come to value (Butler & Winne, 1995; Cowie, 2005).

Students regard feedback retention and confidentiality as critical factors for feedback utilization, as indicated by King, Schrodt, and Weisel (2009). Feedback can be daunting, and its effectiveness (utility) generates a unique perceptual dimension that varies among students. Students are more responsive to corrective feedback from their teachers and are more likely to report its benefits. However, feedback should not be viewed merely as information; it is necessary to consider its different effects on learning and learners when prescribing large amounts of feedback. Learners interpret feedback information based on their relatively stable and potent systems of beliefs about subject areas, learning processes, relationships, and learning products. According to King et al. (2009), it is essential to increase the number of students who perceive feedback as valuable, and educators should endeavour to enhance the usefulness of feedback. When providing feedback, it is important to take into account the diverse impacts it may have on both the learning process and the individual learners. Rather than simply delivering a large quantity of feedback, it is essential to acknowledge that learners often interpret feedback based on their personal beliefs and perceptions related to the subject matter, learning methods, interpersonal connections, and educational outcomes (Andrade, 2010; Butler & Winne, 1995).

The importance of feedback in learning and teaching is well established, but there is limited knowledge on how students understand and interpret feedback. To better understand this, the current research also focuses on exploring the perceptions of Junior High School students regarding the feedback they receive from their math teachers.

Feedback helps students think about their role in an instruction context, and they can use it as a "feedforward" in their learning. Good feedback from classroom-based formative assessment helps students learn better and do better on tasks. Students' progress toward a goal can be evaluated through feedback on assignments and interactions with students. It often helps pupils achieve learning objectives.

It must be highlighted that feedback from either the student or the teacher does not promote learning on its own; rather, learning is boosted only when students actively embrace and act upon it (Brookfield, 2015). In essence, the entire purpose of feedback in education is fulfilled when either the teacher or the student reaches a conclusion. Teachers may determine where students are struggling by providing sufficient feedback and adjusting their teaching methods to help them catch up (Nikolov & García Mayo, 2017). It is also emphasised that acting on feedback helps learners advance since it serves as a feedforward mechanism in the form of a student's learning guide.

The literature suggests that students value timely, specific, and actionable feedback that is given in a supportive and non-judgementsal manner. Students appreciate opportunities to engage with feedback and reflect on their learning, and they value feedback tailored to their individual needs. The factors that influence students' perceptions of feedback include the

context in which feedback is given, the type of feedback, and the teacher's feedback practices. The findings of this review highlight the importance of considering students' perspectives when designing feedback practices and policies.

The Implication of FA on Mathematics Learning Outcomes of Students

When summative assessments have a high level of visibility, teachers may feel compelled to focus solely on test preparation, and students may prioritise performance objectives over actual learning goals (Lau, 2016). This creates a tension between formative classroom assessments of student learning and high-stakes summative examinations. The statement highlights a common issue in education where teachers are often pressured to focus on achieving high scores on summative assessments. This emphasis on the outcome of assessments can result in teachers neglecting the process of learning and focusing solely on teaching material that will help students perform well on the test. As a result, students may learn to memorize and regurgitate information without truly understanding it or applying it in real-world contexts.

When students are driven solely by performance goals, they may become less motivated to engage in the learning process, which can lead to a lack of interest and decreased achievement. In addition, the pressure to perform well on assessments can also create a culture of competition and comparison rather than a focus on personal growth and development.

To counteract this issue, it is important for teachers to place an emphasis on learning goals rather than just performance goals. By setting clear learning objectives and providing students with opportunities to practice and

apply what they have learned in meaningful ways, teachers can help students to understand and master new knowledge. Additionally, by encouraging a growth mindset and focusing on progress rather than perfection, teachers can create a classroom culture that values learning for its own sake rather than just for the purpose of achieving high scores on assessments.

The quality of mathematics education and the learning outcomes of students in Ghana have been a topic of concern for many stakeholders. Government officials, mathematics teachers, educational researchers, and other stakeholders in education are all eager to discover immediate answers to the poor mathematics performance at the basic level of schooling in Ghana. Mullis, Martin, Foy, and Arora (2012) report on the TIMSS 2011 International Results in Mathematics reveals the poor performance of Ghana students. A thorough analysis of the mathematics learning outcomes of Ghanaian students reveals a dismal situation. A nine-year trend study of the WASSCE examination from 2007 to 2016 reinforces the argument for low accomplishment (Abreh, Owusu, & Amedahe, 2018). Several findings from large-scale national examinations like as the BECE and WASSCE corroborate the poor performance of students in mathematics, as reported by Mills and Mereku (2016)

Teaching and learning are aimed at achieving curriculum-based standards. Students are therefore expected to become familiar with the standard set. Teachers are required to simplify discussions through formative assessment activities so that these instructional standards can be accomplished (MacDonald, 2007). Teachers plan measures to bring learning objectives closer to students. Work is evaluated primarily based on its quality concerning

the student's expectations rather than its attitude or commitment. The curriculum aims to help students develop their mathematical literacy, problem-solving skills, capacity for creative thought, and confidence and competence to fully engage in Ghanaian society as responsible local and global citizens.

The Common Core Programme gives competency levels and level-specific descriptions for all grade levels of the curriculum. Individual schools cannot alter these levels and descriptors and are, therefore, universal to all students and learning areas nationwide. Several descriptors are defined as indicated in Table 3 for each assessment criterion.

Table 3: Benchmarks, Competence Levels, and Grade-Level Descriptions

Level of proficiency	Benchmark	Grade level descriptor
Highly proficient (HP)	80% +	The learner has high knowledge, skills, and values and can communicate those things easily and adaptably through real-world performance tasks.
Proficient (P)	68-79%	The learner has enough skilled knowledge, abilities, and basic understanding to use them on their own in real-world performance tasks.
Approaching Proficiency (AP)	54-67%	The learner is progressing toward becoming proficient in knowledge, skills, and values with relatively little assistance. They can also communicate their comprehension by completing activities requiring them to act realistically.
Developing (D)	40-53%	Learner demonstrates growing knowledge, abilities, and values; however, they require assistance with authentic task execution.
Emerging (E)	39% and below	The learner is progressing but has limited knowledge, skills, and values; they also require significant assistance.

Source: Ministry of Education (2020)

Factors Influencing Differences in Students' Perception of Feedback

Feedback is a critical component of effective teaching and learning, as it provides students with information on their progress and areas for

improvement (Hattie & Timperley, 2007). However, research has shown that students' perceptions of feedback can vary significantly based on a range of factors, including their socio-economic background and the quality of their school (Ahea, Ahea, Kabir, & Rahman, 2016; Sortkær, 2019)

The article "Maturational differences in undergraduate medical students' perceptions about feedback" explores the differences in perception of feedback among medical students of different age groups. The study was conducted on undergraduate medical students in their clinical years and divided them into two age groups: younger students (under 25 years) and older students (25 years and above). Murdoch-Eaton and Sargeant (2012) found that the younger students were more likely to perceive feedback as critical, whereas the older students viewed feedback more positively and used it to improve their learning. Additionally, the younger students tended to have a more fixed mindset and saw feedback as a reflection of their abilities, while the older students had a growth mindset and viewed feedback as an opportunity to develop.

One key factor that can impact students' perceptions of feedback is their engagement and motivation (Gan, 2020). Students who are more engaged and motivated are generally more receptive to feedback and more likely to use it to improve their performance. However, students in low-performing schools may be less engaged and motivated due to a range of social and academic challenges (Usher & Kober, 2013).

Another factor that can impact students' perceptions of feedback is the quality and consistency of feedback provided by teachers (Pokorny & Pickford, 2010). Research has shown that teachers in low-performing schools

may face a range of challenges that can make it difficult to deliver effective feedback to their students (Duke, 2006). For example, teachers in these schools may have larger class sizes, fewer resources, and more diverse student populations, which can all make it challenging to provide targeted and meaningful feedback to individual students.

Students' perceptions of feedback can vary significantly based on a range of factors, including their engagement and motivation, the quality of their school, and the consistency and effectiveness of feedback provided by teachers. As such, it is important for educators and policy makers to take these factors into account when designing and implementing feedback practices in schools.

Chapter Summary

The fundamental premise of Sadler's formative assessment philosophy is that students must be able to track the quality of their learning progress. According to Sadler (1989), providing information from teachers to students to close the gap between students' actual performance and the desired outcome constitutes feedback. The theory focuses on the transition from feedback provided by teachers to self-monitoring by learners. According to Leahy et al. (2005), formative assessment strategies are a result of the interaction between the formative assessment process (where the student is going, where the student is now, and how to get there) and agents (teacher, peer and learner). The model developed by Hattie and Timperley (2007) contains three distinct feedback questions; the learner is expected to respond to these questions for any use of the provided feedback. These questions are as follows: Where am

I going? (Feeding up): How am I going? (Feedback); and what comes next? (Feeding forward).

Black and Wiliam (2003) define formative assessment as the use of assessments to support student learning and gather evidence to adjust teaching to meet learning needs. Assessment for learning is a term that is often used synonymously with formative assessment. Black and William suggest that assessment is considered formative only when the evidence collected is utilised to modify teaching content to achieve learning objectives.

CHAPTER THREE

RESEARCH METHODS

This section provides an overview of the data collection, analysis, and interpretation methodologies. It begins with an outline of the research design and elucidates the procedures used to conduct the study. The chapter describes the study area and the study's target population. In addition, the sample/sampling procedure and data collection are discussed. Subsequently, the following section of the chapter elucidates the various scales utilized in the study. In this particular area, instrument adaption and validation are mentioned. It then discusses data analysis, demonstrating how the acquired data were handled and analysed. A summary of the chapter's key ideas appears at its conclusion.

Research Paradigm

This study adheres to a positivist research paradigm within a descriptive, non-experimental survey design. The positivist paradigm aligns well with the study's goals of identifying the types of formative assessment practices used by teachers and their connection to student achievement. By employing a descriptive survey design, the research can gather information on current practices and explore potential associations without manipulating variables. This approach provides valuable insights into the real-world application of formative assessment in mathematics classrooms within the Sagnerigu Municipality.

Research Design

The study employs a descriptive non-experimental survey design, adopting a quantitative approach. A descriptive survey helps a researcher gain

a more profound knowledge of the research problem. A descriptive non-experimental research design describes or explains phenomena without manipulating any variables (Creswell & Clark, 2017; Neuman, 2013). In this research design, the focus lies on the meticulous observation and description of the characteristics or behaviors exhibited by a sample, with a notable absence of any deliberate intervention or manipulation of variables by the researcher.

Descriptive research examines the features of a population of interest, identifies problems within a unit of interest, or investigates the contrasts in characteristics or behaviours between units. Descriptive research aims to describe a person, an event, or a situation by observing it in its natural environment (Siedlecki, 2020). The researcher will not seek to influence variables but rather describe the sample and the variables. This design was chosen with the intention of yielding data that comprehensively describes the formative assessment practices employed by mathematics teachers within the Sagnerigu Municipality. Additionally, it aims to gather valuable data regarding students' perceptions of the effectiveness of the feedback provided by their mathematics teachers.

Study Area

The research was conducted within the Sagnerigu Municipality, which is situated in the Northern Region of Ghana. Established in 2012 as part of the government's initiatives to decentralise local governance and foster grassroots development, the Municipality serves as the geographical context for this study. It was elevated to a Municipality on Thursday,15th March 2018. It is geographically bounded by the Savelugu Municipal to the north, the Tamale

Metropolis to the south and east, Tolong to the west, and Kumbungu to the northwest. The municipality is endowed with an appreciable number of institutions across all levels of acquiring formal education. The Sagnerigu Municipality is a diverse and dynamic area with a rich cultural heritage and a strong agricultural economy. The government and other stakeholders continue to work towards improving infrastructure and promoting development in the area. The municipality is undoubtedly the nerve centre of the basic, second cycle and tertiary institutions. However, the municipality scored below 50% at the annual Basic Education Certificate Examination (BECE) for five consecutive years (2016, 2017, 2018, 2019 and 2020).

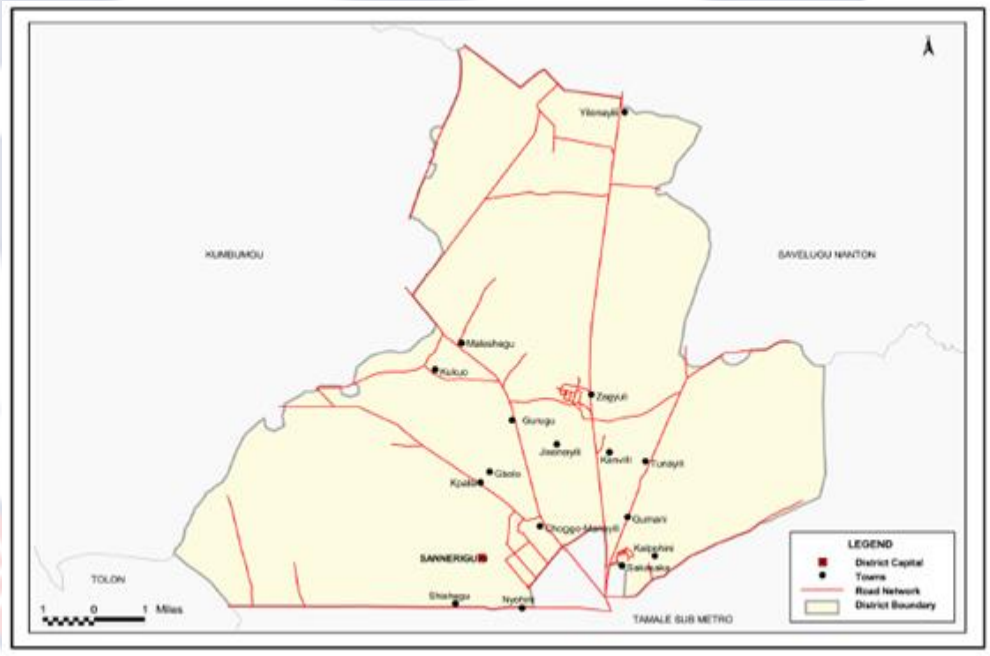

Figure 2: Map of Sagnerigu Municipality

Population

According to scholarly sources, such as Leedy and Ormrod (2013), the term "population" in research denotes a specific group of individuals or objects characteriSed by predetermined attributes, serving as the primary subject of investigation. This group represents the units of interest on which

generalizations and conclusions can be derived (Hayes, 2020; Martínez-Mesa, González-Chica, Duquia, Bonamigo, & Bastos, 2016). The target population comprises all the mathematics teachers and pupils of the public Junior High Schools in the Sagnerigu Municipality. According to the Sagnerigu Education office, the municipality has 98 public junior high school and 114 mathematics teachers in the Public Junior High schools. However, the accessible population of the mathematics teachers for the study was 85.

Sample and Sampling Procedure

A sample refers to a subset of elements that are selected from the larger population (Alvi, 2016; Pandey & Pandey, 2021). Sampling is a technique that researchers use to pick a smaller number of representative items or people from a larger population. Depending on the study's objectives, these items or people will be used as data sources for observing or experimenting (Sharma, 2017).

Teacher participants included all Junior High School mathematics teachers and student respondents, entail students from the purposively selected high-performing and low-performing schools in the 2020 basic education certificate examination. The mathematics teachers were included using the Census sampling technique. It is concerned with the examination of the entire population. Census sampling is a statistical method used to gather data from a specific population by surveying every individual in that population. According to Cochran (1977), census sampling involves a complete enumeration of all the members of a population and is often used when the population size is small. Census sampling entails a comprehensive tally of every individual or entity within a population, achieved through physically

counting them or gathering data from all population members (Bell, Bryman, & Harley, 2022). This sampling technique was selected because it helps provides more precise and accurate information about the participants (Pandey & Pandey, 2021)

This study employed a criterion purposive sampling technique to carefully select 14 schools within the Sagnerigu Municipality. This sampling method was used to gather data regarding students' perceptions of the usefulness of feedback provided by their mathematics teachers. Criterion sampling involves the deliberate selection of participants based on specific criteria directly relevant to the research question (Tashakkori, Johnson, & Teddlie, 2020). The justification for using criterion sampling is that it allows the researcher to ensure that the sample is representative of the population of interest (Creswell & Creswell, 2017). By selecting participants based on specific criteria, the researcher can be confident that the sample includes individuals most relevant to the research question, increasing the validity of the findings.

The chosen schools included seven schools with a 100% pass rate in mathematics in the 2020 BECE (every student in the school scored between 1 and 6) and seven schools with a 0% pass rate in mathematics. Upon selecting the schools, the researcher collaborated with the respective headteachers to acquire the accurate count of students in each school. The chosen schools comprise 518 final-year students, with 291 from high-performing schools and 227 from low-performing schools.

Data Collection Instruments

Two questionnaires were employed as data collection instruments in this study to gather data effectively from a substantial number of individuals. The selection was based on their capacity to accommodate diverse response items and their suitability for distribution to a relatively large population. The Assessment for Learning Measurement instrument (AfLMi) was administered to mathematics teachers within the Sagnerigu Municipality, while the Student Feedback Perception Questionnaire (SFPQ) was administered to the student participants. The scores attained by the students in the standardized mock examination, administered by the Sagnerigu Municipal Education Office as part of the preparation for the 2022 Basic Education Certificate Examination (BECE), were utilised to assess the student's performance. The items from the mathematics mock examination were adapted from the 2019, 2020 and 2021 BECE mathematics papers.

The Assessment for Learning Measurement instrument (AfLMi) developed by Lysaght, O'Leary, and Ludlow (2017) was adopted for this study. The scale comprises a total of 20 items, encompassing four fundamental strategies of Assessments for Learning. These strategies include learning intentions and success criteria, questioning and classroom discussion, feedback, and peer and self-assessment. The acronyms LISC, QCD, FB, and PSA represent the four scales of the Assessment for Learning Measurement instrument (AfLMi). Because of the scale's high reliability and validity, it may be beneficial in system-wide reform efforts focused on AfL (Lysaght et al., 2017).

The measure used to collect data on students' perception of feedback was adapted from Brooks, Huang, Hattie, Carroll, and Burton (2019). The Student Perception Feedback Questionnaire employed in this study consisted of three distinct sections, namely feeding up, feeding back, and feeding forward. These sections align with the three feedback questions proposed by Hattie and Timperley (2007): "Where am I going? Where am I currently? What is my next step?" The Student Perception Feedback Questionnaire (SFPQ) comprised 31 items. Students were expected to indicate if the feedback was not helpful, slightly helpful, somewhat helpful, moderately helpful, mostly helpful, very helpful, or extremely helpful.

Pre-Testing of Instruments

Pretesting AfLMi

According to Hulland, Baumgartner, and Smith (2018), surveys must undergo extensive testing before being administered to participants. To guarantee that the meanings of the questions on the AfLMi are apparent to responders and that they would comprehend the questions as intended, the AfLMi was pretested with 10 mathematics teachers in the Sagnerigu Municipality.

According to some experts, a sample size of 10 is sufficient for a questionnaire pre-test (Dillman, Smyth, & Christian, 2014; Fowler & Floyd, 2013; Willis, 2004). This sample size provides enough information to detect potential problems with the questionnaire and to make necessary modifications before the actual study. Fowler and Floyd (2013) suggest that pre-testing should be done with a small sample of respondents (usually around 10-15 participants) to identify any problems with the questionnaire, such as

unclear or confusing questions, response categories that are too broad or too narrow, or instructions that are difficult to follow. Fowler acknowledges that a sample size of 10 may not provide sufficient statistical power to make definitive conclusions about the quality of the questionnaire. However, he argues that pre-testing is not intended to be a statistical test of the questionnaire's validity but rather a method of identifying and correcting potential problems before the actual study. Pre-testing a questionnaire can be time-consuming and expensive. Selecting 10 participants can be a practical approach to save time and money while obtaining meaningful feedback.

Respondents were asked to complete the questionnaire during the pre-test while the researcher observed. After completing the questionnaire, participants were asked about any possible problems they may have encountered while filling out the questionnaire. The pre-test results did not suggest any changes to the items on the AfLMi. However, further explanations were provided in parenthesis regarding the extent of teachers' assessment practices. For example, formative assessment practices that “occur 90% to 100%” in the classroom were included in parenthesis to explain “embedded” practices.

Pre-Testing of SFPQ

According to Cooper, Schindler, and Sun (2006), a sample between 25 and 100 individuals is enough for a pilot study. The SFPQ was modified from teachers of English language-specific items to mathematics teachers-specific questions. Thus, items relating to teachers of English were changed to mathematics teachers. As a result of modifying a portion of the student feedback perception questionnaire, it was essential to pilot-test the instrument.

In order to determine the suitability of the items and the amount of time required to complete the survey, a pilot test of the student feedback perception questionnaire was conducted on final-year students of two selected schools in the Kumbungu road circuit in the Sagnerigu Municipality who are not part of the actual study. The instrument was pilot-tested on 80 students of the two selected schools in the Kumbungu road circuit in the Sagnerigu Municipality.

Validity and Reliability of Instruments

Prior to the effective adoption or adaption of a measuring instrument, it must be ensured that it can collect high-quality data, especially for empirical research studies. This is achieved by evaluating validity and reliability (Heale & Twycross, 2015). In general, reliability refers to the consistency and accuracy of test findings. Field (2018) defines reliability as an instrument's capacity to produce identical results under identical conditions. Heale and Twycross (2015) concurred that reliability is the degree to which an instrument or research consistently measures the same thing. The idea that high-quality empirical research must be both valid and reliable underpins the common understanding of the link between validity and reliability. Both are necessary for a successful instrument or study to be conducted, and having just one is not sufficient. While both reliability and validity are important, the former is more critical because it allows for sound inferences to be drawn from the data and provides insight into how well the study met its aims (Shute & Becker, 2010).

Reliability Analysis

The reliability of the Assessment for Learning Measurement instrument was assessed using Cronbach's alpha coefficient for each of the

subscales. The results showed that the subscales had acceptable to good levels of internal consistency, with Cronbach's alpha coefficients of 0.79 for Learning Intentions and Success Criteria (LISC), 0.83 for Questioning and Classroom Discussion (QCD), 0.77 for Feedback (FB) and 0.84 for Peer and Self Assessment (PSA)

Table 4: Summary of AfLMi Reliability Results by Subscale

Subscale	Number of Items	Cronbach's Alpha
LISC	5	0.79
QCD	5	0.83
FB	5	0.77
PSA	5	0.84

The two most popular approaches to determining reliability are Cronbach alpha and composite reliability. Cronbach's alpha and composite reliability results of the SFPQ can be seen in Table 4. Composite reliability statistics varied between 0.906 and 0.917, with the Cronbach alpha falling in the 0.899–0.908 range. The reliability statistics for both indicators exceed the minimum threshold of 0.70 (Hair, Sarstedt, Hopkins, & Kuppelwieser, 2014). Hence, construct reliability is established.

Construct Validity

The Assessment for Learning Measurement instrument used in this study was adopted from Lysaght et al. (2017) in their study, Measuring Teachers' Assessment for Learning (AfL) classroom practices in elementary schools. The authors reported a principal axis factoring on the elements, which showed one dominating factor with an eigenvalue of 6.1. (Successive eigenvalues were 2.1, 1.2 and 1.2). 27.7 % of the variation was explained by

this one factor (followed by 7.9%, 3.5% and 2.9%). Most items from each of the four strategies possessed Varimax rotated loadings of 0.5 or higher on the main component. This factor's Cronbach's reliability was 0.87.

The convergent and discriminant validity and reliability of the SFPQ were calculated using Partial Least Square Structural Equation modelling. If different approaches to measurement yield consistent results for the same phenomenon, we have convergent validity. Measurements of the same object should show high covariance if they are truly independent measurements of the same thing. Convergent validity is shown when the average variance extracted (AVE) value is greater than or equal to 0.50 across the items used to measure the central concept (Fornell & Larcker, 1981). Based on the AVE data from the Pilot research, the convergent validity results indicate that all constructs have values larger than 0.5. Table 5 shows the AVE value for each of the constructs.

Table 5: Construct reliability and validity of SFPQ

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Feeding up	0.899	0.909	0.503
Feeding back	0.908	0.917	0.553
Feeding forward	0.897	0.906	0.523

Discriminant Validity

The amount of discriminant validity is the degree to which various measurements are distinct concepts. If two or more concepts are distinct, their appropriate measures should not be too similar. According to Fornell and Larcker (1981) criterion, discriminant validity is established when the square

root of AVE for a construct is greater than its correlation with all other constructs. In the SFPQ, the square root of AVE (in bold as shown in Table 6) for a construct was found to be greater than its correlations with other constructs. Hence providing strong support for the establishment of discriminant validity.

Table 6: Discriminant Validity – Fornell and Larker criterion

Feedback subscales	Feeding up	Feeding back	Feeding forward
Feeding up	**0.709**		
Feeding back	0.691	**0.744**	
Feeding forward	0.698	0.638	**0.723**

Face and Content Validity

To ensure the validity of the study, both face validity and content validity were undertaken. This process involved seeking input and consultation from university experts in the Department of Education and Psychology, as well as regulatory authorities. It is important to note that face validity and content validity are not measured statistically but are essential components in establishing the credibility and relevance of the study's measures.

Ethics Consideration

This study was designed and conducted following the ethical guidelines established by the American Psychological Association (APA) and was approved by the College of Education Review Boardof Cape Coast University.

All participants in this study gave their written consent before taking part. They were informed of the study's purpose, their rights as participants,

the potential risks and benefits of participating, that their participation was voluntary and that they could withdraw from the study at any time without penalty.

The data collected from participants were kept confidential and anonymous. Participant names and personal identifying information were not recorded. Participants were also informed that their data would be used solely for the purpose of this study and that they would not be identified in any publication or presentation of the findings.

This study was approved by the College of Education Review Board of Cape Coast University, protocol number CES/ERB/UCC/edu/v6/22-120 (see Appendix D), on 11th November 2022.

Data Collection Procedure

As the first step of the data collection procedure, an application was made to the College of Education ethical review board of the University of Cape Coast to get approval for the study. After all approval procedures were completed, the researcher, with the help of colleague teachers, administered the questionnaires to the mathematics teachers and student respondents in the Sagnerigu Municipality. Teachers were given the following scale to rate how much each statement reflected their actual classroom practice.

1. Embedded (occurs 90% to 100% of the time)
2. Established (occurs 75% to 89% of the time)
3. Emerging (occurs 50% to 74% of the time)
4. Sporadic (occurs less than 49% of the time)
5. Never (never occurs)

After obtaining the consent of the school's mathematics teachers, the researcher administered the questionnaire to them to respond to. Teachers were instructed to complete the questionnaire during their free time and return it at the end of the school day. Due to the large area that needed to be covered and the dispersed nature of the schools, there were times when the researcher was not available and asked colleague teachers to administer the questionnaire to the mathematics teachers in their schools after a thorough briefing.

As for the student participants, the student feedback perception questionnaire was distributed to students in the 14 schools that were selected for this study. The student survey was distributed in the targeted schools by mathematics teachers. This was done to make sure that the data collection and administration went smoothly and consistently. Before administering the instrument, the researcher presented an overview of the questionnaire, stressed the need to adhere to ethical guidelines, requested teachers read each question aloud, and offered brief explanations. The relevant information was communicated to the teachers, who were permitted to translate any word and provide pupils with examples as needed. This was done so that the instrument items/questionnaire could be more easily understood and administered.

For each question on the survey, students are asked to select a response on a scale from 1 to 7. Students were required to indicate whether or not they found the feedback helpful by selecting "not helpful," "slightly helpful," "somewhat helpful," "moderately helpful," "mostly helpful," "very helpful," or "extremely helpful" across all response items. Students' responses to the questionnaires were gathered at the end of each period or school day.

This study assessed the mathematical outcomes of students using secondary data. Students' mathematics results in the standardised mock examination organized by the Sagnerigu education office in preparing pupils for the B.E.C.E were taken from the mathematics teachers for analysis. The mathematics mock examination consists of questions covering various topics in mathematics, including sets, algebra, geometry and trigonometry. The questions were designed to assess the students' understanding of these topics and their ability to apply mathematical concepts to solve problems.

The mathematics mock examination was administered under standardised conditions to ensure that all students were given an equal opportunity to demonstrate their knowledge and skills. The examination was timed to accurately assess the students' speed and accuracy in solving mathematical problems. The data collected from the mathematics mock examination were used to analyze the mathematics learning outcomes of JHS students in the Sagnerigu Municipality. The mathematics mock examination proved to be a valuable data collection instrument that provided important insights into the level of proficiency of students in high-performing schools and low-performing schools in the Sagnerigu Municipality in attaining the mathematics learning outcomes. The mathematics scores of the municipality mock examination were obtained from the mathematics teachers.

Data Analysis

The questionnaire responses were entered into Excel and later coded into SPSS. Section A of the AfLMi contained demographic data of the participants. The responses were analysed using frequencies and percentages.

The items on section B of the AfLMi were assigned weights 1, 2, 3, 4 and 5 for never happens, happens less than 49% of the time, happens 50% to 74% of the time, happens 75% to 89% of the time and happens 90% to 100% of the time respectively.

Research Question One: What are the formative assessment strategies employed by Junior High School mathematics teachers in the Sagnerigu Municipality in the classroom?

The items of Section B of the AfLMi were used in answering this research question. The statistical tools used to analyse this research question's data were the mean and standard deviation.

Research Question Two: What are students' perceptions of the usefulness of the various types and levels of feedback provided by their mathematics teachers?

The SFPQ was used in answering research question two. The statistical tool used to analyse this research question's data was the mean and standard deviation.

Research Question Three: How does the use of formative assessment strategies relate to students' achievement in mathematics?

Students' mathematics scores from the mock examination organized by the Sagnerigu Municipal education office were used in answering research question three. Table 7 displays the common core curriculum's competency benchmark level of proficiency use in the analysis.

Table 7: Proficiency Level Benchmark Score

S/N	Benchmark	Level of proficiency
1	80% +	Highly proficient (HP)
2	68-79%	Proficient (P)
3	54-67%	Approaching Proficiency (AP)
4	40-53%	Developing (D)
5	39% and below	Emerging (E)

Source: Ministry of Education (2020)

Descriptive statistics involving frequencies and percentages were use to categorise the performance of the students using the competency benchmark level as shown in Table 7.

Hypothesis One: There is no significant difference in students' perception of feedback regarding students in high-performing schools and those in low-performing schools.

This hypothesis sought to examine whether a noteworthy disparity exists between students' perceptions of feedback in high-performing schools versus low-performing schools. The analysis incorporated data obtained from the Student Feedback Perception Questionnaire (SFPQ). To test this hypothesis, a one-way multivariate analysis of variance (MANOVA) was employed.

Chapter Summary

The study population comprises mathematics teachers and Junior High School (J.H.S) three students within the Sagnerigu Municipality. Census sampling was employed to include all mathematics teachers, while purposive sampling was used to select the students. The sample size for the study consists of 85 mathematics teachers and 518 J.H.S three students.

Questionnaires were the primary instruments employed for data collection. Descriptive statistics and one-way multivariate analysis of variance (MANOVA) were the statistical tests utilised in the analysis of the collected data.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the findings of the study's results. The study's objective was to determine the level of involvement of junior high school mathematics teachers in formative assessment practices within the Sagnerigu Municipality. The study selected a descriptive survey with a quantitative approach as the appropriate methodology. The research utilized the AfLMI to gather information about the formative assessment practices of mathematics teachers. Additionally, the SFPQ was employed to assess students' perceptions of feedback from their mathematics teachers. The collected data underwent analysis using descriptive statistics such as means, standard deviations, frequencies, percentages, as well as a one-way multivariate analysis of variance.

Results of the Study

Regarding how mathematics teachers often use formative assessment, the study obtained a response from 80 mathematics teachers, indicating a percentage response rate of 94%. This substantial level of participation proved sufficient for the researcher to draw reliable conclusions and make recommendations. The questionnaire administered to students regarding their perception of the usefulness of feedback from their mathematics teachers yielded a 100% response rate.

Demography of Participants

This section describes the demography of the mathematics teachers in the Sagnerigu Municipality based on gender and teaching experience. A vivid

representation of the mathematics teachers ' demographic variables is illustrated in Tables 8 and 9.

Table 8: Gender Distribution of Mathematics Teachers

Gender	Frequency	Percentage
Male	65	81.3
Female	15	18.8
Total	80	100.0

Source: Field Survey (2022)

Table 8 shows the gender distribution of mathematics teachers, with a total sample size of 80 teachers. Of the 80 mathematics teachers, 65 were male, accounting for 81.3% of the total sample. The remaining 15 teachers were female, accounting for 18.8% of the sample.

Table 9: Teaching Experience of Mathematics Teachers

Teaching experience	Frequency	Percentage
below 4	22	27.5
4 - 10	29	36.3
above 10	29	36.3
Total	**80**	**100.0**

Source: Field Survey (2022)

Table 9 presents the teaching experience of mathematics teachers, with a total sample size of 80 teachers. Of the 80 mathematics teachers, 22 had teaching experience below 4 years, accounting for 27.5% of the total sample. Twenty-nine teachers had teaching experience between 4 to 10 years, which accounts for 36.3% of the total sample. The remaining 29 teachers had teaching experience above 10 years, which also accounts for 36.3% of the total

sample. It is important to note that the teaching experience of the majority of the teachers (72.6%) is below 10 years. This indicates that a significant portion of the mathematics teaching workforce may lack the experience and expertise of more seasoned educators.

Table 10: Demographic distribution of students

	School Category			
Gender	**High Performing**	**Low Performing**	**Total Frequency**	**%**
Male	160	128	288	56
Female	131	99	230	44
Total	**291**	**227**	**518**	**100**

Source: Field Survey (2022)

As shown in Table 10, the given table presents the demographic distribution of students based on their gender and the school category they attend. The total sample size of students is 518. Of the total sample, 56% were males, with 288 students. Among male students, 160 attended high-performing schools, while 128 attended low-performing schools. On the other hand, 44% of the total sample were females, with a total of 230 students. Among female students, 131 attended high-performing schools, while 99 attended low-performing schools. In terms of school category, 291 students (56%) attended high-performing schools, while 227 students (44%) attended low-performing schools.

Research Question One: To what extent do Junior High School mathematics teachers in the Sagnerigu Municipality engage in formative assessment strategies in the classroom?

This question aimed to determine how often mathematics teachers embed formative assessment strategies in the classroom. An AfLMi was adopted from Lysaght et al. (2017) to answer this research question. The instrument contains 20 items measuring four key formative assessment strategies: LISC, QCD, FB, and Peer and PSA. Each of the formative assessment strategies contained five items. The items were evaluated with a five-point Likert scale with "1- Never", "2 – Sporadic", "3 – Emerging", "4 – Established", and "5 – Embedded".

In order to answer this research question, the AfLMi was given to a sample of 85 mathematics teachers at 85 Junior High Schools in the Sagnerigu Municipality between October 2022 and November 2022. The findings of this research question of the study are presented in Table 11. It should be noted that the scale suggests that a practice is embedded if the average rating is close to 5. Smaller mean ratings (closer to 1) denote sporadic or never-occurring practices. It should be noted that fewer than 85 responses (N) are listed in Table 11 because not all math teachers answered the survey.

Table 11: Formative Assessment Practices of Teachers

S/N	Items	N	M	SD
LISC1	Learning intentions are stated using words that emphasise knowledge, skills, concepts and/or attitudes i.e., what the pupils are learning NOT what they are doing.	80	3.57	.99
LISC2	Pupils are reminded about the links between what they are learning and the big learning picture (e.g., "We are learning to count money so that when we go shopping, we can check our change").	80	3.61	1.23
LISC3	Child-friendly language is used to share	80	3.48	1.15

	learning intentions with pupils (e.g., "We are learning to make a good guess (prediction) about what is likely to happen next in the story").			
LISC4	Success criteria related to learning intentions are differentiated and shared with pupils.	80	3.26	1.06
LISC5	Pupils demonstrate that they are using learning intentions and/or success criteria while they are working (e.g., checking their progress against the learning intentions and success criteria for the lesson displayed on the blackboard or flipchart, for exam	80	3.41	1.08
QCD1	Assessment techniques are used to facilitate class discussion (e.g., brainstorming).	80	3.90	1.18
QCD2	Questions are used to elicit pupils' prior knowledge on a topic.	80	3.89	1.23
QCD3	Pupils are encouraged to share the questioning role with the teacher during lessons (e.g., the teacher routinely invites pupils to question their peers' contributions to discussions).	80	3.38	1.06
QCD4	Pupils' incorrect responses are used to guide teaching and learning (e.g., a pupil is asked to explain why he/she gave a particular answer).	80	3.85	1.14
QCD5	Pupils can explain to others what they are learning (e.g., if a visitor came to the classroom, pupils could articulate what they are learning in terms that identify the knowledge, skills, concepts and/or	80	3.59	.96

	attitudes being developed)			
FB1	Feedback to pupils is focused on the original learning intention(s) and success criteria (e.g., "Today we are learning to use punctuation correctly in our writing and you used capital letters and full stop correctly in your story, well done John").	80	3.50	1.05
FB2	Assessment techniques are used during lessons to help the teacher determine how well pupils understand what is being taught (e.g., thumbs up-thumbs-down and/or two stars and a wish).	80	3.79	.95
FB3	Diagnostic information from standardised tests is used to identify strengths and needs in teaching and learning (e.g., pupils challenges in solving word problems in mathematics are identified to guide teaching).	80	3.61	.96
FB4	Pupils are involved formally in providing information about their learning to their parents/guardians (e.g., portfolios or learning logs are taken home).	80	3.34	.91
FB5	In preparing to provide pupils with feedback on their learning, the teacher consults their records of achievement against key learning intentions from previous lessons (e.g., the teacher reviews a checklist, rating scale, or anecdotal record that s/he has	80	3.29	1.13
PSA1	Pupils are given an opportunity to indicate how challenging they anticipate the learning will be at the beginning of a lesson or activity (e.g., by using traffic	80	3.20	1.22

	lights).			
PSA2	Pupils are encouraged to record their progress using, for example, learning logs.	80	3.08	1.20
PSA3	Pupils are encouraged to use a range of assessment techniques to review their own work (e.g., a rubric, traffic lights, thumbs up/down, two stars and a wish).	80	3.12	1.20
PSA4	A visual record of pupils' progress is maintained to celebrate pupils' learning and show areas of/for development (e.g., a bulletin board displaying progression in story writing over a term).	80	3.18	1.30
PSA5	Time is set aside during parent/guardian-teacher meetings for pupils to be involved in reporting on some aspects of their learning (e.g., pupils select an example of their best work for discussion at the meeting).	80	2.68	1.31

Source: Field data (2022)

Table 11 presents the results of a study on formative assessment practices of teachers, including four categories of items: Learning Intentions and Success Criteria (LISC), Questioning and Classroom Discussion (QCD), Feedback to Pupils (FB), Peer and Self-Assessment (PSA), and a total of 20 items. Each item is described in detail and rated on a 5-point Likert scale by 80 participants. The ratings are presented as each item's mean (M) and standard deviation (SD).

Overall, the participants reported high levels of formative assessment practices, with mean scores ranging from 3.08 to 3.90. The highest-rated items were QCD1 (Assessment techniques are used to facilitate class discussion) and QCD2 (Questions are used to elicit pupils' prior knowledge on a topic), both

with mean scores above 3.8. The lowest-rated item was PSA5 - “Time is set aside during parent/guardian-teacher meetings for pupils to be involved in reporting on some aspects of their learning”, with a mean score of 2.68.

In terms of the categories, the QCD category had the highest mean score (3.68), followed by FB (3.55), LISC (3.44), and PSA (3.13). These results suggest that the teachers in this study were more likely to engage in questioning and classroom discussion and to provide feedback to pupils than to set learning intentions and success criteria and encourage pupils' self-assessment.

Table 12 summarises the extent of mathematics teachers' formative assessment practices using the four formative assessment strategies: LISC, QCD, FB, and PSA.

Table 12: Summary of Formative Assessment Practice (FAP) of Teachers

FAS	N	Mean	Std. Deviation	Interpretation
LISC	80	3.47	.82	Emerging practice
QCD	80	3.72	.87	Established practice
PSA	80	3.06	.98	Emerging practice
FB	80	3.50	.69	Established practice

Source: Field data (2022)

Table 12 summarises teachers' formative assessment practice (FAP) based on the items in Table 11. The table includes the number of items in each FAP category, the mean, standard deviation, and interpretation of the FAP based on the mean score. The FAP categories are Learning Intentions and Success Criteria (LISC), Questioning and Classroom Discussion (QCD), Peer and Self-Assessment (PSA), and Feedback (FB). The mean score for LISC is

3.47, which indicates an emerging practice. The mean score for QCD is 3.72, indicating an established practice. The mean score for PSA is 3.06, indicating an emerging practice. The mean score for FB is 3.50, indicating an established practice.

The standard deviation for each FAP category ranges from .69 to .98, suggesting that the responses of the teachers are relatively consistent within each category. Overall, the results suggest that the teachers have established practices in questioning and feedback but still have room for improvement in their use of learning intentions, success criteria, and peer and self-assessment.

Research Question Two: What are students' perceptions of the usefulness of the various types of feedback?

This research question aimed to secure enough data to provide a reasonably large sample of Junior High School students' perception of the usefulness of feedback received from their mathematics teachers. The data collected to answer this research question involved the administration of the student feedback perception questionnaire to a sample of 518 Junior High School pupils across 12 purposively selected schools in the Sagnerigu Municipality. The Student Perception Feedback Questionnaire categorised items into three sections: feeding up, feeding back and feeding forward. The three feedback types correspond to three feedback questions proposed by Hattie and Timperley (2007) – "Where am I going? Where am I headed? What is my next move?"

Students were expected to indicate if the feedback is “1 = not helpful”, “2 = slightly helpful”, “3 = somewhat helpful”, “4 = moderately helpful”, “5 =

mostly helpful", "6 = very helpful" and "7 = extremely helpful". The findings of the questionnaire are presented below.

From Table 12, all the feedback responses on feeding up show that it is moderately useful to students, with a mean range of 3.62 to 4.37 and a standard deviation of 1.43 to 1.78. Regarding feeding back, item 12, showing students' progress in Mathematics, has the least mean score of 3.65. item 22, showing how helpful comments from the teacher helps keep students on track to succeed in Mathematics, has the highest mean score of 4.45. All the remaining items on feeding back have a mean range between 3.65 and 4.45, indicating that feeding up is moderately helpful to the student in their mathematics achievement learning process.

As indicated in Table 12, feeding forward responses had a mean range of 3.73 to 4.58. item 30 "How helpful is it when you are asked what your next improvement step would be on the marking guide?". All the items on feeding forward were perceived to be moderately helpful to students except item 28, which has the highest mean score of 4.58, mainly indicating "helpful feedback" in helping students attain their learning outcomes.

Table 13: Students' perception of feedback responses

S/N	Items	N	M	SD
	Feeding up			
1	How helpful is the feedback that tells you about what you are learning? i.e. a What We Are Learning Today (WALT) statement.	518	3.67	1.67
2	How helpful are exemplars showing you what success looks like in Mathematics?	518	3.94	1.70
3	How helpful are marking guides showing you what success looks like in Mathematics?	518	4.02	1.70
4	How helpful is the feedback that tells you what your teacher is looking for in your work?	518	3.83	1.78
5	How helpful is the feedback that explains the	518	4.37	1.49

	key ideas you have to write about?			
6	How helpful is feedback about the questions you could ask to find out more about your topic?	518	4.22	1.50
7	How helpful is the feedback that highlights the skills you will need to complete the task, e.g. notetaking	518	4.06	1.43
8	How helpful is the feedback that highlights the strategies you will need to complete the task? e.g. using a planning guide	518	4.09	1.53
9	How helpful is it when you are asked what you think you are learning?	518	3.92	1.61
10	How helpful is it when you are asked about the focus of your writing?	518	3.62	1.76
11	How helpful is it when you are asked about your goals for your writing?	518	3.70	1.59
	Feeding back			
12	How helpful is feedback on pre-assessments in showing you the progress you are making in Mathematics?	518	3.65	1.78
13	How helpful is feedback on drafts in showing you the progress you are making in Mathematics?	518	3.77	1.75
14	How helpful is feedback on work in class that tells you if your writing matches what your teacher is looking for?	518	3.90	1.63
15	How helpful is feedback during class discussions about your ideas?	518	4.12	1.50
16	How helpful is feedback during class discussions about your thinking of concepts?	518	3.87	1.40
17	How helpful is feedback during class discussions about your skills in mathematics?	518	4.17	1.46
18	How helpful is feedback during class discussions about your strategies in working on mathematical problems?	518	4.11	1.47
19	How helpful is it when you are asked if you think you are on track to succeed?	518	4.40	1.24
20	How helpful is it when you are asked how your workings match the marking guide?	518	3.68	1.41
21	How helpful is it when you are asked if you are on track to achieving your goal?	518	4.05	1.53
22	How helpful are comments from the teacher that helps to keep you on track to succeed in	518	4.45	1.47

	Mathematics?			
	Feeding forward			
23	How helpful is a draft/rough copy that tells you how you can improve in Mathematics?	518	4.08	1.54
24	How helpful is it when you receive feedback that tells you what you need to focus on to improve in Mathematics?	518	4.04	1.69
25	How helpful is receiving feedback that tells you how to improve your ideas in Mathematics?	518	3.92	1.63
26	How helpful is it when you receive feedback that tells you how to improve your thinking in Mathematics?	518	4.06	1.67
27	How helpful is receiving feedback that tells you how to improve your mathematics skill?	518	4.13	1.54
28	How helpful is receiving feedback that tells you how to improve your mathematics strategies?	518	4.58	1.29
29	How helpful is it when you are asked what to do to improve?	518	4.42	1.28
30	How helpful is it when you are asked what your next improvement step would be on the marking guide?	518	3.73	1.75
31	How helpful is it when you are asked about how you could achieve your goal?	518	3.82	1.75

Table 13 presents the students' perception of feedback responses for various items. A total of 518 students were surveyed, and each item's mean and standard deviation (SD) are presented.

Under the category of feeding up, the items included feedback that tells students what they are learning (WALT statement), exemplars showing success, marking guides, feedback on what the teacher is looking for in the student's work, feedback explaining the key ideas, feedback on questions to find out more about the topic, feedback on skills needed to complete the task, feedback on strategies to complete the task, and feedback asking about what the student thinks they are learning, the focus of their writing, and their goals for their writing.

Under the category of feeding back, the items included feedback on pre-assessments, feedback on drafts, feedback on work in class that tells students if their writing matches what the teacher is looking for, feedback during class discussions about their ideas, thinking of concepts, skills in mathematics, and strategies in working on mathematical problems, and feedback asking if the student thinks they are on track to succeed, how their workings match the marking guide, and if they are on track to achieving their goal. Finally, under the category of feeding forward, the items included feedback on a draft/rough copy, feedback on what to focus on to improve, feedback on improving ideas, thinking, mathematics skill, and mathematics strategies, and feedback asking what to do to improve, what the next improvement step would be on the marking guide, and how to achieve their goal.

The mean scores for each item ranged from 3.62 to 4.58, with most items receiving scores above 4.0, indicating that students found the feedback helpful. The standard deviations ranged from 1.24 to 1.78, indicating some variability in student perceptions of the helpfulness of the feedback.

Table 14: Summary of Students' Feedback Responses

Feedback Types	N	Mean	Std. Deviation
Feeding up	518	3.95	1.17
Feeding back	518	3.98	1.18
Feeding forward	518	4.12	1.22

Source: Field data (2022)

The study examined the perception of secondary school students towards different types of feedback in mathematics. The data in Table 14

shows the mean and standard deviation of the responses of the students to three types of feedback: feeding up, feeding back, and feeding forward. The results show that students perceive all three types of feedback as helpful, with the highest mean score of 4.12 for feeding forward, followed by 3.98 for feeding back and 3.95 for feeding up.

In terms of specific feedback items, the data in Table 12 shows that feedback that highlights the skills and strategies needed to complete a task, feedback that tells students how to improve their mathematics strategies and feedback that helps keep students on track to succeed in Mathematics received the highest mean scores. On the other hand, feedback on the focus of writing and feedback on pre-assessments received the lowest mean scores.

The standard deviations of the responses for all three types of feedback were relatively high, indicating a wide range of responses among the students. This suggests that while most students found the feedback helpful, some may not have found it as useful or relevant to their learning.

In summary, the findings suggest that students value feedback that helps them improve their skills and strategies in Mathematics and keeps them on track to succeed. It also highlights the importance of providing different types of feedback to cater to the diverse learning needs of students.

Research Question Three: How does the use of formative assessment strategies relate to students' achievement in mathematics?

This research question aims to determine students' competency level in relation to their learning outcomes in mathematics. Pupils' results of the standardised mock by the Sagnerigu education office were used in determining the competency level of pupils in attaining the learning outcomes. The results

were analysed using the following benchmark: Highly proficient = 80% - 100%, proficient = 68% -79%, approaching proficiency = 54% - 67%, developing = 40% -53% and emerging = 39% and below.

As indicated in Table 14, The overall average level of performance of students in attaining the learning outcomes in mathematics is 2.6, which is interpreted as being at the level of "attaining proficiency". However, the average mean achievement of students in mathematics in high-performing schools is 2.9, which indicates the attainment of the learning outcomes in high-performing schools is at the level of "attaining proficiency". In contrast, the mean mathematics achievement of students in low-performing schools is 2.3, indicating that the attainment of students' mathematics learning outcomes at the low-performing school is at the "developing level of proficiency".

Table 15: Descriptive Statistics of School Categories Performance

School Classification	**N**	**M**	**SD**
High performing school	291	2.9	.99
low performing school	227	2.3	.65
Average Performance	**518**	**2.6**	**.82**

Source: Field data (2022)

Based on Table 15, the sample size of high-performing schools is 291, with a mean performance score of 2.9 and a standard deviation of 0.99. Low-performing schools' sample size is 227, with a mean performance score of 2.3 and a standard deviation of 0.65. The sample size of the selected schools was 518, with a mean performance score of 2.6 and a standard deviation of 0.82.

These descriptive statistics suggest a difference in performance between high-performing, low-performing, and average-performing schools. High-performing schools have a higher mean performance score than low-

performing schools, while average-performing schools fall between the two. The standard deviations also indicate that the performance scores of high-performing schools have a wider range compared to low-performing schools, suggesting more variability in performance among high-performing schools.

Table 16 presents the students' mathematics learning outcomes, categorized into different proficiency levels.

Table 16: Mathematics Learning Outcomes of Students

Proficiency level	**Frequency**	**%**
Emerging	48	9.3
Developing	187	36.1
Approaching	199	38.4
Proficient	75	14.5
Highly Proficient	9	1.7
Total	**518**	**100.0**

Source: Field data (2022)

Out of 518 students, 48 falls under the "Emerging" category, indicating that they have just started to develop the necessary skills and knowledge in Mathematics. 187 students fall under the "Developing" category, indicating they are progressing but still require further development. 199 students fall under the "Approaching" category, indicating that they are close to meeting the standards for proficiency but still require some improvement. 75 students are considered "Proficient," indicating that they have achieved the desired proficiency level in Mathematics. Lastly, 9 students are classified as "Highly Proficient," indicating that they have exceeded the standards for proficiency in Mathematics.

Overall, the majority of the students fall under the "Developing" and "Approaching" categories, which suggests that there is a need for further improvement in Mathematics teaching and learning in the school.

Hypothesis One: School performance has no statistically significant influence on students' perception of feedback.

Research hypothesis one sought to determine if a significant difference exists between students of high-performing and low-performing schools regarding their perception of feedback. A one-way multivariate analysis of variance was conducted to examine the differences in students' perception of feedback between high- and low-performing schools. The feedback responses (dependent variable) were in three categories: feeding up, feeding back, and feeding forward.

The MANOVA assumption that the dependent variables would be moderately correlated was tested by performing a series of Pearson correlations between all of the dependent variables before running the MANOVA (Gamst, Meyers, & Guarino, 2008).

Table 17 shows that there is a meaningful pattern of correlations between the dependent variables, which supports the use of a MANOVA.

Table 17: Pearson correlations, Mean and Standard Deviation associated with feedback subscales

	1	2	3	M	SD
Feeding up (1)	1			3.95	1.17
Feeding back (2)	.65	1		3.98	1.18
Feeding forward (3)	.64	.56	1	4.12	1.23

Source: Field data (2022)

Multivariate analysis of variance (MANOVA) relies on several assumptions to ensure the validity of its results. One crucial assumption is homogeneity of covariance matrices. This assumption requires that the covariance matrices (which capture the relationships between the dependent variables) be equal across all groups defined by the independent variable. To assess this assumption, Box's M test is commonly employed. This test statistic evaluates the overall difference between the covariance matrices of the groups. A statistically significant result (p-value < .05) indicates a violation of the homogeneity assumption. Table 18 shows the results of the Box's M statistics to test the assumption of the homogeneity of covariance matrices.

Table 18: Box's Test of Equality of Covariance Matrices

Box's M	F	df1	df2	Sig.
39.594	6.556	6	1649950	0.18

Box's M value of 39.594 as shown in Table 18 was associated with a p-value greater than 0.05, which was interpreted as non-significant. Hence, the homogeneity assumption was met.

MANOVA assumes that the dependent variables are normally distributed within each group defined by the independent. To assess this assumption, the Shapiro-Wilk test for normality was conducted on each school category for each dependent variable (Feeding Up, Feeding Back, Feeding Forward). Table 19 presents the results of the Shapiro-Wilk tests.

Table 19: Tests of Normality (Shapiro-Wilk) for School Category

	School category	Statistic	df	Sig.
Feeding_up	High performing	.963	291	.112
	Low performing	.985	227	.398
Feeding_back	High performing	.961	291	.057
	Low performing	.962	227	.201
Feeding_forward	High performing	.947	291	.367
	Low performing	.973	227	.127

Shapiro-Wilk test indicated in Table 19 shows that the dependent variables were normally distributed in both groups ($p > .05$), supporting the assumption of univariate normality.

The Mahalanobis distance values were below 16.27 (see appendix G), supporting the assumption of multivariate normality and suggesting no multivariate outliers. Using chi-square critical table values, a MANOVA with three dependent variables should have a maximum Mahalanobis distance of less than 16.27 (Pallant, 2020).

Scatter plots indicated that the dependent variables were linearly related in high-performing schools and low-performing schools (appendix H)

Table 20 presents the results of the multivariate test of analysis of variance (MANOVA) conducted to to examine the differences in students' perception of feedback between high- and low-performing schools. The feedback responses (dependent variable) were in three categories: feeding up, feeding back, and feeding forward. Table 20 displays the overall effect of the independent variable on the combined set of dependent variables.

Table 20: Multivariate Tests of school category on Student perception of feedback usefulness

	Pillai's Trace	F	df1	df2	p-value
School Category	.82	62.15	3	514	.000

A one-way multivariate analysis of variance (MANOVA) was conducted to test the null hypothesis that there is no statistically significant difference between high-performing and low-performing schools regarding students' perception of feedback from their mathematics teachers. Table 20 shows a statistically significant difference between high-performing schools and low-performing schools on the combined dependent feedback variables, Pillais' Trace = .82, F(3,514) = 62.15, p = .000. Based on these results, evidence was sufficient to reject the null hypothesis and conclude that students combined perception of feeding up, feeding back and feeding forward differed significantly on school category (i.e. high-performing schools and low-performing schools.

Following the MANOVA, a series of one-way ANOVAs on each of the three dependent variables was conducted. Using a Bonferroni Adjusted alpha of .017, there was a significant difference in students' perception of feedback between high-performing and low-performing schools regarding feeding up, $F(1, 516) = 116.82$, $p < .017$; feeding back $F(1, 516) = 48.66$, $p < .017$ and feeding forward, $F(1, 516) = 157.19$, $p < .017$. As can be seen in Table 18, all of the ANOVA's were statistically significant.

Table 21: One-Way ANOVA with Feedback Subscales as Dependent Variables and School Type as Independent Variable

	Levene's		ANOVA's		High performing		Low performing	
	F(1,516)	**p**	**F(1,516)**	**p**	**M**	**SD**	**M**	**SD**
Feeding up	.112	.738	116.822	.000	4.39	1.07	3.38	1.04
Feeding back	2.562	.110	48.658	.000	4.29	1.11	3.59	1.16
Feeding forward	1.401	.237	157.190	.000	4.64	1.07	3.45	1.078

Source: Field data (2022)

Table 21 shows the results of a One-Way ANOVA with Feedback Subscales (Feeding up, Feeding back, and Feeding forward) as the dependent variables and School Type (High performing and Low performing) as the independent variable. Levene's test was conducted to test the homogeneity of variances.

The results show that Levene's test was insignificant for Feeding Up, indicating that the assumption of homogeneity of variances was met. The ANOVA result was significant ($p < .001$), indicating that there was a significant difference in the mean scores of Feeding Up between high-performing and low-performing schools. The mean score of Feeding Up was higher in high-performing schools ($M = 4.39$, $SD = 1.07$) than in low-performing schools ($M = 3.38$, $SD = 1.04$).

For Feeding Back, the Levene's test was not significant, indicating that the assumption of homogeneity of variances was met. The ANOVA result was

also significant ($p < .001$), indicating that there was a significant difference in the mean scores of Feeding back between high-performing and low-performing schools. The mean score of Feeding back was higher in high performing schools ($M = 4.29$, $SD = 1.11$) than in low performing schools ($M = 3.59$, $SD = 1.16$).

For Feeding forward, the Levene's test was not significant, indicating that the assumption of homogeneity of variances was met. The ANOVA result was also significant ($p < .001$), indicating that there was a significant difference in the mean scores of Feeding forward between high performing and low performing schools. The mean score of Feeding forward was higher in high performing schools ($M = 4.64$, $SD = 1.07$) than in low performing schools ($M = 3.45$, $SD = 1.08$).

Discussion of Findings

The major findings obtained from this study are discussed in this section. The discussion is in relation to the relevant literature reviewed in this study. The formative assessment strategies of mathematics teachers were determined, and students' perception of the usefulness of feedback was also explored, as well as the students' mathematics learning outcomes. The results of the hypothesis tested is also discussed. The hypothesis had to do with the difference in students' perception of the usefulness of feedback with regard to school category (high performing school and low performing school).

Formative Assessment Practices of Mathematics Teachers

The results of this study indicate that the teachers in this sample have a good understanding of formative assessment practices and are implementing them in their classrooms. However, there is still room for improvement,

particularly in the areas of setting learning intentions and success criteria and involving pupils in self-assessment. This is consistent with the existing empirical literature, which suggests that teachers generally have a positive attitude towards formative assessment and recognise its potential benefits for student learning (Ntim, 2021).

However, the study also highlights some areas for improvement, particularly in the areas of setting learning intentions and success criteria and involving pupils in self-assessment. This is consistent with previous research that has shown that these areas can be challenging for teachers to implement effectively, despite their overall positive attitude towards formative assessment (Bekoe et al, 2013).

The implications of these findings are that while teachers may understand formative assessment practices well, ongoing professional development and support may be necessary to help them effectively implement these practices in their classrooms. Specifically, training and resources focused on setting learning intentions and success criteria and involving pupils in self-assessment may be particularly beneficial.

This study adds to the growing body of literature on formative assessment practices and provides valuable insights into how teachers are implementing these practices in their classrooms. The findings suggest that while there is progress being made, there is still work to be done to fully realize the potential benefits of formative assessment for student learning.

The findings of this study reveal that mathematics teachers in the Sagnerigu Municipality are utilising peer and self-assessment, as well as sharing learning intentions and success criteria, as emerging formative

assessment strategies in their classrooms. These findings have important implications for mathematics education in the region, as they suggest that teachers actively seek new and innovative ways to support student learning and improve learning outcomes. The study also reveals that classroom questioning and feedback are established formative assessment practices. Classroom questioning and feedback are essential tools for teachers to assess students' understanding, identify misconceptions, and provide students with targeted feedback to enhance their learning (Black & Wiliam, 1998b). The study findings suggest that teachers in the research setting utilise these practices as an integral part of their teaching practice.

This finding supports many of the concerns in the literature on teachers' formative assessment practices. This study confirms (Asare, 2020) assertion that feedback and classroom questioning are dominant assessment practices among basic school teachers.

Peer and self-assessment are important formative assessment strategies that help students develop metacognitive skills and take greater responsibility for their learning (Topping, 2010). By encouraging students to evaluate their own work and that of their peers, teachers can provide targeted feedback and support tailored to individual student needs. This approach is particularly effective in mathematics education, where problem-solving and critical thinking skills are key to success.

Sharing learning intentions and success criteria is another important formative assessment strategy that mathematics teachers in the Sagnerigu Municipality are utilising. This approach involves clearly communicating the learning objectives and criteria for success to students and involving them in

evaluating their own progress towards these goals. This helps to make learning more transparent and accessible to students and can also help to motivate them by providing a clear sense of purpose and direction.

The findings of this study highlight the importance of professional development and support for mathematics teachers. By encouraging innovative formative assessment strategies such as peer and self-assessment and sharing learning intentions and success criteria, teachers can help support student learning and improve learning outcomes. This has important implications for the overall quality of mathematics education in the region and for students' long-term success and well-being.

The emerging formative assessment strategies of peer and self-assessment and sharing learning intentions and success criteria are important developments in mathematics education in the Sagnerigu Municipality. These strategies reflect a commitment to ongoing learning and improvement among mathematics teachers in the region and suggest that they are actively seeking out new and innovative ways to support student learning and improve learning outcomes. With continued support and professional development, these strategies have the potential to make a significant positive impact on mathematics education in the region.

Classroom questioning is a form of formative assessment that involves asking students questions during instruction to assess their understanding and promote deeper thinking. Effective classroom questioning can increase student engagement, motivation, and learning outcomes (Walsh & Sattes, 2015). The study findings suggest that teachers in the research setting use questioning as a formative assessment strategy to promote student learning and understanding.

Feedback is another important formative assessment practice that has been established in the research setting. Effective feedback can provide students with information on their progress, areas of strength, and areas that require further development (Hattie & Timperley, 2007). The study findings suggest that teachers in the research setting are providing students with feedback as a formative assessment practice to enhance their learning and improve their understanding. How students react to the feedback makes it an effective formative assessment strategy for improving student learning outcomes. Besides, in providing feedback to students about the discrepancies in learning outcomes, teachers should motivate learners to close the gap between desired and actual learning outcomes. According to Shute (2008), feedback should alter the thinking and behaviour of students to engage in activities that will enhance their learning. It becomes ineffective if feedback cannot change students' thinking and behaviour.

However, the findings of this study contrast with Onuka and Oludipe (2006), who opine that providing assessment feedback on students' learning influences the improvement of their learning. Though providing feedback to students can influence an improvement in students' learning outcomes, it does not guarantee improvement in students' learning outcomes. Although the findings of the study showed feedback as an established formative assessment practice of teachers, the inability of students to internalise and act on the information obtained from the feedback may make it ineffective in improving students' learning outcomes. Teachers who want their students to gain a deep understanding of the feedback they receive must allow students to elaborate on concepts that remain unclear, correct common misunderstandings, and

promote discussion. The poor attainment of students' learning outcomes in mathematics revealed in this study, although feedback is an established practice, may be due to how the students receive feedback.

Teachers' feedback should put less emphasis on students' relative performance to their peers and more on students' actual growth toward learning goals if they are to be effective in fostering students' mastery of instructional learning outcomes. In providing feedback, teachers must create an atmosphere of trust and set classroom norms that allow for constructive criticism. Negative feedback can undermine students' willingness to make subsequent efforts to improve their learning (Darling-hammond & Bransford, 2007).

The use of classroom questioning and feedback as established formative assessment practices has important implications for teacher education and professional development. These practices can be further developed through teacher education programmes and professional development opportunities, which can help teachers hone their questioning skills and feedback to better support student learning.

Furthermore, it is essential for teachers to receive support and training in utilising these formative assessment practices effectively. This can include guidance on how to ask effective questions, provide targeted feedback, and use these strategies to identify and address student misconceptions. Education policymakers and administrators can promote effective formative assessment practices in classrooms and improve student learning outcomes by providing teachers with the necessary support and training.

The study findings suggest that classroom questioning and feedback are established formative assessment practices in the research setting. These practices have important implications for student learning outcomes and should be further developed through teacher education and professional development. Education policymakers and administrators should prioritise providing support and training to teachers in these practices to promote effective formative assessment practices in classrooms.

Students' Perception of Feedback Usefulness

Feedback is a critical component of effective teaching and learning, as it provides students with information about their performance and helps them identify improvement areas. The findings of this study suggest that feedback is moderately useful to students, indicating that it has significant benefits for student learning and achievement.

One of the primary benefits of feedback is that it helps students to understand how well they are performing and what they need to do to improve. According to Sadler (2010), specific, timely, and actionable feedback helps students identify their strengths and weaknesses and develop a plan for improvement. This is particularly important for students who may be struggling with a particular subject or skill, as feedback can provide the guidance and support they need to succeed.

The findings of this study also suggest that feedback is useful across various feedback subscales: feeding up, feeding forward, and feeding back. Feeding up feedback helps students to understand learning goals and expectations, while feeding forward feedback helps students to identify the next steps and opportunities for improvement. Feeding back feedback helps

students to review and reflect on their performance, providing a sense of closure and encouraging further learning.

The finding of this study on students' perception of feedback is in tandem with the findings of Cobbinah and Annan-brew (2020), which showed that students have a good perception of feedback. However, the current study indicates the magnitude at which students perceive the usefulness or goodness of feedback which was not inherent in the study of Cobbinah and Annan-brew (2020). The findings indicate that students have at best moderate opinions regarding the quality and value of feedback. In receiving feedback on their performance, students should be encouraged to reflect on their learning and identify areas for improvement. This helps them to become more self-aware of their strengths and weaknesses, and better equipped to take ownership of their learning.

The atmosphere in the classroom may affect how well students comprehend and apply feedback. Students may be less likely to respond to questions that reveal their opinions if classmates lack trust and respect out of fear of being hurt (Cowie, 2005). Perhaps, this might be a contributory factor to why students do not have a high rating of the usefulness of feedback. This study provides an eye-opener for mathematics teachers to understand that feedback can only be effective in enhancing student learning outcomes when it is geared towards altering students' mindsets towards utilising feedback as a tool for learning.

The findings of this study provide insight to mathematics teachers on how students' perception of feedback could adversely affect their learning and performance. It can be challenging for students to use teacher feedback to

enhance their learning since it is sometimes imprecise and unreasonable (Mayer & Alexander, 2011). Teachers must provide specific and reasonable feedback to ensure students have a positive mindset about the usefulness of the various feedback types. When students perceive feedback well, they act on it, which helps them learn and do better. As noted by (Black & Wiliam, 1998b), feedback acknowledging students' efforts and highlighting their successes can boost their confidence and encourage them to continue working hard. Similarly, feedback that identifies areas for improvement and provides specific suggestions for how to improve can inspire students to take action and work towards their goals.

The Difference in Students' Perception of Feedback

The study findings have raised significant issues related to student perception of feedback usefulness for researchers, educational practitioners and policymakers. The present study has provided empirical evidence that feedback helps improve student learning outcomes to the extent they perceive its usefulness. Student perception of feedback influences how it is internalised and implemented by students. The study's findings revealed a significant difference in students' perception of feedback regarding high-performing and low-performing schools. Students from high-performing schools tend to have a higher perception of the usefulness of feedback than those from low-performing schools.

The finding that students' perception of feedback differed significantly between high-performing and low-performing schools is interesting and has important implications for teaching and learning. One possible explanation for this finding is that in high-performing schools, students may be more

motivated and engaged in their learning and may be more receptive to teacher feedback. In contrast, in low-performing schools, students may be more disengaged or discouraged and less likely to perceive feedback as valuable or useful.

Another possible explanation is that feedback in high-performing schools may be delivered more effectively or more frequently than in low-performing schools. Teachers in high-performing schools may have more training and support in delivering effective feedback or may be more likely to prioritise feedback as a key component of their instructional practice. In contrast, teachers in low-performing schools may face greater challenges in delivering feedback effectively due to larger class sizes, limited resources, or other factors. The literature review supports the study's findings, which revealed that students' perception of feedback differs depending on the context in which it is given. According to Hattie and Timperley (2007), feedback is effective when it is specific, timely, and focused on the task or process rather than the person. However, students from low-performing schools may not receive feedback that meets these criteria, which can lead to a negative perception of feedback (Hattie & Timperley, 2007). This is consistent with the current study's finding that there is a significant difference in students' perception of feedback in high-performing and low-performing schools.

Research by Black and Wiliam (1998b) suggests that the formative assessment practices of teachers influence the quality of feedback. When teachers use formative assessment effectively, they are better able to provide specific and targeted feedback to the needs of individual students. This

highlights the importance of ensuring that all teachers have the necessary training and support to implement effective formative assessment practices.

The implications of this finding are significant for both teachers and policymakers. Teachers should be encouraged to reflect on their feedback practices and seek training and support to enhance their skills in this area. Policymakers should prioritise resources and support for schools in low-performing areas, including targeted professional development opportunities for teachers and increased funding for resources and technology that can support effective feedback practices.

Furthermore, this finding highlights the importance of addressing broader issues of educational equity and access. Students in low-performing schools may face a range of barriers to academic success, including poverty, limited access to educational resources, and a lack of opportunities for enrichment and extracurricular activities. Addressing these broader issues will require a comprehensive approach that goes beyond feedback practices alone.

Overall, the finding that students' perception of feedback differs significantly between high-performing and low-performing schools underscores the need for ongoing efforts to promote educational equity and access, and to support teachers in delivering effective feedback to all students, regardless of their school or background.

Chapter Summary

The results revealed QCD and FB as established formative assessment practices of the mathematics teachers, whereas LISC and PSA are emerging formative assessment practices of the mathematics teachers in the Sagnerigu Municipality. On average, the students' average responses on the usefulness of

each of the feedback types had a rating of 4 out of 7, which was interpreted as moderately useful. Regarding students' attainment of the mathematics learning outcomes, the data suggest that the overall performance of the students is at the level of "attaining proficiency".

The study revealed that students combined perception of feeding up, feeding back and feeding forward differed significantly between students of high-performing schools and low-performing schools.

Implication of Formative Assessment on Mathematics Learning Outcomes of Students

When summative assessments have a high level of visibility, teachers may feel compelled to focus solely on test preparation, and students may prioritise performance objectives over actual learning goals (Lau, 2016). This creates a tension between formative classroom assessments of student learning and high-stakes summative examinations. The statement highlights a common issue in education where teachers are often pressured to focus on achieving high scores on summative assessments. This emphasis on the outcome of assessments can result in teachers neglecting the process of learning and focusing solely on teaching material that will help students perform well on the test. As a result, students may learn to memorize and regurgitate information without truly understanding it or applying it in real-world contexts.

When students are driven solely by performance goals, they may become less motivated to engage in the learning process, which can lead to a lack of interest and decreased achievement. In addition, the pressure to

perform well on assessments can also create a culture of competition and comparison rather than a focus on personal growth and development.

To counteract this issue, it is important for teachers to place emphasis on learning goals rather than just performance goals. By setting clear learning objectives and providing students with opportunities to practice and apply what they have learned in meaningful ways, teachers can help students to understand and master new knowledge. Additionally, by encouraging a growth mindset and focusing on progress rather than perfection, teachers can create a classroom culture that values learning for its own sake rather than just for the purpose of achieving high scores on assessments.

The findings of the study conducted in the Sagnerigu Municipality, which revealed that most Junior High School (JHS) students are performing below proficiency level in mathematics, are alarming. Mathematics is a fundamental subject that provides the foundation for many other academic fields and is an essential skill for success in various professions. The fact that a significant number of students are struggling with this subject raises concerns about the quality of education in the municipality and the implications of this performance gap for the future of the students. The findings indicate that teaching and learning, which are supposed to help students achieve curriculum-based standards, are not achieving their targets.

This finding agrees with the findings of Mills and Mereku (2016), who found that many junior high school students in Ghana struggle with mathematics. The report of Mullis et al. (2012) on students' poor mathematics performance is also in agreement with this study.

The poor performance of JHS students in mathematics in the Sagnerigu Municipality could be attributed to teachers' inadequate implementation of formative assessment practices. Formative assessment is an essential tool that helps teachers identify students' strengths and weaknesses in real-time, providing immediate feedback to adjust their instruction accordingly. Effective formative assessment practices can help teachers identify students who are struggling with the subject and provide them with the necessary support to improve their performance.

The findings of the study suggest that teachers in the municipality are not implementing formative assessment practices effectively. This could mean that teachers are not regularly monitoring students' learning progress and not providing them with feedback to improve their understanding of the subject. As a result, students may be unaware of their weaknesses and may not have the opportunity to address them, leading to poor performance in mathematics.

To improve the quality of mathematics education and students' performance, it is essential to address teachers' poor implementation of formative assessment practices. Teachers need to be adequately trained on how to use formative assessment practices effectively and provided with the necessary resources to carry them out. Policymakers should also consider providing support and incentives to encourage teachers to implement these practices regularly.

Students should be informed about the standard, a benchmark against which their work will be measured. According to Sadler (1989), standards are predefined levels of performance and excellence. It becomes a goal when it is desired or aspired to. The goal may be external or internal. External goals are

those assigned by the teacher, whereas the students form internal goals. Except for a coercive situation, a learner can ignore an external goal that can negatively impact his achievement. A goal can only play a significant role in the voluntary regulation of performance when a learner takes ownership of it.

The findings of the study have important implications for policymakers, headteachers, teachers, and students in the Sagnerigu municipality. Policy makers could use the findings to develop policies aimed at improving mathematics education in the municipality. These policies could include measures to increase the availability of resources and teacher training programmes focused on effective formative assessment practices. They could also consider initiatives that encourage the use of technology-based tools to enhance learning outcomes.

Headteachers could use the findings to develop and implement professional development programmes to improve mathematics teaching quality. They could also consider conducting regular classroom observations to ensure teachers effectively implement formative assessment practices.

Teachers could use the findings to reflect on their practice and identify areas for improvement. They could attend professional development programmes focused on effective formative assessment practices, collaborate with colleagues to share best practices and develop new strategies to improve student learning outcomes.

Students could use the findings to understand the importance of effective formative assessment practices in their learning process. They could also work with their teachers to develop strategies to improve their learning outcomes in mathematics.

The municipal director could use the findings to prioritise mathematics education and allocate resources to address the issues identified in the study. The director could work with policymakers, headteachers, and teachers to develop and implement policies and initiatives aimed at improving mathematics education in the municipality.

Overall, the findings of the study could provide important insights for policymakers, headteachers, teachers, and students in the Sagnerigu Municipality, to identify areas for improvement and develop strategies to enhance mathematics education and student learning outcomes.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter provides the finalisation of the study by presenting a comprehensive summary of the significant findings in relation to the research questions and hypothesis. The section explicitly gives recommendations for formative assessment practices that educate students to monitor their learning and take responsibility for learning in improving their learning outcomes. It highlights areas teachers need to consider to ensure effective implementation of emerging trends in formative assessment practices.

Summary

This study aimed to determine the extent to which formative assessment practices of mathematics teachers in the Sagnerigu Municipality are embedded in their classroom practice. The study was structured around the following research inquiries:

1. To what extent do Junior High School mathematics teachers in the Sagnerigu Municipality engage in formative assessment strategies in the classroom?
2. What are students' perceptions of the usefulness of the various types and levels of feedback provided by their mathematics teachers?
3. How successful are students in attaining the learning outcomes in mathematics?

The results revealed QCD and FB are established formative assessment practices of the mathematics teachers. LISC and PSA are emerging formative assessment practices of the mathematics teachers in the Sagnerigu Municipality. The students' average responses on the usefulness of each

feedback type (feeding up, feeding back, and feeding forward) from their mathematics teachers were given a rating of 4 out of 7, which was interpreted as moderately useful. Regarding students' attainment of the mathematics learning outcomes, the data suggest that the overall performance of the students is at the level of "attaining proficiency". Students in high-performing schools tend to be at a higher level than those in low-performing schools: Whereas students in higher-performing schools are at the level of "attaining proficiency", low-performing schools are at the level of "developing proficiency". The majority of the students tend to be performing at the level of "Approaching proficiency". Only a few students are at the level of "highly proficient."

The following research hypothesis was also tested to enrich the findings of the study:

1. H_0: School performance has no significant influence on students' perception of feedback.

The analysis of research hypothesis one finding provided sufficient support to reject the null hypothesis and conclude that high-performing and low-performing schools had significantly different student perceptions of feedback. Thus, the combined perception of feeding up, feeding back and feeding forward differed significantly between students of high-performing schools and low-performing schools.

Conclusion

The identification of both established and emerging formative assessment practices among mathematics teachers provides valuable insights into the strategies employed to assess student progress and provide timely

feedback. By recognising these practices, educators can leverage their strengths and address areas that require improvement, ultimately enhancing the overall quality of formative assessment in mathematics classrooms.

The study's examination of students' perceptions of feedback revealed a moderate level of perceived usefulness. This emphasises the importance of feedback as a tool for student growth and development.

Furthermore, the variations in students' learning outcomes between high-performing and low-performing schools underscore the significance of the academic context. The findings also emphasise the potential role of formative assessment practices in supporting student progress and narrowing these performance disparities.

The study's research hypothesis exploring the influence of school performance on students' perception of feedback yielded significant results, reinforcing the idea that the educational context plays a crucial role in shaping students' experiences and attitudes towards feedback. These results provided further support to the notion that the educational context holds a pivotal role in shaping students' perspectives and attitudes towards feedback. This finding underscores the significance of considering the broader school environment when implementing formative assessment practices and underscores the necessity of comprehensive, systemic approaches to enhance students' learning experiences.

Recommendation

The findings also suggest the need for further support and guidance to optimise the impact of feedback on student learning outcomes. Educators can create a conducive environment that promotes student engagement and

achievement by equipping teachers with effective feedback techniques, emphasizing constructive comments and avoiding grades.

There is the need for directors of education and head of schools to engaged in targeted interventions and support systems in low-performing schools to bridge the achievement gap and ensure equitable learning opportunities for all students.

For effective learning to occur, it is crucial that learners actively engage with the feedback provided and subsequently apply what they have learned. Teachers should take it as a matter of responsibility to ensure students act upon the feedback provided by their teachers. Students should not be passive feedback receivers. They should actively be involved in the feedback activity. Feedback should be approached as an interactive dialogue between the teacher and the student, promoting active participation from both parties, rather than a one-sided monologue where the student acts as a passive recipient. The effectiveness of feedback depends not only on its timing and delivery but also on the listener's ability to process and act upon the information provided (Andrade, 2010; Hattie & Gan, 2011; King et al., 2009).

The interpretation of assessment results in relation to criterion needs to be emphasised more. There is a need for teachers to place a greater emphasis on the criterion-referenced interpretation of assessment results. This type of diagnostic interpretation tends to assist students in identifying areas of their learning that need improvement and assessing their level of achievement of the stated learning objectives.

Teachers should use open questions or a problem-solving task during questioning and classroom discussion because these can set the stage for a

lesson and either provoke extensive discussions or prompt focused small group discussions. Teachers can then better anticipate their students' needs by gaining insight into their students' prior knowledge and identifying any knowledge gaps or misconceptions.

Students can show how they can apply "traffic light" icons in the real world by labelling their work as "green," "yellow," or "red" to represent their level of assurance in their own comprehension of the material. Using these tags, students have a simple means of communicating their self-assessment. Students can make the transition from self-assessment to peer assessment by being asked to defend their evaluations in front of a group of their peers. This relationship has the potential to facilitate the acquisition of the knowledge and impartiality necessary for precise self-assessment. Moreover, students have the option to employ "traffic light" symbols on their work and subsequently indicate their usage by raising their hands, denoting the utilization of the green, yellow, or red symbol. The instructor may then pair the green and yellow students together so that they can assist one another in resolving their issues. In contrast, the red students can meet with the instructor in small groups to address the more serious problems they are experiencing. Many students will require instruction in group dynamics, such as listening to one another and taking turns speaking, before they can complete such projects effectively as a group.

In providing feedback, teachers must create an atmosphere of trust and set classroom norms that allow for constructive criticism. Negative feedback can undermine students' willingness to make subsequent efforts to improve their learning (Darling-hammond & Bransford, 2007).

Students learn nothing from a numerical score or grade; hence, a chance to increase their learning is missed. Teachers' feedback should put less emphasis on students' relative standing in the class and more on their actual progress toward meeting learning goals if they are to be effective in fostering students' acquisition of those goals. Consequently, a shift away from norm-referenced assessment towards criterion-referenced assessment is imperative. Feedback is most useful when it is about students' performance against established criteria, identifies strengths as well as weaknesses, and provides support or guidance about what to do to improve.

Suggestions for Further Research

Further research could delve deeper into the differences between established and emerging formative assessment practices among mathematics teachers. Investigating the effectiveness of various formative assessment techniques and their impact on student learning outcomes could provide valuable insights.

Extending the study to explore in more detail how students interpret and utilize feedback received from their mathematics teachers could be fruitful. Qualitative research methods, such as interviews or focus groups, could be employed to gain a deeper understanding of students' perspectives on feedback.

Research could focus on identifying the factors that influence students' perceptions of the usefulness of feedback. This could include exploring the clarity, timeliness, and specificity of feedback provided by teachers, as well as students' prior experiences and attitudes towards feedback in mathematics education.

Further investigation into the relationship between formative assessment practices and students' mathematics learning outcomes could be conducted. Longitudinal studies or experimental designs could be employed to assess the causal relationship between formative assessment practices and academic achievement in mathematics.

Given the finding that students' perceptions of feedback differed significantly between high-performing and low-performing schools, future research could explore the role of socioeconomic factors in shaping students' attitudes towards feedback. Understanding how factors such as parental involvement, access to resources, and school environment impact students' engagement with feedback could inform targeted interventions to support students from diverse backgrounds.

Research could investigate the effectiveness of routine training programs for mathematics teachers in enhancing their utilization of feedback information and formative assessment practices. Evaluating the impact of professional development initiatives on teacher pedagogy and student learning outcomes could provide valuable insights for educational policymakers and practitioners.

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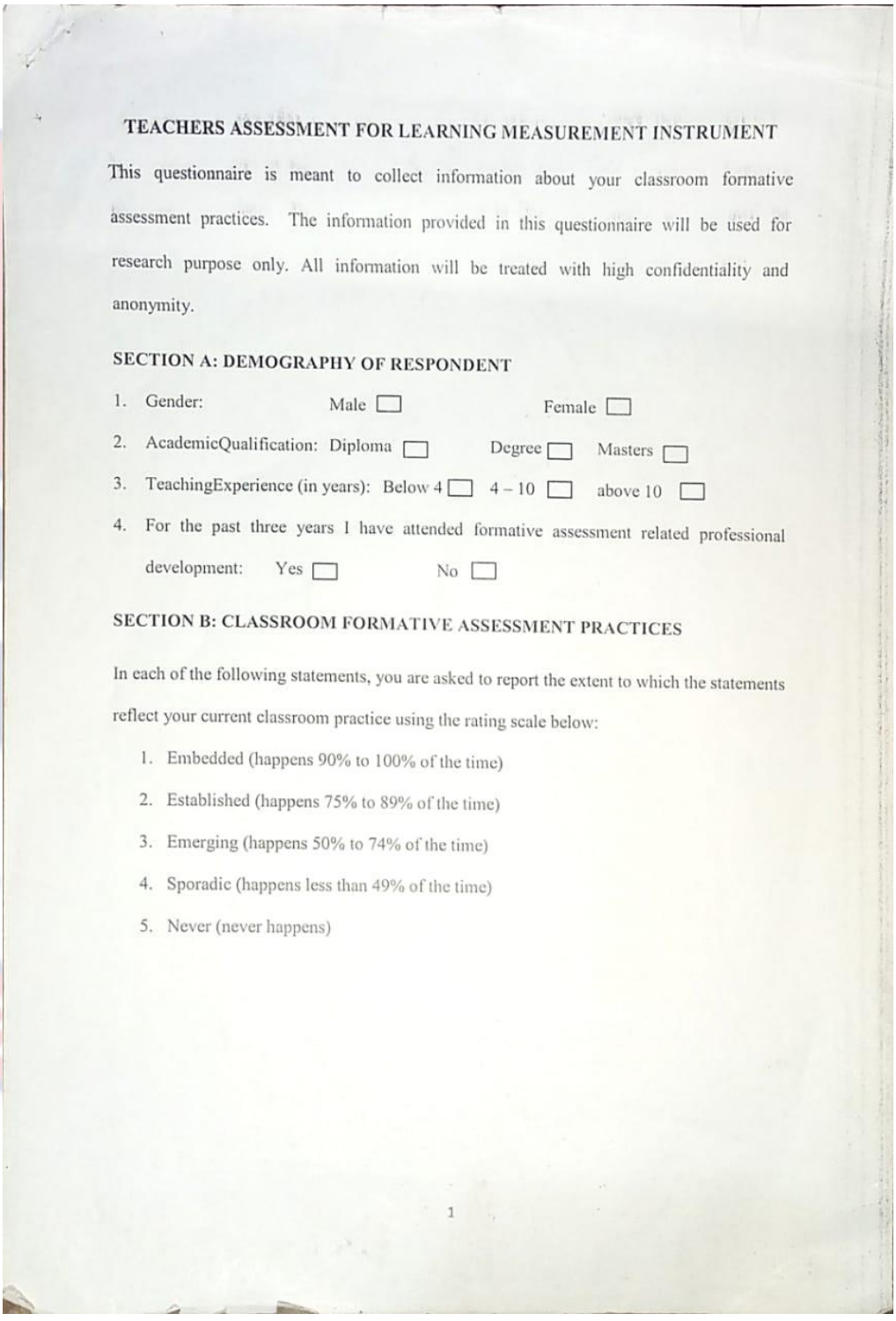
APPENDICES

Appendix A: Teachers AfL Measurement Instrument



TEACHERS ASSESSMENT FOR LEARNING MEASUREMENT INSTRUMENT

This questionnaire is meant to collect information about your classroom formative assessment practices. The information provided in this questionnaire will be used for research purpose only. All information will be treated with high confidentiality and anonymity.

SECTION A: DEMOGRAPHY OF RESPONDENT

1. Gender: Male ☐ Female ☐
2. AcademicQualification: Diploma ☐ Degree ☐ Masters ☐
3. TeachingExperience (in years): Below 4 ☐ 4 – 10 ☐ above 10 ☐
4. For the past three years I have attended formative assessment related professional development: Yes ☐ No ☐

SECTION B: CLASSROOM FORMATIVE ASSESSMENT PRACTICES

In each of the following statements, you are asked to report the extent to which the statements reflect your current classroom practice using the rating scale below:

1. Embedded (happens 90% to 100% of the time)
2. Established (happens 75% to 89% of the time)
3. Emerging (happens 50% to 74% of the time)
4. Sporadic (happens less than 49% of the time)
5. Never (never happens)

1

Note:LISC = Sharing learning intentions and success criteria; QCD = Questioning and classroom discussion; FB = Feedback; PSA = Peer- and self-assessment

Items	Statements	1	2	3	4	5	6
LISC1	Learning intentions are stated using words that emphasise knowledge, skills, concepts and/or attitudes i.e., what the pupils are learning NOT what they are doing.						
LISC2	Pupils are reminded about the links between what they are learning and the big learning picture (e.g., "We are learning to count money so that when we go shopping, we can check our change").						
LISC3	Child-friendly language is used to share learning intentions with pupils (e.g., "We are learning to make a good guess (prediction) about what is likely to happen next in the story").						
LISC4	Success criteria related to learning intentions are differentiated and shared with pupils.						
LISC5	Pupils demonstrate that they are using learning intentions and/or success criteria while they are working (e.g., checking their progress against the learning intentions and success criteria for the lesson displayed on the blackboard or flipchart, for example).						
QCD1	Assessment techniques are used to facilitate class discussion (e.g., brainstorming).						
QCD2	Questions are used to elicit pupils' prior knowledge on a topic.						
QCD3	Pupils are encouraged to share the questioning role with the teacher during lessons (e.g., the teacher routinely invites pupils to question their peers' contributions to discussions).						
QCD4	Pupils' incorrect responses are used to guide teaching and learning (e.g., a pupil is asked to explain why he/she gave a particular answer).						
QCD5	Pupils can explain to others what they are learning (e.g., if a visitor came to the classroom, pupils could articulate what they are learning in terms that identify the knowledge, skills, concepts and/or attitudes being developed)						
FB1	Feedback to pupils is focused on the original learning intention(s) and success criteria (e.g., "Today we are learning to						

2

	use punctuation correctly in our writing and you used capital letters and full stop correctly in your story, well done John").						
FB2	Assessment techniques are used during lessons to help the teacher determine how well pupils understand what is being taught (e.g., thumbs up-thumbs-down and/or two stars and a wish).						
FB3	Diagnostic information from standardised tests is used to identify strengths and needs in teaching and learning (e.g., pupils challenges in solving word problems in mathematics are identified to guide teaching).						
FB4	Pupils are involved formally in providing information about their learning to their parents/guardians (e.g., portfolios or learning logs are taken home).						
FB5	In preparing to provide pupils with feedback on their learning, the teacher consults their records of achievement against key learning intentions from previous lessons (e.g., the teacher reviews a checklist, rating scale, or anecdotal record that s/he has compiled).						
PSA1	Pupils are given an opportunity to indicate how challenging they anticipate the learning will be at the beginning of a lesson or activity (e.g., by using traffic lights).						
PSA2	Pupils are encouraged to record their progress using, for example, learning logs.						
PSA3	Pupils are encouraged to use a range of assessment techniques to review their own work (e.g., a rubric, traffic lights, thumbs up/down, two stars and a wish).						
PSA4	A visual record of pupils' progress is maintained to celebrate pupils' learning and show areas of/for development (e.g., a bulletin board displaying progression in story writing over a term).						
PSA5	Time is set aside during parent/guardian-teacher meetings for pupils to be involved in reporting on some aspects of their learning (e.g., pupils select an example of their best work for discussion at the meeting).						

3

Appendix B: Student Feedback Perception Questionnaire

School Code: _____ **Gender: _____**

Dear Student, your cooperation in participating in this survey is greatly appreciated. Your privacy is respected, and the answers you provide will only be collected for research purposes.

This survey is asking you questions about how helpful different types of feedback are to your learning in Mathematics.

You will be asked to tick a box to show if the feedback is **not** helpful; **slightly** helpful; **somewhat** helpful; **moderately** helpful; **mostly** helpful; **very** helpful; or **extremely** helpful.

These 11 questions are about information that helps you understand: **What success looks like in Mathematics?**

Tick a box that shows how you feel. You can choose from

1 = **not** helpful

2 = **slightly** helpful

3 = **somewhat** helpful

4 = **moderately** helpful

5 = **mostly** helpful

6 = **very** helpful

7 = **extremely** helpful.

B. What does success look like in Mathematics?								
		1	**2**	**3**	**4**	**5**	**6**	**7**
1	How helpful is the *feedback that tells you about what you are learning? i.e. a What We Are Learning Today (WALT) statement.*							
2	How helpful are **exemplars** showing you *what success looks like* in Mathematics?							
3	How helpful are **marking guides** showing you *what success looks like* in Mathematics?							
4	How helpful is the feedback that tells you what your teacher is looking for in your work?							
5	How helpful is the feedback that explains the key ideas you have to write about?							
6	How helpful is feedback about the questions you could ask to learn more about your topic?							
7	How helpful is feedback highlighting the skills you need to complete the task? e.g. notetaking							
8	How helpful is the feedback highlighting the strategies you will need to complete the task? e.g. using a planning guide							
9	How helpful is it when you are asked what you think you are learning?							
10	How helpful is it when you are asked about the focus of your writing?							
11	How helpful is it when you are asked about your goals for your writing?							

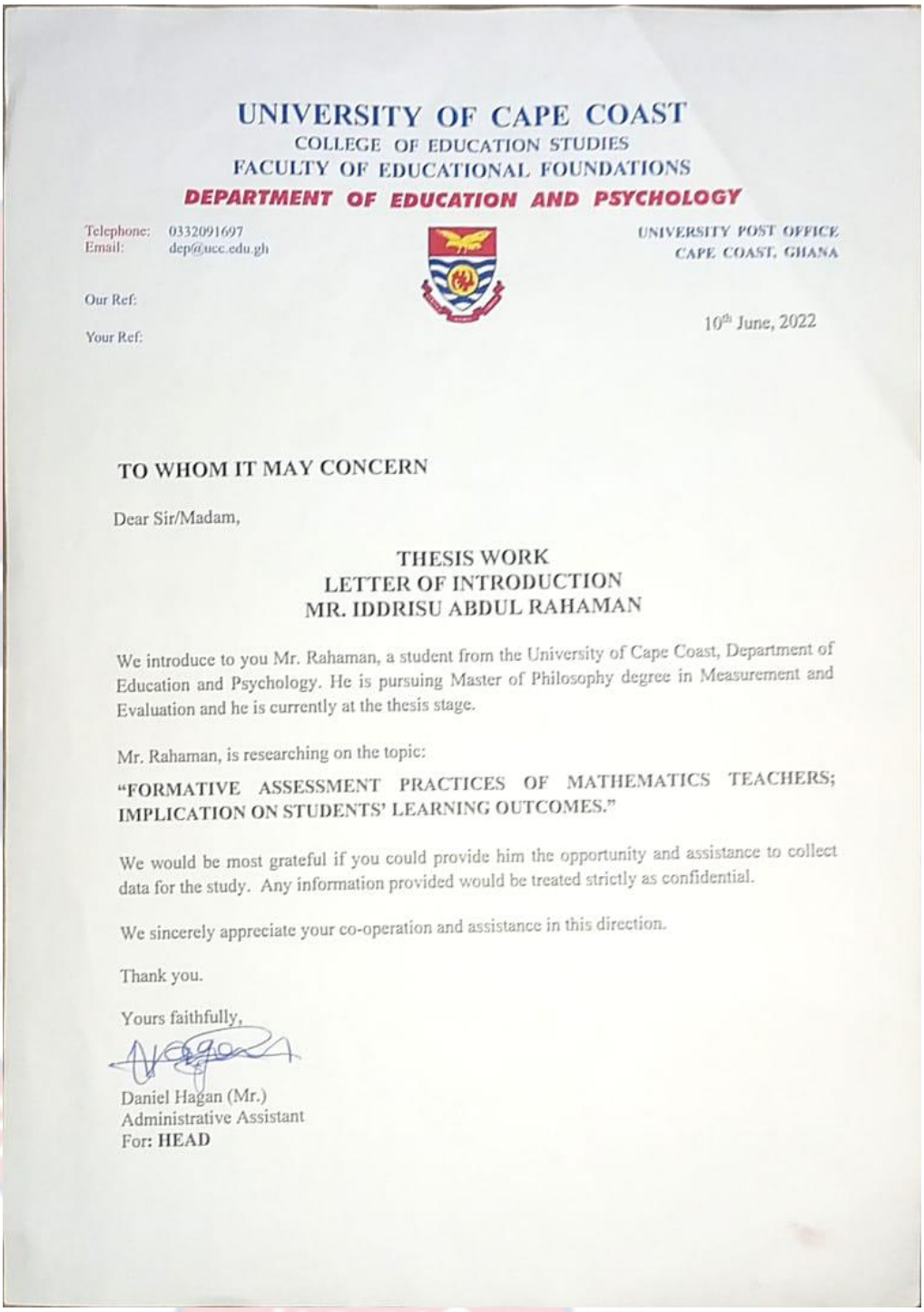
These 10 questions are about feedback that helps you understand: **What progress you are making in Mathematics?**

C: What progress are you making in Mathematics?								
		1	**2**	**3**	**4**	**5**	**6**	**7**
1	How helpful is feedback on **pre-assessments** in showing you *the progress you are making in Mathematics?*							
2	How helpful is feedback on **drafts** in showing you *the progress you are making in Mathematics?*							
3	How helpful is feedback on **work in class** that tells you if your writing matches what your teacher is looking for*?*							
4	How helpful is feedback during **class discussions** about your ideas*?*							
5	How helpful is feedback during **class discussions** about your thinking of concepts*?*							
6	How helpful is feedback during **class discussions** about your skills in mathematics*?*							
7	How helpful is feedback during **class discussions** about your strategies in working mathematical problems*?*							
8	How helpful is it when you are asked if you think you are on track to succeed?							
9	How helpful is it when you are asked how your writing matches the marking guide?							
10	How helpful is it when you are asked if you are on track to achieving your goal?							

These 10 questions are about information that helps you understand: **How you can improve in Mathematics?**

D. How can you improve in Mathematics?								
		1	**2**	**3**	**4**	**5**	**6**	**7**
1	How helpful are comments from the **teacher** that helps to keep you on track to succeed *in Mathematics?*							
2	How helpful is a draft/rough copy that tells you *how you can improve in Mathematics?*							
3	How helpful is it when you receive feedback that tells you what you need to focus on to *improve in Mathematics?*							
4	How helpful is it to receive feedback that tells you how to *improve your ideas in Mathematics?*							
5	How helpful is it when you receive feedback that tells you *how to improve your thinking in Mathematics?*							
6	How helpful is it when you receive feedback that tells you *how to improve your mathematics skill?*							
7	How helpful is it when you receive feedback that tells you *how to improve your mathematics strategies?*							
8	How helpful is it when you are asked what to do to improve?							
9	How helpful is it when you are asked what your next improvement step would be on the marking guide?							
10	How helpful is it when you are asked about how you could achieve your goal?							

Appendix C: Introductory Letter from Department



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Your Ref:

10th June, 2022

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

THESIS WORK
LETTER OF INTRODUCTION
MR. IDDRISU ABDUL RAHAMAN

We introduce to you Mr. Rahaman, a student from the University of Cape Coast, Department of Education and Psychology. He is pursuing Master of Philosophy degree in Measurement and Evaluation and he is currently at the thesis stage.

Mr. Rahaman, is researching on the topic:

"FORMATIVE ASSESSMENT PRACTICES OF MATHEMATICS TEACHERS; IMPLICATION ON STUDENTS' LEARNING OUTCOMES."

We would be most grateful if you could provide him the opportunity and assistance to collect data for the study. Any information provided would be treated strictly as confidential.

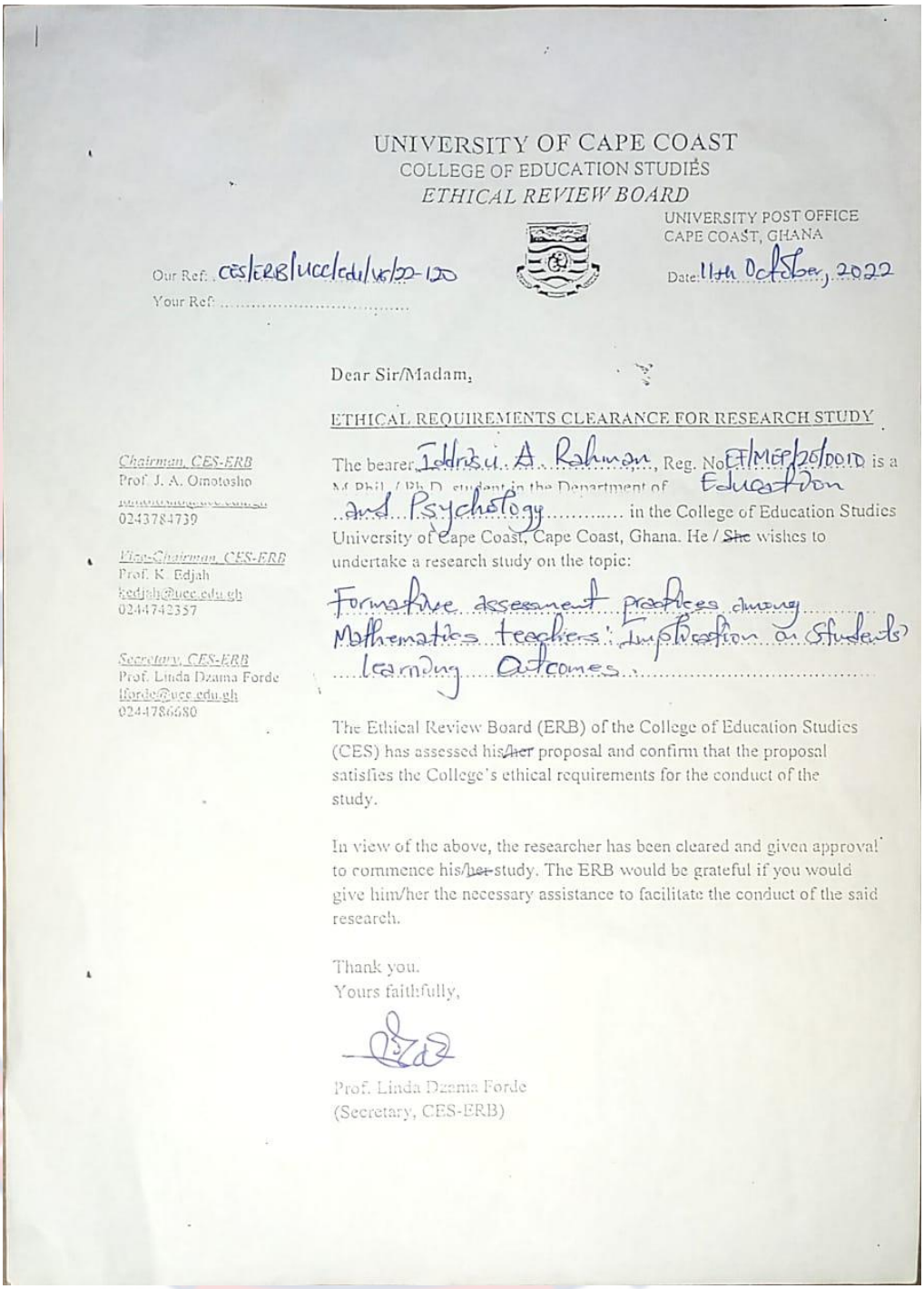
We sincerely appreciate your co-operation and assistance in this direction.

Thank you.

Yours faithfully,

Daniel Hagan (Mr.)
Administrative Assistant
For: HEAD

Appendix D: College of Education Ethical Clearance Letter



UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
ETHICAL REVIEW BOARD

UNIVERSITY POST OFFICE
CAPE COAST, GHANA

Our Ref: CES/ERB/ucc/edu/vol22-120 Date: 11th October, 2022
Your Ref: .....

Dear Sir/Madam,

ETHICAL REQUIREMENTS CLEARANCE FOR RESEARCH STUDY

The bearer Idris-u A. Rahman, Reg. No. EF/MEP/20/0010 is a 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:

Formative assessment practices among Mathematics teachers' Implementation on Students learning outcomes.

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)

Chairman, CES-ERB
Prof. J. A. Omotosho
0243784739

Vice-Chairman, CES-ERB
Prof. K. Edjah
kedjah@ucc.edu.gh
0244742357

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

Appendix E: Consent Form of Mathematics Teachers

Dear Potential Participant,

You have been cordially invited to take part in a research investigation regarding the formative assessment methods employed by mathematics teachers. This study is being conducted by Iddrisu Abdul Rahaman, a student at Cape Coast University. The primary objective of this research is to explore the formative assessment practices of mathematics teachers. The findings from this study will contribute towards enhancing and advancing mathematics education approaches in Ghana.

If you decide to participate, you will be requested to complete a survey focusing on your formative assessment practices in mathematics education. It is anticipated that the survey will require approximately 20-30 minutes of your time. There are no foreseeable risks associated with your involvement in this study. However, the outcomes derived from this research may facilitate the improvement of mathematics education practices in Ghana.

Rest assured that all data collected during this study will be treated with the utmost confidentiality and anonymity. No personally identifiable information will be used in any publications or presentations resulting from this research.

Participation in this study is entirely voluntary, and you have the freedom to withdraw from the study at any point without facing any consequences. Your decision to partake or decline participation will not impact your relationship with Cape Coast University or any individuals associated with this research.

If you have any questions or concerns regarding this study, please contact:

Researcher's Name: Iddrisu Abdul Rahaman

Email Address: a.abdul@stu.ucc.edu.gh

By continuing with this survey, you acknowledge that you have read this consent form and agree to participate in this study.

Participant Signature: _____

Date: _____

I acknowledge that I have reviewed the provided information and comprehended the purpose and requirements of the study. I hereby offer my voluntary consent to participate in this research and acknowledge my right to withdraw from the study at any time without incurring any negative consequences. I have been provided with a copy of this consent form for my personal records.

I appreciate the opportunity to contribute to this study.

Appendix F: Assent Form for Students

Dear Parent/Guardian,

Your child has been extended an invitation to partake in a research project examining students' perspectives on the value of feedback. The primary aim of this study is to gain insights into how students perceive feedback and identify opportunities for its enhancement.

Participation in this study is entirely voluntary, and your child has the freedom to decline participation or withdraw from the study at any time without facing any consequences. We kindly request that you review this form attentively and discuss its contents with your child. If both you and your child agree to participate, please sign and return this form.

Study Procedures:

Your child will be requested to fill out a questionnaire focusing on their opinions regarding the effectiveness of feedback. The questionnaire is anticipated to require approximately 20-25 minutes to complete. Please rest assured that all responses provided by your child will be treated with strict confidentiality and anonymity.

Benefits of Participation:

While your child will not receive direct benefits from their participation in this study, their involvement will significantly contribute to our understanding of students' perspectives on feedback and its potential for improvement. By participating, your child will play a crucial role in advancing our knowledge in this area.

Risks and Discomforts:

The study protocol has been thoroughly assessed, and there are no foreseen risks or discomforts associated with your child's participation in this study. The well-being and safety of all participants are prioritise, and every precaution has been taken to ensure a risk-free and comfortable experience throughout the study.

Contact Information:

If you have any inquiries, doubts, or concerns regarding the study, please do not hesitate to reach out to the researcher at the following contact information:
Researcher's Name: Iddrisu Abdul Rahaman

Email Address: a.iddrisu@stu.ucc.edu.gh

Mobile Contact: 0248274885

I have read this form and discussed it with my child. I agree to allow my child to participate in the study.

Parent/Guardian Signature…… Date …….

I have carefully read and comprehended the information regarding the study, and

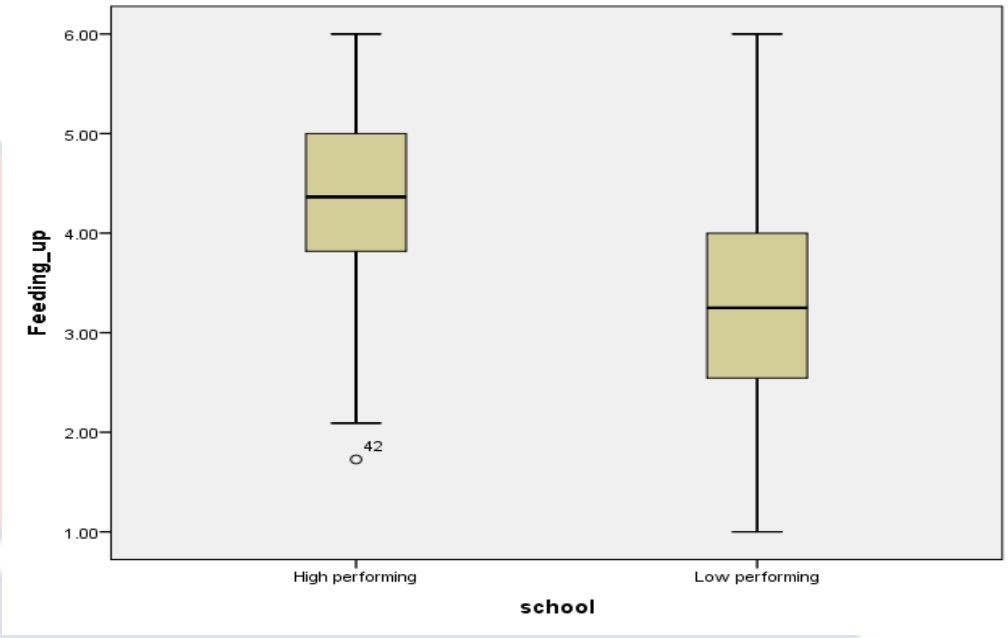
I provide my informed consent to participate.

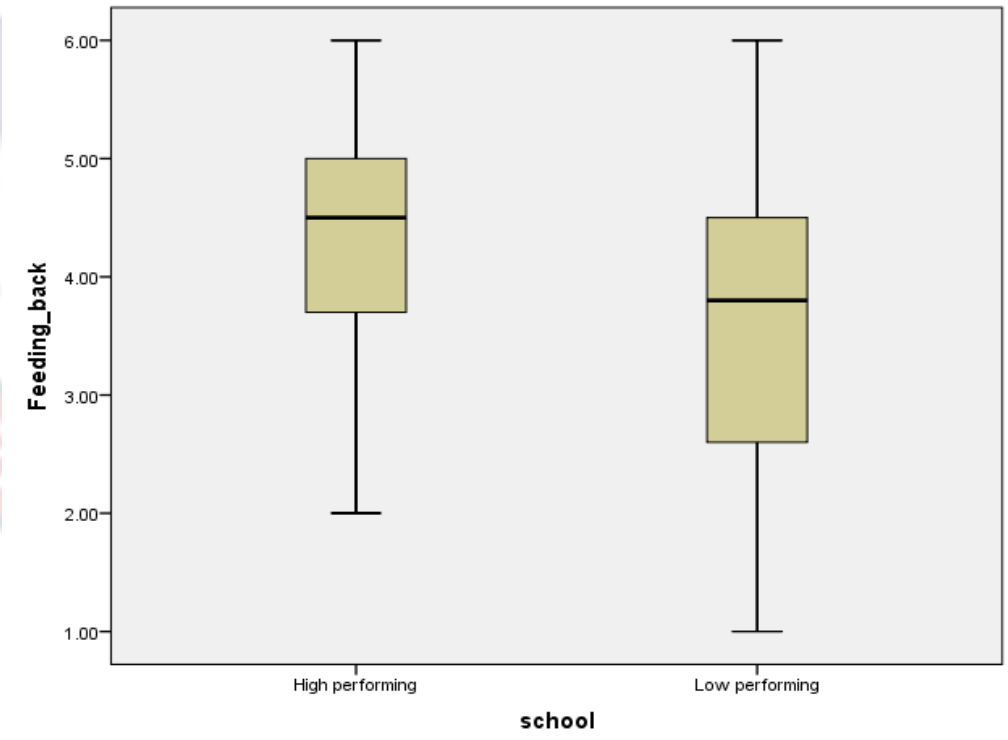
Child's Signature…… Date ……

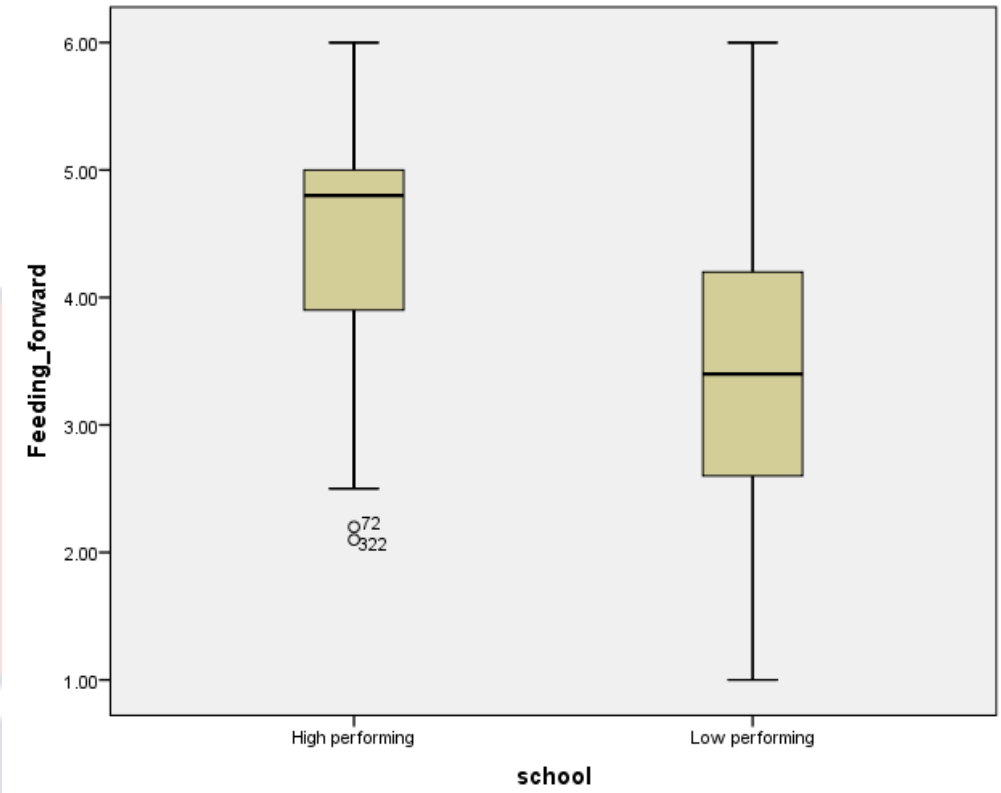
APPENDIX G: Multivariate Normality Assumption Test Output

	Minimum	Maximum	Mean	Std. Dev	N
Predicted Value	.7244	2.0133	1.4473	.25741	518
Std. Predicted Value	-2.808	2.199	.000	1.000	503
Standard Error of Predicted Value	.020	.078	.037	.011	503
Adjusted Predicted Value	.7148	2.0301	1.4470	.25755	503
Residual	-1.01335	.96956	.00000	.42598	503
Std. Residual	-2.372	2.269	.000	.997	503
Stud. Residual	-2.391	2.281	.000	1.001	503
Deleted Residual	-1.03009	.97924	.00028	.42911	503
Stud. Deleted Residual	-2.403	2.290	.000	1.002	503
Mahal. Distance	**.117**	**15.918**	**2.994**	**2.427**	**503**
Cook's Distance	.000	.024	.002	.003	503
Centered Leverage Value	.000	.032	.006	.005	503

APPENDIX H: Multivariate Outliers Test Assumption Output (Box Plots)







Appendix I: Linearity of Dependent Variables