UNIVERSITY OF CAPE COAST

EFFECT OF FORMATIVE ASSESSMENT PRACTICES ON JUNIOR HIGH SCHOOL STUDENTS' MATHEMATICS ACHIEVEMENT IN THE NSAWAM-ADOAGYIRI MUNICIPALITY, GHANA.

FRANK AGYEMANG OPPONG

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BY

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Thesis submitted to the Department of Education and Psychology, Faculty of Educational Foundations of the 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 2021

DEBLARATION

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

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

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

Name:……..

ABSTRACT

The research aimed to investigate the impact of formative assessment practices on the academic performance of junior high students in mathematics within the Nsawam-Adoagyiri Municipal Assembly, Ghana. This research work was guided by two research questions and two corresponding hypotheses. It utilized a quasi-experimental pretest and posttest design with non-equivalent control groups. A randomly selected sample of 140 students from two public junior high schools in grade two participated in the research. Mathematics Achievement Tests, designed to be alternative in nature, were used for both pretest and posttest data collection. Statistical tools used to analyse the data were one-way analysis of covariance, two-way analysis of covariance, independent samples t-test and dependent sample t-test. The findings suggested that students who were given formative assessment practices as treatment recorded did better in the post-test scores as compared to control group's participants who were not given the intervention. Male students did not perform differently from their female counterparts as the study revealed no significant gender effect on mathematics achievement. It was concluded that the intervention programme of formative assessment practices were effective for participants' academic success in mathematics. The study proposed recommendations for the Ghana Education Service, Ministry of Education, school administrators, and curriculum developers to prioritize and enhance the integration of formative assessment practices within their teacher training programs and workshops. This approach aims to further strengthen the proficiency of educators in implementing formative assessment techniques when instructing mathematical concepts, ultimately contributing to improved student learning outcomes

KEYWORDS

Formative assessment

Summative assessment

Academic Achievement

Gender

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DEDICATION

To my sweet mother Beatrice Georgia.

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CHAPTER ONE

INTRODUCTION

In the Nsawam-Adoagyiri Municipality, a concerning pattern has emerged where approximately twenty-five percent of students, who sit for the Basic Education Certificate Examination (BECE) perform abysmally in mathematics as compared with their achievements in other core subjects (Educational Management Information System, 2016-2020). This underperformance in mathematics raises significant concerns about potential solutions. Given the pivotal role of core mathematics in academic advancement in Ghana, students' struggles in this subject may impede their progression to higher educational levels. This issue warrants investigation in light of Ghana's emphasis on Science, Technology, Engineering, and Mathematics (STEM) as a cornerstone for nurturing future leaders with strong critical thinking and problem-solving skills. The Metropolitan Director of Education in the Nsawam-Adoagyiri Municipality has consistently underscored that students in the area's lower performance in BECE mathematics not only hampers their ability to pursue their preferred courses but also jeopardizes their eligibility for the government's 'Free Senior High School Education' policy (Education Management Information System, 2020)

Numerous scholars (Mefor, 2014; Mensah, Okyere & Kuranchie, 2013; Enu, Agyemang & Nkum, 2015) have accounted for various contributors, including those stemming from students, teachers, the school environment, home, and the assessment tools employed, that influence how students perform

in mathematics and other disciplines. Consequently, this study aimed to investigate whether specific assessment tools, particularly formative assessment practices, have an impact on the mathematics achievement of junior high school students in the Nsawam-Adoagyiri Municipality. This research serves as a valuable reference for policymaking, addressing the issue, and fostering lifelong learning among students as they progress through their educational journey.

Background to the Study

The classroom serves as a fundamental learning environment where the teaching and learning processes unfold. It functions as a hub for dynamic interactions, wherein the teacher's role is to effectively impart knowledge to the learners, leading to changes in their understanding and determining their mastery level in a particular subject area. In the classroom context, the teacher endeavors to understand the competency level his or her students have brought to the learning environment and what they acquire through instruction. The teacher gains this insight through classroom assessment. According to Nitko and Brookhart (2007), assessment involves the gathering relevant data to inform decisions about students, curricula, programs, and educational policies. In any educational system, assessing students is a fundamental tool to monitor improvement and achievements.

The assessment of students' achievements is evolving in response to the changing demands placed on students, which require new knowledge, skills, and abilities. Assisting students in developing these capabilities necessitates adjustments in the way assessment is done at both the school and classroom levels, as well as the adoption of innovative methods to assessment that involves a lot of people or large-scale (Suliman & Iles, 2000). Assessment could be

considered as a means to teaching and learning, rather than being the sole objective of students' educational experiences. It should be regarded as a well-planned and systematic process that enables teachers to make reliable and valid judgments about a learner's progress. With the increasing student population in secondary schools in Ghana due to the introduction of the 'Free Education' policy, assessments in the classrom have a major role in promoting students' learning and guiding them towards achieving distinct academic standards at the foundational level.

In the classroom, every teacher's objective is to observe students' increasing competence and success in their learning journey. When teachers engage in the process of assessing students in the classroom, the focus shifts from merely collecting information for grading or certification to a more proactive approach known as formative assessment. As described by McManus (2008), formative assessment is a feedback-driven technique employed by both teachers and students during instruction with the aim of enhancing students' attainment of specific educational goals.

Formative assessment is a "hot topic" among teachers and administrators right now, and it's widely acknowledged to be among a host of many effective strategies to boost student engagement and accomplishment (Cauley & Mcmillan, 2010). A strong link exists between student accomplishment and formative classroom assessment on both large-scale and classroom examinations (Brookhart, 2007; McMillan, 2004). Assessment for learning, according to the Broadfoot et al (2002) is any assessment whose primary goal in design and implementation is to enhance students' learning. Formative assessment, on the other hand, is sometimes misunderstood as just getting data

from students and applying it to improve learning. Formative assessment is much more than that, and teachers may grasp how useful formative assessment can be for student development by employing its specialised methodologies. It varies, however, from assessments developed solely for the purposes of accountability, ranking, or certification of competence. According to William et al. (2004), learning-focused assessment, also known as assessment for learning, takes place when students achievement is enhanced as a result of employment relevant assessment practices in the classoris employed to enhance student achievement. This approach involves the use of assessment data by both teachers and students to identify areas of challenge and subsequently implement tailored instruction to address these difficulties. It requires careful planning on the part of educators, with the aim of utilizing the gathered information to not only assess what students know but also how, when, and whether they are able to apply their knowledge.

Afemikhe (2018) asserts that collected data can be utilized by educators to refine and streamline instruction and resources, while also offering students constructive responses to support their advancement. For both teachers and students, formative assessments in the classroom offer direct insights into the learning process. Formative feedback highlights the gap between a student's current knowledge and understanding and the teacher's expectations regarding that knowledge and comprehension.

A thorough examination of current educational trends has revealed a significant shift in students' perceptions of schools. They no longer view school as a place solely for studying and exploration but rather as a means to obtain correct answers. The prevailing grading system has contributed to this mindset,

fostering an environment where students are more focused on accumulating points and achieving correct responses rather than genuine learning and the pursuit of lifelong knowledge. This overemphasis on grades has led to classroom activities being predominantly used for summative assessment purposes. As a result, once a grade is assigned, students often lack motivation to continue their learning journey beyond the assessment.

Numerous scholars, including O'Connor (2002), Reeves (2009), and Marzano (2006), have proposed substantial modifications to grading systems to reorient the educational climate towards a focus on learning rather than point accumulation. Reeves (2009) highlights that a pivotal policy change that significantly impacted student achievement was the transition from a traditional report card to a standards-based grading system. This transition also necessitated a corresponding shift in instructional methods towards a learning-centric approach.

Echoing this sentiment, O'Connor (2002) has advocated for a multitude of grading reforms. These include clearly defining learning objectives, employing high-quality assessments that align with these objectives, avoiding non-educational factors in determining grades, allowing students the opportunity to learn and demonstrate mastery even after assessments, and crucially, involving students actively in the assessment process. These proposed changes aim to refocus education on the genuine pursuit of knowledge and meaningful learning experiences.

The creators of Ghana's new basic education curriculum stated that most teachers are unable to assess everything that made up the learning goal taught in an academic year or period. The importance of using and intensifying

formative assessment methods such as projects, take-home assignments, and class exercises to assess short-term specified objectives was emphasized. So doing mitigates the weaknesses in the utilisation of summative evaluation over the long haul. The importance of Ghanaian teachers using testing as a tool for facilitating learning and unveiling learners' highs and lows in knowledge is emphasized in this curriculum. As postulated by National Council for Curriculum and Assessment, this will allow teachers to determine how their students respond to instruction (NaCCA, 2019).

Academic achievement refers to students in a school successfully completing academic tasks. In other words, it has to do with a score on an achievement exam determining a student's performance in academic topics. Achievement refers to a student's, teacher's, or institution's ability to achieve their educational goals as a result of their education (Ezuedu, 2013). One's achievement refers to something he or she has accomplished successfully via his or her own efforts and abilities (Okeke, 2016). Academic achievement, according to Okeke (2008), is a measure of information obtained via the educational process, as shown by test results, grade point average, and degree. Academic achievement is used to assess the cognitive, emotional, and psychomotor domains of a learner. Scores acquired from exams or examinations on courses studied can be used to explain students' academic achievement. Academic achievement, as defined by Adeyemi (2008), is a student's scholastic status at a given time that reflects individual ability. As a result, a person's learning ability, which can lead to favorable or negative results.

Teaching mathematics to students is anticipated to ignite strong interest and equip them with the essential knowledge and skills necessary for excelling

in the fields of science and technology. This emphasizes the importance of having a solid foundation in basic mathematics as a prerequisite for successful academic endeavors in second cycle and other higher education stages. As a result, students are more likely to excel when fundamental mathematics is taught using effective pedagogical strategies that promote a profound understanding of the subject matter.

In this context, formative classroom assessment emerges as a pivotal instructional tool employed by educators to provide students with the foundational knowledge required for enhanced learning and achievement in mathematics. Therefore, to attain educational success in the realm of fundamental mathematics, it becomes imperative to employ teaching tactics that empower learners to grasp and engage with the intricacies of the subject matter effectively.

Gender is known to be a variable that indirectly affects students academic achievement in mathematics (Moyosore, 2015; Ali & Igbal, 2013; Mawak & Ugodulunwa, 2012). Gender refers to the socially and culturally determined roles that males and females are assigned in any community (Erinosho, 2005 & Okeke, 2008). Gender, according to Opre & Opre (2005), is a set of broad categories that reflect our perceptions and ideas about females and males. It refers to a set of categorical ideas about a person's characteristic attributes (man and woman) based on whether or not he or she belongs to one of the two genders. While females are known to do well in English language and verbal abilities, males are speculated to perform better in mathematics and logical reasoning.

In their respective studies, Mawak and Ugodulunwa (2012), Ajogbeje (2012), and Ali and Igbal (2013) observed students' academic achievement was impaced when feedback and assessment with formative intensions was used. Mawak and Ugodulunwa (2012) noted that formative feedback had a more significant effect on the academic achievement of Senior Secondary Form Two students in the experimental group compared to the control group. Similarly, Ajogbeje (2012) reported a substantial improvement in learners' competence in mathematics when formative assessment with guidance was employed in basic school arithmetic in Ondo State. Ali and Igbal (2013) reported similarly when their study exposed eighth-grade students' to formative assessment to document the scientific impact on achievement and found that the experimental group did better than the control group in their post-test mean marks. This improvement was evident across gender and ability levels, with both boys and girls and high and low ability students exposed to treatment surpassing their colleagues in the control group, although no significant difference among medium ability students in both groups was recorded.

As per Moyosore's research (2015), the integration of formative assessment into instruction enhances the average mathematics scores of students. In contrast, students who were not exposed to formative assessment showed no difference in their mean achievement scores in mathematics. Additionally, Moyosore's study revealed that there was no significant difference between the performance of girls and boys in mathematics among learners who had undergone formative assessment. The use of formative assessment for diagnostic purposes in a course was also found to boost students' academic performance and enable a deeper understanding of the subject's content

The inception of the No Child Left Behind (NCLB) policy in 2002, along with its subsequent implications for underperforming school districts, ignited a multitude of educational initiatives aimed at elevating student achievement. Among these initiatives, formative assessment emerged as a prevalent process designed to enhance student accomplishment. It serves the dual purpose of refining educators' pedagogical practices and offering targeted, informative support to students who may be struggling academically.

Numerous research studies have already established a strong correlation between formative assessment and improved student achievement, consistently demonstrating its positive impact on academic success. However, the focus of this particular study was to ascertain whether similar outcomes could be observed within the educational context of Ghana, particularly in the context of mathematics education. Thus, the primary objective of this study was to investigate the influence of formative assessment on students' academic progress in basic-level mathematics within the Nsawam-Adoagyiri Municipal Assembly.

Statement of the Problem

The purpose of schools is to transmit knowledge and skills to students who attend them (Ghanney & Aniagyei, 2014). The instructor constructs information and passes it on to the student during the learning process. One of the key purposes of a school is to achieve mastery of instructional content as assessed through test results. In the traditional classroom, the concept of performance-based assessment encourages students to explore knowledge rather than memorise it.

Formative assessment is becoming increasingly visible as an important component of the teaching and learning process (Nolen, 2007). All of this is motivated by the desire to improve academic achievement (Ankomah, Koomson, Bosu & Oduro, 2005). As outlined by Bordoh, Bassaw, and Eshun (2013), formative assessment primarily serves the purpose of gathering pertinent evidence regarding students' anticipated performance. It involves identifying their strengths and weaknesses and providing recommendations to help students maintain or improve their performance on exercises they have either succeeded or struggled with. Hence, effectiveness of teaching tactics resulting in better results is assured when formative assessment is embedded in instruction.

Over the past years, concerns have been raised about the poor academic performance of pupils in Nsawam-Adoagyiri Municipality by parents and the community. A study of the BECE results of the schools from 2018 to 2020 buttress this:

Table 1- *BECE performance of pupils from 2017-2020 in mathematics*

Grade	2018	(%)	2019	(%)	2020	(%)
1	52	2.71	63	2.88	69	2.70
2	66	3.44	142	6.49	107	4.18
3	85	4.43	185	8.46	198	7.74
4	190	9.91	229	10.47	236	9.22
5	155	8.08	244	11.15	278	10.86
6	191	9.96	271	12.39	319	12.47
7	298	15.54	263	12.03	332	12.97
8	382	19.92	377	17.24	362	14.15
9	499	26.02	414	18.93	658	25.71
Total No. of pupils	**1,918**	**100.0**	**2,188**	**100.0**	**2,559**	**100.0**

GES Office, Nsawam (2021)

From table 1, mathematics performance in BECE from 2018 – 2020 show that out of the total students present for the examination, consistently, a

greater number obtain grade 8 and 9, thus, 45.94%, 36.17% and 49.86% respectively. Not only do students miss out on their preferred schools and programme of choice but not having a strong foundation in mathematic for future endeavours. This situation of poor performance can be addressed by closing students' knowledge gap and formative assessment practices appears to be the likely remedy to the present situation.

Formative assessment practices have been noted to have no substantial favourable influence on students' academic accomplishments (Andrews, 2011; Collins, 2012; King, 2003). In their research, Yin et al (2008) and Touminem (2008) reported that formative assessment did not have a significant impact on students' achievement, motivation, or conceptual changes. Contrary, the prowess of formative assessment strategies have been documented to enhance both academic achievement and motivation among students (Moyosore, 2015; Ajogbeje & Alonge, 2012; Ali & Iqbal, 2013; Wiliam et al, 2004; Li, 2016; Mehmood et al, 2012).

Controversy surrounds male and female students' academic attainment when formatives assessments are used in the classroom. When subjected to formative assessment, both boys and girls achieved similarly in mathematics, according to Moyosore (2015). However, Raimi and Adeoye (2002) reported that when it comes to integrated science, students who were males out-performed their female counterparts after getting instructed using formative assessment strategies.

Therefore, it is reasonable to confirm or disconfirm the effectiveness of formative assessment practices in students' academic progress in mathematics. Also, between male and female students who benefits more when formative

assessment practices are embedded in mathematics instruction? Will students who are exposed to formative assessment practices in mathematics have higher academic achievement? There are no readily available answers to these questions.

Purpose of the Study

This study sought to investigate formative assessment on students' academic progress in mathematics at the basic level in the Nsawam-Adoagyiri Municipality. These precise objectives guided the research work:

1. Ascertain the effect of formative assessment practices on students' academic achievement in mathematics
2. Explore the difference in mean scores between female and male students in mathematics when exposed to formative assessment practices.
3. Establish the difference in pre-test mean scores of students in the experimental group and the control group
4. Examine the difference between the before and after mean scores on Mathematics achievement obtained by the experimental group

Research Questions

The subsequent research questions were employed as a framework for this investigation:

i. What is the effect of formative assessment practices on students' mathematics scores in the Nsawam-Adoagyiri Municipal Assembly?

ii. What difference exists between female and male students mean scores in mathematics when exposed to formative assessment practices and those not exposed to formative assessment practices?

Research Hypothesis

Derived from the research problem and objectives, the subsequent hypotheses were formulated:

1. **H_o1:** There is no statistically significant difference in the pretest scores of students exposed to formative assessment practices and those not exposed to formative assessment.

   H_A1: There is a statistically significant difference in the pretest mean scores of students exposed to formative assessment practices and those not exposed to formative assessment practices.

2. **H_o2**: There is no difference in the pre-test and post-test mean scores of students instructed with formative assessment in mathematics.

   H_A2: There is a difference in the pre-test and post-test mean scores of students instructed with formative assessment in mathematics.

Significance of the Study

The current study contributes significant value for public school educators as they shed light on the impact of classroom assessment on students' academic performance. These findings can guide school administrations in recognizing the importance of formative assessment, integrating it into their teaching practices, and ensuring the availability of necessary resources to enhance student achievement. Additionally, curriculum developers can use these insights to assess and emphasize formative evaluation practices within the curriculum to support effective learning.

Furthermore, teacher training institutes can benefit from these findings by incorporating the significance of formative evaluation into their teacher training programs and providing guidance on effective approaches. Ultimately,

the conclusions drawn from this study may necessitate the development of in-service courses for teachers, equipping them with a diverse range of formative assessment strategies to enhance student performance.

Delimitations

The outcomes of this research carry substantial significance for educators in both public and private schools, offering valuable insights into how classroom assessment impacts students' academic performance. These findings can serve as a compass for educational administrators, aiding them in recognizing the significance of formative assessment, incorporating it into pedagogical approaches, and ensuring the availability of essential resources to boost student achievement. Furthermore, curriculum developers can utilize these insights to assess and underscore the importance of formative evaluation methods within the curriculum, fostering effective learning. Additionally, teacher training institutions stand to benefit from these findings by integrating the significance of formative evaluation into their teacher preparation programs and offering guidance on effective methodologies. Ultimately, the conclusions drawn from this study may prompt the development of in-service training courses for teachers, equipping them with a diverse array of formative assessment techniques to enhance student performance.

Limitation

The investigator acknowledged three potential factors that could have limited the effectiveness of the results. Firstly, the duration of the intervention, as the two-week timeframe in each of the schools may not have been sufficient to achieve the desired impact. Additionally, the study focused on a limited number of topics in the Junior High School (JHS) two curriculum, including

algebraic expressions, linear inequalities, decimal fractions, statistics, and fractions, which may not have provided comprehensive coverage. Furthermore, there were cases where some students participated in the pre-test but did not complete the post-test. However, it should be noted that the statistical methods employed in the study were designed to mitigate such limitations.

Definition of Terms

In order to clarify the context in which some key concepts have been utilised in this study, it is necessary to define some essential concepts that have been employed**.**

Formative assessment refers to how teachers use a variety of formal and informal assessment processes during the learning process to change teaching and learning activities in order to increase student achievement.

Academic Achievement

This refers to an overall success in a specific subject area. It is indicated by descriptive commentaries' grades, marks, and scores.

ZPD – Zone of Proximal Development

Organisation of the Study

This research work has five chapters. Chapter one offered an appreciation of the study's context, outlines the problem statement, defines the research objectives and questions, highlights its significance, discusses delimitations and limitations, and provides a glossary of key terms. Chapter two delves into the existing literature concerning the influence of formative assessment practices on students' academic performance in Mathematics. Theories that supported the study were reviewed as well as concepts and empirical studies done on the topic. Chapter three offers a comprehensive description of the research methodology

employed, including research design, demographics, sample selection and sampling procedures, as well as details on data collection tools. It also covers aspects related to instrument validity and reliability, ethical considerations, fieldwork procedures, and data processing and analysis. Chapter four focused on presenting and discussing the study's results and findings, while chapter five encapsulated the essential findings, drew conclusions, and put forth pertinent recommendations. Suggestions for future research directions were also mentioned.

CHAPTER TWO

LITERATURE REVIEW

Overview

The aim of this study was to investigate the impact of formative assessment on the academic performance of junior high school students in mathematics within the Nsawam-Adoagyiri Municipal Assembly, located in Ghana's Eastern Region. This chapter conducts a comprehensive review of pertinent literature related to the subject matter. The primary objective is to delve into the insights and perspectives of prominent authors and scholars who have contributed to this field of study. The review was done under the following subheadings;

1. Theoretical Review
2. Conceptual Framework
3. Empirical Review

Theoretical Review

Drawing on the theoretical foundations of Constructive theory (Lev Vygotsky, 1962) and Social learning theory (Albert Bandura, 1969), this study aims to provide a deeper understanding of how the interplay between theory and assessment, particularly in the form of formative practices, shapes students' academic advancement in the realm of mathematics. These theoretical frameworks were originally developed to elucidate the essence of formative assessment and its application in educational settings, with the overarching goal of conveying a meaningful construct of interest or educational purpose to students within the context of classroom instruction.

The Constructivist theory

The constructivist learning theory posits that new information is built upon a foundation of prior knowledge (Davis, 1991). Drawing on Vygotsky (as cited in Davis, 1991), it asserts that children are not blank slates, and knowledge cannot be simply imparted to them; instead, children learn most effectively when they have the opportunity to construct their own understanding based on their experiences and reflections. According to Davis (1991), learners play an active role in creating meaning and knowledge, and a constructivist approach to education fosters critical thinking and cultivates self-motivated and independent students. This theory suggests that learning continually builds upon the existing knowledge that a student possesses, which is referred to as a schema (Davis, 1991). Davis then, at that point, clarifies that since all learning is separated through prior schemata, constructivists propose that learning is more successful when a student is effectively occupied with the learning system rather than endeavouring to get knowledge inactively.

According to Harlen (2006), the constructivist viewpoint on learning places emphasis on the learning processes and the active role of students. In this approach, educators engage students in self-assessment and encourage them to use their own assessments to identify their current levels of understanding and mastery

The research was guided by Lev Vygotsky's (1896-1935) constructivist theory, which is rooted in cognitive and social psychology (Huitt, 2003). Constructivism posits that individuals construct knowledge by understanding the information available to them. Vygotsky's social constructivism theory explains how children are socialized and shaped through collaborative learning and interaction. This theory is based on the premise that human learning occurs in conjunction with collaboration between a student and an expert within the zone of proximal development (ZPD). In the ZPD, learners can almost, but not entirely, accomplish tasks independently. Therefore, the "Zone of Proximal Development" (referred to as "ZPD" in this work) is a crucial concept in the classroom.

Verenikina (2001) explains that the Zone of Proximal Development (ZPD) is a term coined by Vygotsky to encompass a range of activities that a student can perform independently as well as those that require the guidance and expertise of a more knowledgeable individual. The ZPD can be defined as the spectrum of tasks a person can accomplish with support and autonomously. It delineates the lower and upper limits of the learning process. The lower limit of the ZPD, as outlined by Mishra (2013), represents the extent to which a student can work without assistance, while the upper limit signifies the additional tasks a student can complete with the guidance of a more experienced

peer. Scholars who endorse formative assessment contend that Vygotsky's ZPD is invaluable for assessing a student's current level of understanding and their potential for future comprehension (Trumbull & Lash, 2013; Sach, 2012; Sach, 2015; Magno & Lizada, 2015; Clark, 2015).

The mathematics instructor serves as the expert in this study. Learners perceive through observation, become attentive, and their memory capacities are modified by social environment, culture, belief, and linguistics with the help of the mathematics teacher.

The Zone of Proximal Development is the medium through which lapses in knowledge can be bridged through the teacher (Vygotsky's "more knowledgeable other") give scaffolding (learning aids) to help pupils achieve their planned and achievable learning objectives (Wiliam, 2009; Vygotsky, 1978; Heritage & Heritage, 2013; Crossouard & Pryor, 2012).

Magno and Lizada (2015) argue that when students display abilities or completes the assessment activities on their own, then the learning gap has been filled. Hence, the ZPD and the objective of formative assessment are well connected. Teachers may decide a student's ZPD and the needed platforms through which the identification of student knowledge gap through the formative assessment process (Torrance, 2012; Vygotsky, 1978). The responsibility falls upon teachers to adjust their instructional approaches using effective pedagogy based on the feedback obtained from formative assessment. This process allows educators to align their teaching methods with the specific learning needs and challenges faced by their students. Consequently, the combination of informed instruction and knowledge acquisition can be significantly enhanced when formative assessment demonstrates that students

have grasped key curriculum concepts. This alignment with the Zone of Proximal Development conceptual framework, as elucidated by Heritage and Heritage (2013), can be effectively realized through the thoughtful integration of formative assessment into the instructional process. When students' responses demonstrate knowledge gap or disconnected hold of the relevant Zone of Proximal Development, Heritage and Heritage advised this should prompt the teacher to assess the educational need and decide on the corresponding solution and how it should be executed in a repeated pattern.

Furthermore, as Dagar and Yadar (2016) point out, social-cultural constructivist learning theories contain inherent qualities. They include:

1. The teacher's job shifts from that of an information dispenser to that of an inspirer, facilitator, and guide.
2. Knowledge is developed through communication between the student and the educator.
3. It emphasises student-centeredness, student-directedness, and joint effort, with scaffolding and real encounters provided by the teacher.

Furthermore, Vygotskian theory stresses the scaffolding model. Scaffolding and the Zone of Proximal Development are inextricably linked. Scaffolding, according to Mishra (2013), is tailoring aid and support to a child's present level of performance. In education, scaffolding, according to Myftiu and Topciu (2015), is an educational methodology where the teacher adjusts the technique or learning task to build student independence. According to Mishra (2013), teachers can use Vygotsky's theory to increase the intensity of questioning or specificity until the student can get the right answer. Teaching based on the Zone of Proximal Development, according to Verenikina (2001),

entails reacting to the student's present status of advancement and providing assistance that aids in the achievement of their goals and increases capacity for prospect involvement. In support of this, Mishra (2013) emphasizes that scaffolding instruction entails an expert in a field and educated individual giving assistance or gradual steps to aid the learner's acquisition of knowledge or learning.

Relevance of Constructivist theory in Education

Within a constructivist classroom, students primarily engage in group work, fostering interactive and dynamic learning and knowledge exchange (Harlen, 2006). Davis and Sumara (2002) emphasize that in such an environment, there is a significant emphasis on developing social and communication skills, promoting collaboration, and encouraging the exchange of ideas. This stands in contrast to the traditional classroom, where students typically work independently, relying on repetitive learning methods. In the traditional setting, subjects are strictly adhered to and often guided by a prescribed textbook. Duffy, Jonassen, and Lowyck (1993) outlined several activities that are encouraged in constructivist classrooms:

1. Experimentation: Students engage in individual experiments and subsequently participate in class discussions to analyze and discuss the results.
2. Research projects: Students conduct research on a particular topic and may present their findings to the class.
3. Field trips: These outings enable students to apply the concepts and ideas learned in class to real-world situations, often followed by group discussions.

4. Films: Visual media provides additional sensory input and enhances the learning experience.
5. Class discussions: This method is utilized in all of the aforementioned activities and is a vital component of constructivist teaching approaches.

Assessment in the constructivist approach

In traditional classroom settings, assessment primarily relies on testing, emphasizing the correctness of students' answers (Davis, 1991). However, in constructivist teaching, the learning process is considered equally significant as the final outcome. Consequently, assessment encompasses not only tests but also includes observations of students, their work, and their perspectives (Davis, 1991). As per Davis (1991), constructivist assessment strategies encompass:

1. Oral Discussions: The teacher initiates open discussions by presenting students with a "focus" question, encouraging discourse on the topic.
2. KWL-H (What We Know, What We Want to Know, What We Have Learned, How We Know It) Chart: This method can be employed throughout the study of a specific topic and serves as a valuable assessment tool, illustrating a student's progress over the course of study.
3. Mind Mapping: In this activity, students compile and categorize concepts and ideas related to a particular topic.
4. Hands-On Activities: These activities prompt students to interact with their surroundings or specific learning materials. Teachers

can employ checklists and observations to assess students' proficiency with the materials.

Social Learning Theory

People can learn new behaviours through seeing others, according to the Social (or Observational) Learning Theory. This concept pertains to the mutual relationship among ecological and social factors, the manner in which individuals perceive them, and the extent to which an individual possesses the capacity and motivation to replicate the observed behaviors. This theoretical framework is grounded in the notion that our learning is profoundly influenced by our interactions within a group setting, as articulated by Nabavi (2014). Independently, individuals take on similar practices through noticing the activities of others. Individuals acclimatise and emulate others' conduct subsequent to seeing it, particularly assuming their observational encounters are favourable or include prizes contingent on the observed behaviour.

According to Bandura (as described in McLeod, 2011), behaviour is learnt in the natural setting through observation. Albert Bandura opined Social Learning Theory due to the inability of behaviorism to explain all surrounding learning. He felt that behaviour and environment were intertwined. Bandura's social learning speculation was propelled by the progressions he found in a youngsters' activities in the wake of noticing a grown-up show outrage. Self-guideline, as per Bandura, permits us to deal with our own behaviour. Self-regulation necessitates self-observation, judgments about ourselves and our surroundings, and self-response. People have an impact on the world around them and are impacted by it. Social learning theory or observational learning is

said to be at work when the behaviour of an observer is altered after observing a behaviour. The good or negative exhibition of behaviour witnessed can influence an observer's behaviour.

The combination of innate elements such as cognitive, affective, and biological events; behaviour; and surrounding events explain much of the growth in human cognition (Lou, 2013). Nabavi (2014) cited Bandura's famous "Bobo doll" experiment to analyse behavioural patterns using social learning theory, and that people learnt various practices by demonstrating their singular conduct after the showcases of models. The results of Bandura's "Bobo Doll" experiment influenced the trajectory of contemporary psychology, where he is largely recognized with helping academic psychology move its focus from true behaviorism to cognitivism. He confirmed that children replicate the behaviours they see in others. Bandura argued that direct reinforcement could not account for all types of learning, and that people can learn new information and behaviours through watching other people, according to Banyard and Grayson (2000). According to Shaffer (2005), people learn from one another, via: Observation; Imitation; and Modeling.

Observational Learning: According to Lou (2013), Bandura established that children learn and replicate behaviours they see in other people in his famous "Bobo doll" experiment. In Bandura's study, children witnessed an adult acting violently toward a "Bobo doll." When the children were later allowed to play with the "Bobo doll" in a separate room, they began to emulate the violent behaviour they had previously witnessed.

Imitation Process: This alludes to the capacity to rehash a conduct or activity. A child who observes a particular conduct as often as possible is probably going to have the option to copy and reproduce it sooner or later.

Modeling process: It is imperative to remember that some observed displays may or may not be acquired successfully. O'Rorke (2006) has itemized ways by which modelling processes impact learning. The model and observer should keep the accompanying guidelines for the interaction to be effective.

a) Attention: A model must be primary focus of the individual.

b) Retention: The observer should remain cable of recalling the behaviour they have seen.

c) Reproduction: The capability to reproduce the behaviour displayed by the model is the third criteria.

d) Motivation: Finally, there must be a drive for modeling to happen, since learners must desire to replicate their observation.

Relevance of Social Learning theory in Education:

It is worth noting that the relevance of conveyed influence comes from the fact that observers might develop long-term attitudes, affective reactions, and behavioral patterns to people, places, or objects linked with modeling. Mathematics encompasses practical endeavors that include calculations and critical study of events and relationships in order to creatively solve global problems. According to social learning theories, individuals build analytical skills, critical thinking, logical reasoning abilities and mathematical abilities by observing a model.

According to Lawal and Obebe (2011), the social learning theory encourages learners to stay attentive in the process of collaboration, the use of

the immediate environment to help meet the basic needs, norms, morals, and real events, cultural identity, and its vibrant on-going features, all of which are essential for Ghanaian student's development. In the school setting, the mathematics teacher becomes the model whiles in the indigenous informal education system comprised students' family members, local area elder folks, and guardians act as models by helping the child with homeworks and assignments.

Edinyang et al (2015), argue that learners remained expected to replicate the unwritten curriculum's content, which required them to actively participate in the teaching-learning process. The native educational plan reflects Albert Bandura's idea of modeling and imitation. A number of educational practices were utilised to pass on society standards and qualities to the children through play-acting, dramas, observation, presentation, simulation, investigation, self-teaching and learning, and peer interaction.

Watson, as cited by Shaffer (2005) believed that a child is a clean slate, a vacant record to be composed on by exposure to the environment. Watson, a social learning theorist, claimed parents and significant others in children's surroundings contribute to how they turn out in future. He considered growth to be a permanents process everyone goes through and it is shaped by their environment which varies from person to person.

For the effective and successful transmission of instructional goals, attitudes, talents, and aptitudes in mathematics education, it is imperative that individuals within the learner's immediate environment align with the qualities sought to be instilled. This alignment is crucial as it directly influences students' learning outcomes. Being able to model and demonstrate these attributes can

bolster a learner's self-confidence and character. Moreover, it can impact how they are perceived and accepted by their peers and society at large, ultimately contributing to the attainment of educational objectives.

At the point when students become self-managed, in addition to the fact that they develop their own learning objectives, yet track their direction to those objectives, and assess the productivity of their endeavors. The theory explains why teachers clarify their cognitive processes while demonstrating good abilities, and why students who self-direct show improvement over their companions who do not. According to Lou (2013), both intellectual and social learning standards are employed to produce desirable behaviours in learners; the combined use is more effective than using only behavioural principles. The discriminative stimuli are the learner's thinking. Self-instruction, in which the student teaches himself, is a good fit for this technique.

Bandura (as stated in Lou, 2013) defines self-efficacy as an individual's faith in their capacity to achieve the blueprints needed to oversee imminent difficulties, or an individual's confidence in their capability to succeed in a certain situation. As children encounter with a wide range of events, tasks, and situations, these beliefs begin to form in early life. Self-efficacy development, on the other hand, does not stop in adolescence and continues throughout life as people gain new abilities and experiences. Observers pay attention to models, according to O'Rorke (2006), at the point when they accept they are equipped for learning or imitating the exhibited conduct. Self-efficacy is influenced by observation of similar models since it tests the learner's potential to successfully imitate events. These social learning speculations suggest that presenting students to appropriate behavior in mathematics classes will aid in the

achievement of mathematics' aims and objectives, as well as the development of persons with the appropriate skills and potentials to thrive in society.

Social learning theories propose that students' behavior can be influenced and transformed through the process of observing and imitating behaviors and actions that occur within the classroom. In the realm of education, the primary objective is to serve as a model for students, guiding them towards adopting socially acceptable norms, attitudes, and achieving academic success. Social learning theories offer valuable insights into the mechanisms through which teachers convey learning objectives to their students. In this context, formative assessment emerges as a tool that fosters lifelong learning practices that are not only embraced within the educational setting but also recognized and accepted by society at large.

Conceptual Review

The Concept of Assessment

The term 'assessment' can hold varying interpretations for different individuals. Nitko (2004) explains that within state institutions, including teachers, measurement experts, and stakeholders, assessment is viewed as a method for collecting data used to inform decisions related to students' curriculum, programs, and even national policies. In assessment, teachers communicate with students in a variety of ways in order to obtain useful information and make judgments about many parts of their lives. Tamakloe, Amedahe and Atta (2005), maintained that "assessment occurs when one person through some kind of interaction with another, obtains and interprets information about that other person in terms of his knowledge and understanding or abilities or attitudes" (p. 176).

McMillan (2001) highlights several essential assessment concepts that teachers need to grasp in order to make accurate judgments about their students. Various methods should be employed to acquire the information in order to eliminate any bias. In order to make a judgement regarding the student, the information obtained could come from a variety of sources. McMillan agrees that assessment must be used to acquire information about students' progress. Also, Broadfoot et al (2002) assert that assessment is the most common way of looking for and deciphering proof for use by students and their instructors to choose where the students are in their learning, where they need to go and how best to arrive.

Assessment serves multiple purposes, benefiting not just students but also teachers and various stakeholders. As McAlpine (2002) suggests, assessment functions as a means of communication, providing feedback to students on their learning progress. It also offers feedback to teachers about their teaching methods, curriculum designers regarding the curriculum's effectiveness, administrators regarding resource allocation, and employers in assessing job performance quality.

Furthermore, assessment plays a crucial role in safeguarding the welfare of society. For instance, as outlined by the Organisation for Economic Co-operation and Development (OECD) (2012), the assessment framework for evaluating the competence of graduating engineering students aims to assess their capacity to apply fundamental engineering and scientific principles, engineering methodologies, and general skills in addressing societal challenges. This evaluation of competence is essential to promote enhancements in the

quality of life, address social requirements, and contribute to the economic prosperity of the community (OECD, 2012).

Biggs (2003) and Boud and Falchikov (2007) emphasize that the process of assessment is intricate, entailing significant challenges, motivations, and inherent values. The practice of assessment sparks extensive debates involving academics, industry professionals, government bodies, students, and various stakeholders in society. Each of these groups holds distinct agendas, assumptions, and perspectives regarding assessment. Gipps and Murphy (1994) suggest that the design of assessment should follow a clear understanding of its purpose. This diversity of viewpoints underscores the notion that assessment carries different meanings for different individuals. Within the realm of education, assessment can be categorized into three main types: summative assessment (assessment of learning and development), formative assessment (assessment for learning and development), and assessment as learning.

Formative Assessments

Assessment for Formative purposes are direct and indirect measurements of understanding which are utilised through the educational cycle to track learners' development toward set objectives or expectations. Rather than simply assigning a grade, the fundamental purpose of formative evaluations is to increase learning (Godbout & Richard, 2000). Formative assessments provide educators with information that helps them make appropriate instructional decisions that fit the requirements of their students. According to William James Popham's research, "if teachers use the means-ends paradigm of formative assessment in their classrooms, their pupils would learn better" (Popham, 2013, p. 5). Because formative assessments are intended to guide

instruction, they must be delivered at regular intervals during the unit or course in order to provide feedback and maximize student progress.

Formative assessment, according to Ojugo (2013), is advantageous to both students and teachers because it aids in the diagnosis of students' learning issues and the prescription of different remedial procedures aimed at enhancing academic proficiency in the topic at hand. As a result, appropriate teaching strategies to assist students in comprehending the topic issues in attempt to optimise their academic accomplishments in a subject. The primary needs for successful formative assessment, according to Ugodulunwa and Uzoamaka (2015), are the implementation of good assessment instruments and the subsequent application of the data accumulated from these tests to further develop guidance and learning.

Formative assessments can be done in a variety of ways. The following are some of the strategies or practices used for formative assessments:

1. Analysing Learner's work – Instructors evaluate students' work in relation to predefined standards to identify disparities between their actual performance and the learning goals. This information is then utilized to determine whether students have achieved mastery of the learning objectives, providing educators with insights to enhance or adapt their teaching methods.
2. Classroom Polls - This method serves as a means to gauge the collective comprehension of the entire class. The teacher poses a question and conducts a survey of students' responses to determine the frequency of selections for each option (e.g., 'Indicate your choice by raising your hand if you selected option A, B, C, or D.'). Students convey their

answers by either inscribing them on chalkboards or indicating their choices by raising their hands, demonstrating the number of fingers representing their selection. According to Bambrick-Santoyo (2016), this approach allows for a rapid and straightforward assessment of learning.

3. Conferencing — In this assessment method, the teacher engages in a one-on-one meeting with the student to discuss a particular assignment. During the conference, the teacher assesses the student's understanding of concepts and offers immediate feedback for enhancement (Fluckiger, Vigil, Pasco & Danielson, 2010).

4. Essays/Open-Ended Questioning — To demonstrate mastery or understanding of a learning objective, students are presented with a question for them to address. An open-ended question requires learners to generate their own solution, rather than choosing the correct answer from predefined options (closed-ended). Closed-ended questions demand a higher level of thinking compared to open-ended essay questions. Open-ended questions assess both the breadth of content and the depth of students' understanding of topics (Eddy & Kuehnert, 2018, p. 37).

5. Exit Tickets – This strategy is mostly referred to as "Tickets Out the Door," are assessments where students have a limited amount of time to answer to a test, answer a problem, or summarise the central idea of the day's course. An index card or a "sticky note" is commonly used for this type of informal assessment (Dodge, 2009).

6. Formative Paper-Pencil Assessments – Multiple-choice tests, expository items, execution exercises, and other assessment tactics are used in this sort of assessment to permit learners to show authority of an idea. The findings of formative paper-pencil tests are evaluated and shared with students as a mind on their development (Ketabi & Ketabi, 2014).
7. Games - Instructive games are generally utilised in class by instructors as a great method for checking learners' comprehension. Instructive games are broadly utilised in the classroom by educators as a great method for checking learners' understanding. Because of the wide range of possibilities and their motivating appeal, they are widely used for purposes of analysis. They could be utilised to assess an individual's or a group of students' knowledge (Kumar, 2018).
8. Graphic Organisers - Students use graphic organizers to establish links in their knowledge, emphasize relationships between concepts, and consolidate subject knowledge (Dodge, 2009).
9. Journal Reflections - Students must express themselves and record their ideas and experiences in a diary as part of this continuing evaluation technique. Reflective journals have the benefit of documenting the learner's personal developments over time (Clark, 2012).
10. Multiple Choice Assessments – The simplicity with which it can be graded and the fact that it is objective make this type of formative assessment appealing. Barlow and Marolt (2012) stress that learners are given a brief and told to choose just the right option(s) from the accessible conceivable outcomes.

11. Observation - All through this technique, the instructor notices or records learners at work in order to restructure instruction. Teachers can use this method to discover more about their students' mental cycles, studying styles, and misguided judgments (Liu, 2013).
12. Performance-Based Assessments – Learners must deliver a presentation, achieve an objective, or build or fabricate an item with practical applications. This strategy of evaluation is expected to survey student's critical thinking and decisive reasoning capacities (Harada, 2004). Harada (2004) argues that in this type of testing, students must design an artefact and submit as proof of learning.
13. Portfolio - A portfolio is an aggregation of a student's composed tests from a course all through occasions. The students' work is gathered and inspected to show their development after some time. The portfolio work chose ought to show an assortment of capacity and abilities created all through the course. Portfolio appraisals can likewise be utilised to advance self-reflection and improvement (Adeyemi, 2015).
14. Quizzes — Before taking the summative exam, class tests can be utilised as baseline exercise to determine whether or not a learner knows their teaching material. Quizzes should be directly tied to specifications and instructional objectives. A quiz may use a number of question styles (constructed responses, multiple-choice, supply short answers and so forth) to measure student development and further improve knowledge (Turner, 2014).
15. Self-assessments – This sort of developmental evaluation further enhances the education system by necessitating learners to guage their

own development relative to specified desired outcomes. Panadero, Brown and Strijbos (2016) argue that students are trained and encouraged to "manage their own learning" by "verifying their work and progress match with benchmarks, assumptions, goals, or objectives" (p. 811).

16. Summarization/Reflection - Time is allotted to learners from their studies to ponder what they have learned and make meaning of the knowledge gained. Summary is a helpful developmental evaluation action since it encourage learners to solidify content, sort through thoughts and discover the most vital information. Reflective summarization is one of the less demanding forms of formative assessment, and research have shown that it lets learners retain their information, thereby improving learning (Bingham, Cone, Mock, Heberlein-Larson, Stanek, Blackmore, & Likos, 2016).

According to Stiggins (2007), traditionally, assessments have been a tool to identify disparities in students and then rank them accordingly. Assessment in its present form evokes negative reactions from pupils who are struggling intellectually. When a student obtains unfavorable summative assessment results, he or she feels forlorn and terrified, as if he or she is a failure who is embarrassed. The unfavourable responses to summative assessment data lead students to pursue easier learning experiences, avoid new concepts or critical thinking, and avoid obstacles, and the findings urge students to give up if they are not successful right away.

According to Stiggins (2007), formative assessment has an impact on student achievement because it is based on changing the student's attitude

toward the use of assessments and including the student as the primary user of the data. This notion is backed up by Leahy, Lyon, Thompson, and Wiliam (2005), who argue that education has to shift from collecting rights and wrongs to encouraging instructors to gather data to influence instructional decisions. Students should also have access to this information in order to make informed learning decisions. Current education, according to Leahy, Lyon, Thompson, and Wiliam (2005), is similar to quality control in manufacturing: identify those who did not learn at the end of the lesson. They proposed that education should be viewed as a quality assurance process, with data collected through formative assessments used to decide what needs to be done to ensure that each student learns (Leahy, Lyon, Thompson, & Wiliam, 2005).

Strengths of Formative Assessment

In many ways, formative assessment benefits the educational process. As verified by Bekula (2010), it is utilised to enlighten what learners are expected to learn, equip instructors with educational methodologies, and permit reteaching to address the issues of struggling students. Assessment for learning also benefits the instructive interaction by giving "constant" information that permits educators and students to change their instructing and learning (Crossouard & Pryor, 2012). It encourages teachers to employ effective tactics in the classroom since they can gather data and alter teaching and learning in real time.

Hollingworth (2012) argues that students become self-reflective about their learning and development through the usage of Formative assessments by teachers as well as making appropriate instructional decisions. Assessments that is formative allow students to monitor their advancement over the span of an

academic unit. As indicated by one review, assessments that is formative help stakeholder to gain strong understanding of what is needed for the student by using the information gained to establish learning goals and development of the student (Curry, Mwavita, Holter, & Harris, 2016).

Furthermore, Formative assessments are less costly than other types of assessment. They are normally utilised together with other scholarly strategies to portray a learner's level of achievement. Different appraisals, like end of term, state tests, have higher consequences and may be utilised to elevate a learner to a higher level or gets through a class.

Demerits Formative Assessment

According to Reeves (2009) one significant obstruction in the utilization of assessments that are formative in contemporary classroom is that educators are not privy to viable testing practices when in college and this skill requires extensive and ongoing training to develop. It is a waste of effort if the evaluation does not properly measure what it is intended to measure.

Due to the level of seriousness attached to summative examinations, assessments for learning lack the seriousness and usually low-stakes. This may cause pupils to not take their tests seriously and to not provide their best effort. In such situations, teachers become helpless by not having a candid reflection of their students' ability and the gathered information would be misused. (2018, Sasser).

Formative Assessment Practices Studies in Ghana.

Akyeampong (1997) investigated the nature and extent of activities, as well as the challenges experienced by instructors in the practice of frequent testing of teacher education at the tertiary level in Ghana. Akyeampong

conducted an investigation into the training and support provided to individuals responsible for conducting continuous assessments, as well as the impact of these new assessments on the teaching and learning process. The research followed a qualitative case study design, with three teacher training institutions purposefully engaged as the study's focal points due to their rich information on the central phenomenon of the study. The findings of the study suggested that several challenges persist, posing obstacles to realizing the advantages of integrating continuous assessment into training institutes. College organisational and internal environment, highly qualified support systems for tutors to undertake comprehensive monitoring, tutor mastery in assessment, and assessment-related considerations grounded in tutor ideals and ethics that define their assessment culture and action plan are all critical to such problems. The limited sample size was inadequate to support broad generalizations concerning the challenges affecting continuous assessment practices among tutors in teacher training colleges, highlighting a notable limitation in the study.

Hayford (2008) conducted a study in the Agona and Affutu districts of Ghana, examining the implementation of continuous assessment in basic schools and its impact on lower-achieving students. The research collected data from different sources, including self-administered surveys, focus groups as well as semi-structured interviews. The study interviewed twelve teachers selected from a systematic sample of 107 basic school teachers who completed questionnaires. Also, four focus groups comprising 6 basic school students identified as low-achieving were interviewed. It was found out that majority of teachers believed that continuous assessment had the potential to enhance the performance of lower-achieving students. However, teachers identified

challenges that prevented supporting low achievers such as legislative constraints, larger class sizes, and inadequate training. The lower-achieving students expressed feelings of anxiety, disappointment, and helplessness before and during assessments, as well as frustration in the event of failure. Notably, these students described classroom tasks as challenging and pointed to less supportive learning environments as a major hindrance.

Bordoh, Bassaw, and Eshun (2013) examined the formative assessment Social Studies tutors used across Ghanaian educational institutions to promote cognitive processes. The research was conducted using a multiple case study approach to study three educational institutions located in the Central Region of Ghana. Data from multiple cases were integrated to create a single case for analysis. The selection of teachers and colleges for the study was purposeful and convenient. Data collection involved interviews and classroom observations

Tutors in Social Studies education utilize formative assessment methods to evaluate the learning of teacher-trainees, as indicated by Bekoe, Eshun, and Bordoh (2014). Using a case study approach, their investigation was conducted in three colleges of education in Central Region of Ghana. The selection of both teachers and colleges for the study was based on convenience. Participants included nine Colleges of Education tutors of Social Studies who were interviewed and observed in their classroom setting using a checklist. The study revealed that the nature and scoring of formative assessment practices tended to constrain instructors, leading them to prioritize the cognitive domain over affective and physical activities. Furthermore, the research identified that the frequently used formative assessment approaches included self-evaluation,

diagnostic assessment, peer assessment, and portfolio assessment in teachers training colleges in Ghana. However, it should be noted that the study did not employ a substantial sample size for robust generalization and did not offer an explanation for why the cognitive domain was the focus for tutors at the expense of other domains.

Asare (2015) conducted an investigation into formative assessment practices employed by kindergarten teachers within classroom settings, focusing on two key aspects: (a) the frequently utilized assessment methods and (b) the rationales guiding the selection of specific assessment approaches. The research was structured as a sequential mixed methods study, incorporating both quantitative and qualitative data collection. Questionnaires were distributed to gather quantitative data from a total of 192 instructors from six different regions in Ghana, representing both public and private kindergartens across. Simultaneously, through interviews in-depth qualitative insights were obtained after engaging a subset of three participants from the initial sample of 192 teachers, serving as the source of qualitative data.

The quantitative data obtained in this study underwent statistical analysis through an independent samples t-test. The research outcomes unveiled a prevalent preference among teachers for the paper-and-pencil test format as their primary assessment method. Additionally, the findings suggested that teachers were often inclined to adopt specific assessment practices not necessarily aligned with the curriculum's prescribed assessment guidelines but rather to satisfy the demands of educational authorities and parents. Interestingly, when comparing public and private kindergarten instructors, the study revealed no significant differences across most items in the two assessed

subscales. However, notable disparities emerged in relation to the reasons behind the selection of particular assessment methods. In light of these findings, the study recommended the implementation of workshops and regular professional development opportunities, emphasizing utilizing formative assessment techniques that are suitable for the students' developmental stage. Such initiatives should involve active participation from all stakeholders, comprising teachers, parents, and educational leaders, to facilitate effective coaching of students' learning.

The implementation of Assessment for Learning technique by basic school teachers in Ghana was explored by Osei-Asibey, Kusi, Nimoh, and Bosson-Amedenu (2020). The characteristics, tactics, and concepts that drive Assessment for Learning strategy were used to build a 16-item Likert scale. From the population, the study engage 100 randomly selected basic school teachers as the sample. The researchers reported that instructional division, experience, and sex had a relationship with the utilisationation of assessment as an education approach. Female instructors outperformed their male colleagues when it came to giving intuitive evaluation that gives fast constructive criticism.

In their research, Asamoah, Songnalle, Sundeme, and Derkye (2019) delved into knowledge of formative assessment disparities based on gender among second cycle school teachers in Ghana's Upper West Region. The research design adopted for this investigation was a descriptive survey. To obtain data, 295 second cycle teachers as sample was selected from a larger population of 1,139 educators through the utilization of a simple random sampling technique. In this study, data was gathered through the utilization of a custom-designed questionnaire, and the ensuing results were subjected to

analysis employing an independent t-test. The research outcomes indicated a noteworthy gender disparity in the formative assessment proficiency of second cycle educators. Specifically, male teachers in second cycle institutions exhibited significantly higher levels of expertise compared to their female counterparts. To address this imbalance, it was recommended that educational stakeholders organize seminars and workshops aimed at enhancing the formative assessment skills of second cycle educators, with particular emphasis on female teachers.

In Ghana's Cape Coast Metropolis, Asare (2020) researched public basic schoolteachers' perceptions and formative assessment techniques. The study used a descriptive survey as well as a multistage sampling process to choose 300 teachers from the Cape Coast Metropolis' six (6) circuits. Frequencies, percentages, means, standard deviations, and the Pearson product-moment correlation coefficient were used to examine the data. The findings revealed that primary school teachers believe formative evaluation is beneficial in the classroom. It was also discovered that common practices used by elementary school teachers included ensuring effective class participation, discussing feedback with students, using question and answer during instruction, making formative use of summative assessments, giving students home assignments, and engaging students in role-playing activities. There was a beneficial association between basic teachers' perceptions and their formative assessment procedures, according to the findings. The Ghana Education Service (GES) and the Cape Coast Metropolitan Directorate of Education shall offer short-term courses, workshops, seminars, and other necessary in-service training activities for basic schoolteachers.

In a study conducted by Amoako (2018), the primary objective was to ascertain whether distance education course tutors utilized a diverse range of formative assessment techniques or relied solely on a single method. The research sample consisted of 150 respondents, all of whom were tutors, selected through a census approach. Data collection was carried out using a self-designed questionnaire that underwent pilot testing and subsequent modification. The findings of this scholarly investigation revealed that current formative assessment techniques adopted by on-site course facilitators in Ghana's Distance Education programs encompassed oral questioning, peer assessment, tutor-generated tests, peer-to-peer assessment, and student self-assessment. A noteworthy observation was that the majority of tutors demonstrated a willingness to employ a variety of formative assessment approaches. Based on the results, it was suggested that educators be encouraged to diversify their formative assessment practices through the provision of seminars and in-service training, rather than adhering to a single method

In the Cape Coast metropolitan area of Ghana, Amoako, Asamoah, and Bortey (2019) second cycle teachers' knowledge and competence in formative assessment was examined. Employing a descriptive cross-sectional survey design, the study opted for a census approach to enlist the participation of 148 mathematics teachers from all thirteen public high schools within the specified geographical region under investigation. For data collection, a questionnaire containing closed-ended items was created. In the Cape Coast Metropolis, a significant majority of secondary school mathematics teachers were discovered to lack familiarity with formative assessment techniques. Furthermore, the data revealed a strong beneficial association between formative assessment

knowledge and practices among SHS mathematics teachers. The Metropolitan Directorate of Education, Cape Coast should ensure that SHS mathematics instructors receive frequent workshop and in-service training on formative assessment procedures.

To sum up, a comprehensive analysis of various studies on formative assessment in the educational context of Ghana consistently indicates its widespread recognition and utilization. This assessment approach is not confined to a specific level of education but finds application across the entire spectrum, spanning from primary to postsecondary education.

Summative Assessments

The test administered to learners at the close of an instructional session to measure what has been leaned is referred to as summative assessments. DuFour and DuFour (2010) asserts that summative assessments should answer questions like: "were my students able to grasp the essential knowledge and skills at the end of the day?" Is it possible to answer affirmatively or negatively? Do you believe you'll get a good grade or a bad grade? "Do you consider yourself a pro or a novice?" After an instructional cycle is completed, summative assessments are given (for instance: a final project, senior recital, research paper). Data from summative assessments has a broader influence than data from other types of examinations, which are primarily focused on the particular student. The results of some summative assessments have high stakes since they are meant for promotion, appraise the teacher's pedagogy as well as the performance of the syllabus, or a programme's certification (Garrison & Erhinghaus, 2019).

Advantages of Summative Assessment

Summative assessment ensures high objectivity. This is because they are conducted at the end of a course to measure growth, attainment of skills and achievement of set objectives. Anything dissimilar prompts the attention of the teacher for redress. Also, they are criterion-referenced assessments therefore their attainments signify level of knowledge and mastery of course content (Klapp, 2018). Klapp (2018) argues that summative assessments act as motivation for learners. Also, considering the significance of the assessment, learners accord more seriousness to summative examinations and are encouraged to do their best (Concordia, 2017).

Demerits of Summative Assessments

Most summative tests are recognized considering the numerous strengths and benefits. However, there are several disadvantages to using these assessments. For some high-stakes choices, summative assessments are frequently employed as a single variable. Students in Ghana, for example, are promoted to the next grade based on their achievement on end of term examination and nationwide examinations. Whiles those in basic school must pass end of term examination to move to the next class, final year students must sit and pass nationwide examination to move to the next level in education. Such promotions are done considering less or no results from the formative assessment performance in schools.

Furthermore, most of summative assessments are developed by psychometricians and used as an accountability tool for assessment and state/federal funding, rather than by classroom teachers who teach the topic. For

so many years, structured formative examinations have been doubted on their trustworthiness (Strauss, 2017).

Concept of Academic Achievement

Achievement in academics can be viewed as the demonstration of complete mastery in a particular subject area. This achievement is typically assessed through the assignment of grades, marks, or scores, serving as indicators of a student's traits and capabilities (Dimbisso, 2009). Academic performance, In accordance with the perspective put forth by Ferla, Martin, and Yonghong (2009), provides insights into a person's understanding and their perceived competence in successfully, at a given level, completing academic tasks. Therefore, the notion of academic performance is akin to a consistent evaluation of an individual's perceived competence in a particular academic field or for a specific academic undertaking (Ferla, Martin & Yonghong, 2009).

Adane (2013) underscores that assessing students' academic performance can be inherently objective, as it involves assigning various scores to their learning outcomes. These scores serve as measures of students' adaptability within the educational system as a whole. Conversely, the subjectivity of academic performance arises from the influence of students' attitudes toward their own achievements and self-perceptions, as well as the attitudes of significant individuals in their lives towards their success and self-concept (Adane, 2013)

The academic performance of students in mathematics can vary, falling into categories of high or low achievement. This study, however, specifically focused on the aspect of low academic performance among students at the basic level in mathematics within Nsawam-Adoagyiri Municipality. Diaz (2003)

contends that poor academic performance can be described as a circumstance in which students are subsequently impacted in their personality and overall life because they cannot achieve the expected competencies in a chosen field. Likewise, Aremu (2005), when describing low academic performance, observed that it is a situation in which a student's performance falls below the anticipated standard established by the assessor.

The relevance of Mathematics Skills

The skills acquired via the study of mathematics are widely applied in many facets of human life (Mensah, Okyere, & Kuranchie, 2013). According to Anthony and Walshaw (as mentioned in Mensah et al., 2013), mathematics has a crucial part in determining how people handle their personal, social, and civil life. Every civilization views mathematics as the backbone of scientific and technological knowledge, which is critical to a nation's economic transformation (Mbugua, Kibet, Muthaa & Nkonke, 2012).

Mathematics has evolved into an essential tool that no nation aspiring for socio-economic progress can afford to neglect in its educational pursuits. Its significance extends beyond academic qualifications, as it equips individuals for diverse future endeavors, regardless of their chosen career paths (Davis & McPartland, 2012). It is essential to emphasize that mathematics permeates every aspect of the universe, intertwining with the daily lives of individuals. Consequently, it stands as a subject without which education and human functionality would lack meaningfulness (Mefor, 2014).

Mathematics, as a discipline, shares an intrinsic connection with various technical and scientific fields, rendering it the cornerstone for economic as well as, technological, and scientific development in every nation (Umameh, 2011;

Tshabalala & Ncube, 2013). In the words of Mefor (2014), mathematics, especially core mathematics, finds relevance in virtually every aspect of the world, intricately woven into one's daily existence. Consequently, it stands as a subject indispensable for meaningful functioning in society. UNESCO (1999) underscores the necessity of mathematical knowledge for reducing poverty in Africa whiles promoting industrialization.

In the educational landscape of Ghana, mathematics, especially core mathematics, assumes significant prominence across educational policies and the curriculum, spanning all education levels. Mathematics, as mentioned by Sa'ad, Adamu, and Sadiq (2014), assumes a critical role in nurturing fundamental computational skills, fostering precision in problem-solving, and equipping individuals with the competence to comprehend and engage with advanced mathematical concepts. Furthermore, learning mathematics greatly enhances one's abstract thinking and logical reasoning, the capacity to identify and resolve challenges through mathematical knowledge, and instills creativity and inquisitiveness in individuals as they seek solutions in their daily lives. Acknowledging its central significance, Ghana mandates mathematics as a mandatory subject taught across levels in all educational institutions.

According to Mereku (2012), within the Ghanaian educational framework, mathematics has been granted the requisite significance within the curriculum and educational policies, spanning all educational levels. Mathematics plays a pivotal role in cultivating fundamental computational skills and knowledge, thereby promoting precision in problem-solving and facilitating the pursuit of advanced mathematics (Sa'ad et al., 2014). Therefore, comprehensive engagement with mathematics nurtures the development of

logical and abstract thinking capabilities, problem-solving proficiency aided by mathematical knowledge, and exposes individuals to creativity and a sense of curiosity as they explore solutions to their everyday challenges (Sa'ad et al., 2014).

Similarly Akinyi (2003) maintained that mathematics as a discipline enjoys a prestigious standing owing to its fundamental role in driving scientific breakthroughs. Akinyi highlighted that pivotal inventions like computer, calculators, satellites, telegrams, radio, and television and others, owe their existence to the myriad achievements in pure mathematics. The significance of mathematics within the realm of education is underscored by its multifaceted applications, rendering basic mathematical knowledge indispensable for individuals employed in both public and private sectors as they navigate their daily pursuits.

As noted by Akinyi (2003), mathematics holds substantial importance, particularly for individuals engaged in public and various other sectors, necessitating a foundational understanding of mathematics for their daily activities. As a result, mathematics retains its significance as a fundamental subject of study in universities that provide business and scientific programs, and it serves as a prerequisite for various job openings. (Akinyi, 2003). Given the significance of mathematics in both personal and educational domains, concerns arise not only regarding poor academic performance but also the potential impact on the development of future leaders who require robust analytical and problem-solving skills.

Mathematics at the Basic Level in Ghana

Mathematics education in basic schools is mandated as an essential subject for all students. It equips students with fundamental scientific and analytical skills, preparing them for the study of science related disciplines like physics, biology and chemistry at the second cycle levels. Notably, in Ghana, core mathematics is also a prerequisite for admission to tertiary educational institutions offering scientific and business programs, as well as many employment opportunities. To meet admission requirements for second cycle education, students must achieve a grade between 1 and 8 in their culminating statewide examination (BECE) in mathematics. Consequently, students aiming for both advanced education and lucrative job prospects must excel in core mathematics. It underscores the importance of implementing measures to enhance students' academic performance, particularly in mathematics.

Research studies have consistently pointed out the subpar students' performance in mathematics at the basic level. (Mills & Mereku, 2016; Mereku, 2012). The causes of poor performance have been linked to several identified challenges, including how the teaching of mathematics has change in the course of time (Mereku, 2000). Notably, the established school curriculum for mathematics may pose difficulties for educators who perceive modern mathematics as a replacement for traditional approaches. Consequently, some teachers may allocate significant instructional time to foundational topics like sets, numeration systems, rational numbers and integers, often overlooking real-life applications. This tendency is more pronounced at the basic levels, where educators can struggle with effectively teaching certain modern syllabus content

in years two and three, potentially resulting in the omission of crucial topics (Mereku, 2000).

Building on the aforementioned insights, when certain topics are omitted due to teachers' unfamiliarity with basic-level content and other factors, students encounter a conceptual gap that hampers their ability to grasp related concepts at the secondary level. Directly, this impacts foundational knowledge of students, aligning with the objectives outlined in the syllabus for teaching mathematics at the second cycle level in Ghana. According to the National Council for Curriculum and Assessment (2010), mathematics is increasingly intertwined with students' everyday experiences, it is imperative for them to acquire practical knowledge at the elementary level before advancing to secondary education to attain a more profound understanding of core mathematics.

It is crucial to emphasize the importance of mathematics in the junior high school education context. Fundamental mathematical knowledge plays a pivotal role in laying a strong foundation for the development of essential mathematical understanding and skills, which in turn contributes to improved academic performance among students. Additionally, this knowledge empowers students with the ability to apply mathematical concepts to real-life situations, thus equipping them for advanced studies and future careers across various fields such as mathematics, science, commerce, industry, and beyond (National Council for Curriculum and Assessment, 2010).

Considering the elementary level, it is believed that Ghana has a weakened foundation due to the poor performance in mathematics, making the issue of low performance a critical concern. Numerous reports about statewide

examinations at the basic level show that students' academic achievement in mathematical ability at Ghanaian, specifically, Junior High Schools has been consistently low and is a matter of concern for improvement (Mereku, as cited in Mills & Mereku, 2016)

Assessment in Mathematics

Formative assessments are defined as assessments that are used to improve learning (Stiggins & Chappuis, 2005). While different experts in the field have different definitions of formative assessment, they all have some basic components. Formative assessment is an orderly and ongoing procedure used by educators to evaluate learners acquisition of knowledge while it is yet in session during instruction (Black & William, 1998). At the classroom level, assessment for learning is identified with educational targets and coordinated into each part of instructing and learning. In this appraisal, both the instructor and the student are enthusiastically partaking (Stiggins & DuFour, 2009). An essential objective of formative assessment is to give educators with a nonstop input circle that permits them to adjust continuous guidance and close learning holes. Formative assessment, as described by Kaminski and Cummings (2007), involves utilizing data to adapt teaching methods in order to meet the learning needs of students.

According to one of the Principles and Standards for School Mathematics, teachers should "build new mathematical knowledge through problem solving," (National Council of Teachers of Mathematics, 2000). Hence, learners must be offered the platform without discrimination or favour to practice with quality problems that encourage and instill love for arithmetic or confidence. Educators should comprehend the critical thinking cycle and give

learner with directed guidance and a scope of critical thinking exercises to help such learning (Kroll & Miller, 1993). Due to the co-morbidity of reading and mathematical challenges, SWD often face the added barrier of deciphering text when solving problems (Knopik, Alarcon & Defries,1997).

Problem-Based Learning is an educational technique that aims to provide students with trustworthy real-world situations in order to strengthen their problem-solving abilities (PBL). PBL has its origins in Dewey's (1944) belief that teachers should appeal to pupils' inherent tendencies of creativity and investigation. It was this idea that learning ought to be connected to "day to day existence," and that thusly, students' ability to learn and think would naturally build (Dewey, 1944). Albeit this thought was embraced by clinical foundations to show grown-up students, it has just recently acquired instructive footing in government funded schools. Problem-Based Learning is defined by Barrows and Tamblyn (1980) as learning that occurs as a result of attempting to comprehend or solve a difficulty. Problem-Based Learning (PBL) in the classroom, according to Delisle (as referenced in Oestreicher, 2019), readies the present 21st century students for achievement in a quick changing climate by creating capacities in reasoning, exploring, critical thinking, and innovation.

Empirical review

Formative Assessment and Student Achievement

Some researchers have conducted studies to determine which educational approaches had the best impact on learners achievement. Hattie (2012) performed meta-analyses research articles on student achievement to find which teaching techniques had the greatest influence on performance. He discovered that two procedures utilised in the formative assessment process

have the greatest effect size of any strategy tested. Teacher questioning and student-to-teacher feedback contributed to students achievement (Hattie, 2012). The relevance of this research supports the use of formative assessment in promoting overall student progress in schools, particularly those with poor standardized examination scores.

Other scholars have investigated how the use of formative assessment has an influence on student progress across diverse disciplines. Mehmood, Hussain, Khalid, and Azam (2012), for example, used a pretest/posttest paradigm to conduct an experimental investigation on English learners. According to statistical analysis, there was no genuinely huge contrast in pretest outcomes between the experimental and control participants. The participants instructed as well as evaluated by an instructor that utilised assessment for learning, had a mean posttest score of 26.86, contrasted with the benchmark group's mean score of 14.83. As indicated by Mehmood et al., assessment for learning essentially affected learner's accomplishment.

. In a comparative report, Ali and Iqbal (2013) researched the impact of using formative assessment in the class on progress in science. The intervention class was taught six scientific chapters embedded with formative assessment in the courses. The benchmark group did not get formative input yet composed a test toward the finish of every part. As per the discoveries, learners trained by means of the intervention did better than the benchmark group as far as progress was concerned

Li (2016) found an observable impact of formative testing on learners' development in literacy and fluence skills in a state administered examination. The researcher investigated the connection that linked formative appraisal and

students' literacy accomplishment utilizing the 2009 PISA test, a global standardized examination. Li evaluated students' reactions on the survey about the recurrence of their instructors' formative assessment procedures, educator-learner connections, understanding perspectives, reading habits, and student PISA reading section scores. According to the findings, formative assessment and reading achievement are highly correlated for Minority children than for White children. Similarly, reading achievement and assessment practices that are formative are significantly correlated for Minority children than for White children (Li, 2016). The research revealed that the group that upheld the utilization of formative assessment to support the ethnic minority student achievement in literacy and fluency and also an improvement in comprehension scores.

Curry, Mwavita, Holter, and Harris (2016) conducted research in a district that encouraged instructors to collect data from assessment instruments that are formative in nature as a way to improve student performance on standardized tests. The state examinations revealed a moderate increase in student reading scores. Similarly, Hattie (2012) discovered that increased teacher use of formative assessment boosted learners achievement on standardized assessments. According to research, school administrators must be aware of teachers' assessment techniques that are formative which are necessary to increase students progress.

Klute, Apthorp, Harlacher and Reale (2017) published a meta-analysis of twenty-three papers to see how formative assessment affects student learning. Nineteen of the twenty-three studies were found to have sufficient data to measure 30 distinct effect sizes. The study discovered that of all the students

who took part in the experiments, those who used formative assessment performed better on "metrics of academic accomplishment" than those who did not participate in the formative assessment instructional process. According to this comprehensive analysis of studies, "formative assessment had a beneficial influence on student academic success on average across all studies" (Klute et al., 2017, p. 6). This assessment can provide guidance to educators and schools on how to effectively employ formative assessment in order to attain the best level of academic achievement.

On the contrary, literature has reported that formative assessment has no statistically significant influence on learner academic success. According to Andrews (2011), Collins (2012), and King (2003), formative assessment did not have a favorable impact on students' academic progress; nevertheless, the effect was not statistically significant. Formative assessment did not have a substantial impact on students' achievement, motivation, or conceptual changes, according to Yin et al. (2008); however, this was due to the difficulty of implementing formative assessment effectively and not necessarily its efficiency. Tuominen (2008) similarly found formative assessment not effective in improving student academic development, citing the study's short duration and the diversity of teachers' unique methods as reasons.

In Educational Psychology, Wininger (2005) conducted a scientific inquiry to show the effects of assessment that is summative-formative on second administrations of a test. From an Educational Psychology course instructed by the researcher, 34 students were assigned to the treatment group. Students were encouraged to self-evaluate their performance after receiving feedback from the lecturer and classmates. The control group included 37 students who were also

assigned to the class of the researcher. There was no additional feedback or self-assessment assistance was provided aside students receiving a copy of their test materials that contains information on which items on the test they missed. The treatment group greatly outperformed the control group when the test was retested on the participants, where feedback was given to students in the experimental group. The participants that received the treatment obtained nine marks when they made an initial attempt at the examination, while the control participants got two marks. Furthermore, thirty-nine percent (39%) of the observed variance could be attributed to participation in the first test whiles extra 25% came from the formative summative treatment.

After a six-month training period with 24 teachers, Wiliam, Lee, Harrison, and Black (2004) investigated the influence of the use of formative assessment on knowledge acquisition. While the findings are encouraging, the authors have raised severe concerns about their generalizability. First, they stressed that because each of their findings represents a different "mini-experiment," caution should be exercised in making any wide determinations with respect to the net impact of carrying out formative assessment (p. 60). These researchers additionally bring up that the way of comparison utilised in every "smaller than usual test" was unique. For instance, in one study, a teacher that taught different groups of students from previous and current academic years were compared in terms of performance. In another comparison, Wiliam and his research collaborators made a comparison of one teacher's students in two different classes. These authors concluded that the quantitative proof they provided was "hard to comprehend" because of the anomalies in the study's research design (Wiliam et al., 2004; p. 62).

Moyosore (2015) looked into the impact of formative assessment on secondary school mathematics achievement. The research was guided by three theories. It was decided to use an experimental research design. Using a purposive technique, the study sample 120 Mathematics students from two public second cycle institutions in Iseyin Local Government, Oyo State, Nigeria. Students are introduced to formative assessment have a large significant difference in their mean achievement score (t = 36.54, p =.001), whereas students who are not exposed to it have no critical distinction (t=2.053, p = 0.045). Gender difference related to mathematics scores among students who receive formative assessment was not significant (t=0.112, p = 0.053). As a result, instruction combined with formative assessment leads to an increase in students' academic attainment.

The impact of remediation and feedback as instructional tactics on junior secondary school students' mathematics achievement were explored by James and Folorunso (2012). Gender and socioeconomic level had an impact on these learning outcomes as well. From the Akure South Local Government Area of Ondo State, the study randomly selected 240 junior secondary two (JSS II) pupils from three co–educational schools. Participants were grouped into those exposed to Formative Testing without remediation and feedback, those exposed to Formative Testing with remediation and feedback and Formative testing with comment from the teacher only as levels of treatment using a quasi-experimental design. Students' socioeconomic position (high, medium, and poor) and gender were used to determine treatment levels (male and female). Five study instruments were created, verified, and used to collect all essential data that involved Mathematics Achievement Test (MAT) the Socio-Economic

Status Questionnaire (SESQ), and three Formative Tests in Mathematics. Scheffe's Post–Hoc comparisons as well as Analysis of Covariance (ANCOVA) were used to analyze the data. The study revealed that feedback and comments from teacher had a considerable impact on pupils' mathematics attainment. However, no significant influences of gender or socioeconomic level (SES) on mathematics achievement was recorded.

In a fifth-grade history studies class, Ozan and Kincal (2018) investigated the effects of formative assessment procedures on students' academic achievement, attitudes toward lessons, and self-regulation abilities in Erzurum. The investigation was conducted using mixed method research. In the academic year 2014–2015, the sample comprised of 45 pupils, as well as a teacher who carried out the activities. It took a total of 28 weeks to carry out this scholarly work. Data was collected using social studies performance assessments, attitude inventories for social studies classrooms, self-regulatory learning skills measures, semi-structured interview forms, and observation forms. With regards to the outcome of the review, it was found that students exposed to the treatment thus formative assessment had a lot higher scholarly accomplishment and better attitude about the class over control group participants. Although the formative assessment had a good influence on the students' self-regulation skills, both experimental and control participant did not perform differently.

Using a quasi-experimental design, Ugodulunwa and Okolo (2015) studied the impact of using formative assessment to test performance and anxiety among secondary school students in Jos, Nigeria. From a population of 2,326 form two students, the study used simple random sampling techniques to

sample of 110 students. Data was collected using two different types of mathematics achievement tests and a scale for mathematics test anxiety. to to analyze the data inferential and descriptive statistical techniques were utilised. Formative assessment lowered anxiety and enhanced pupils' mathematics performance, according to the findings.

Gender, Formative Assessment and Academic Achievement

A study to test whether formative assessments influence on students' marks in mathematics was different based on gender by Moyosore (2015). The experimental group's post-test was analyzed using an independent sample t-test based on their gender. According to the findings, male students in the experimental group had a mean score of 29.1 while female students had a mean score of 29.17. The findings revealed that both male and female students performed similarly well, with a mean score of 29. Despite the fact that there was a difference, the difference was not significant, making $p = 0.053$ insignificant because $p > 0.005$.

Lubienski, Lubienski, and Crane (2009) referred to the assessment conducted by the National Assessment of Educational Progress, which found that gender disparities in mathematics achievement and attitudes were generally limited. Female and male students showed differences in domains such as geometry, numbers and operations, and measurement. Notably, gender differences were absent for Hispanic students but were noticeable at the upper end of the score distributions, particularly among white, high-SES learners (McGraw, Lubienski, & Strutchens, 2006). For both boys and girls, arithmetic achievement was highly linked to future competences in and approach to science subjects, according to a study (Ma & Xu, 2004).

Among college students performance in integrated science, gender disparities was investigated as indicators to academic excellence by Raimi and Adeoye (2002). They discovered considerable disparity regarding science achievement between female and male students. In terms of marks in integrated science, male students outperformed their female counterparts. Raimi and Adeoye (2002) found considerable disparity between female and male learners' attitudes toward integrated science, with the later showing better attitude. Perhaps this explains why males outperform females in comprehensive science achievement. This research backs up Raimi and Oduwaye's (1997) findings, which found similar differences between males and females.

Olutola and Owolabi (2019) investigated the impact of formative testing and gender on senior secondary school biology students' performance. Students in experimental group one (formative testing with remediation) did better in Biology than students in experimental group two and the control group, according to the findings (formative testing without remediation and no formative testing). It was likewise uncovered that while gender has no critical impact on students' Biology execution, gender and formative testing have a substantial interacting effect on their performance.

At the Akure south local government area in Ondo State, Ajogbeje, Ojo, and Ojo (2013) looked at the impact of formative testing with guided response as a teaching technique on basic school students' mathematics attainment. On this learning outcome, the impacts of gender and socioeconomic position were also investigated. The study included a randomly selected sample of 227 basic school form two (JSS II) pupils from intact classrooms in three co-educational schools. Formative test with guided response, Formative testing only, and non-

formative testing as a control were the three conditions using quasi-experimental design. Students' socioeconomic position (high, medium, and poor) and gender were used to determine treatment levels (male and female). For the gathering of all relevant data, five data gathering tools were created, and validated for use. Scheffe's Post-Hoc Analysis and Analysis of Covariance (ANCOVA) and were the statistical tools used to analyze the data. The study's findings demonstrated that therapy had a considerable impact on pupils' mathematics achievement. Nonetheless, no significant gender or financial status effect was recorded on mathematics achievement.

In the Egor Local Government Area of Edo State, Matilda and Helen (2019) investigated the influence of classroom assessment this formative n nature on the academic performance in Basic Science. The research employed an experimental design with a pretest-posttest approach. The study encompassed all public basic school seniors (JSS II) were engaged in the study. A sample of 80 was randomly selected for participation. The Basic Science Achievement Test (BSAT) was utilized for pre-test as well as post-test assessments, with content-verified by subject specialist teachers to ensure its validity. The test-retest approach was used to establish the reliability of the BSAT reliability coefficient of 0.70. Tested at a significance level of .05, data analysis analysed using paired sample t-tests and independent sample t-tests. The findings indicated that formative classroom assessment had a positive impact on students' academic performance, as evidenced by the difference between pre-test and post-test scores in favor of the post-test. Nevertheless, there were no statistically significant differences in the scores of male and female students who underwent formative classroom assessment.

Esonomu and Eleje (2020) looked into the impact of diagnostic testing on second cycle students' academic achievement in quantitative economics. The research work was guided by three research topics and three stated hypotheses. The research employed a quasi-experimental design with a 2x4 factorial pretest-posttest configuration. The study included a sample of 210 economics students drawn from four secondary schools within the Nnewi Education Zone in Anambra State, Nigeria. Three experimental groups and one control group were formed. Relevant data for the study came from students' responses to two instruments: the Diagnostic Quantitative Economics Skill Test (DQEST) and the Test of Achievement in Quantitative Economics (TAQE). The data was analyzed using t-tests and ANCOVA. The findings revealed a significant impact of the intervention on students' achievement, favoring the DQEST with feedback and remediation group (F (3, 209), p > 0.05). Using the TAQE, no gender difference in student achievement. For this reason, investigative testing work best when combined with feedback and remediation.

Mohammed and Okolo (2020) looked at assessment for learning on second cycle students' Economics achievement in Kogi local area of Kogi state. With non-equivalent pretest posttest in quasi-experimental research design was employed in the study. The study population comprised 740 form 2 students from public secondary schools. In all, 120 students as a sample from 2 public secondary schools participated. Data were collected using Economics Achievement Test. Analysis of Covariance was used to analyse the hypotheses at a significance level .05.. The effect of the treatment on students' achievement in Economics was found to be significant, according to the results (F (1, 115) = 69.28; p = .001). However, there was no significant main effect of gender on

students' achievement in Economics (F (1, 115) =0.19; p = .66). The study concluded that students' achievement in Economics improved through assessment for learning more than conventional assessment. The study suggested to Ministry of Education Science and Technology of Kogi State to formulate regulations that will enforce second cycle school teachers to use AFL to enhance students' academic achievement in Economics among others.

Summary of the Literature Reviewed

When learners are given the appropriate materials to learn, the constructivist theory of learning proposes that they construct knowledge from experience (Onwu, 2012; Bhutto and Chhapra, 2013).

Formative assessment practices are in harmony with Vygotsky's (1978) social constructivism, which posits that individuals, viewed as reflective beings, actively build new knowledge through social interactions and activities (Mishra, 2014). Within social constructivism, the zone of proximal development (ZPD) is particularly relevant to scientific education and learning. The ZPD emphasizes that collaborative learning is the most effective way for individuals to acquire new knowledge. It posits that more knowledgeable individuals guide learners in conceptualizing and assimilating new knowledge through collaborative activities. Therefore, this study utilizes both social learning theory and constructivist theory to aid learners in constructing, interpreting, and internalizing information, facilitated by the guidance of the teacher.

Mathematics is a core topic in Ghana's educational system at all levels. Not only will mastery and knowledge of essential concepts in the topic lead to academic success, but it will also lead to the development of critical thinking and analytical skills. However, it appears in the literature that in the school

system, evaluation that describes the amount of success obtained has been overshadowed by assessment for grading purposes. As a result, many scholars have worked hard to design assessment practices that will stand the test of time and contribute to the formation of life-long learners who can demonstrate the value of what they have learned.

A review of the research reveals that the benefits of formative evaluation on academic attainment are conflicting. Also, males and females have opposing viewpoints on which gender benefits more.

CHAPTER THREE

RESEARCH METHODS

Overview

The study aimed to investigate the impact of formative assessment practices on the mathematics achievement of students in basic schools within Ghana's Nsawam-Adoagyiri Municipality. The hypothesis was that consistent utilization of formative assessment practices during mathematics instruction would result in enhanced mathematics achievement among students. The methodology section encompassed details on research design, the study's geographical area, population, sample selection and procedures, the data collection instrument, its validation, and reliability assessment. Additionally, ethical considerations arising during the study were addressed.

Research Design

Research investigations must incorporate a study design to effectively fulfill their objectives, as stated by Bless and Higson-Smith (2000). Yin (2015) further elaborates that research design serves as the framework guiding data collection and subsequent analysis, encompassing the methodologies employed for these purposes

The researcher used a quasi-experimental strategy, which included a non-equivalent group method for the pretest and posttest. A quasi-experiment is an empirical study employed to assess the causal impact of an intervention on a specific population, even in the absence of random assignment. The decision to opt for this design and the relevance it has on the present study were deemed

appropriate because subject randomization was not possible because the study's two groups were intact classrooms. When random assignment to groups is not practicable, researchers recommend leveraging existing groups for research (Gliner, Morgan, & Leech, 2009; Ary, Jacobs, Sorensen & Razavieh, 2010; Robson, 2011). This is consistent with Uzoechi's (2015) assertion that "the use of such non-randomized designs is referred to as the quasi-experimental design" (p.11). The investigation included one experimental group and one control group. Formative assessment practices were used in the experimental groups, while traditional assessment methods were used in the control groups. The design is symbolically represented below:

Table 2 - *Display of Treatment across Research Groups*

Research Groups		Treatment	
Experimental Group	0_1	X_1	0_2
Control Group	0_1	-	0_2

Where:

0_1= Pretest with the Mathematics Achievement Test

0_2= Post-test with the Mathematics Achievement Test

X_1= Experimental group (formative assessment practices)

-= Control group (Conventional practices)

The quantitative approach entails using objective measures to analyze numerical data, aiming to reveal relationships between variables (Cresswell, 2014). In the study, the pretest and post-test scores from the mathematics achievement tests demonstrate objective measures of construct to be mastered. This therefore makes it verifiable and easy to compute. In the realm of quantitative research, scholars utilize quantitative methods to gauge the scale

and occurrence of constructs. This approach not only seeks to uncover the significance and comprehension of these constructs but also aims to forecast the relationships between variables (Creswell & Plano-Clark, 2011). Thus, higher marks on the test demonstrate the magnitude of mastery of the instructional content. The use of mean and standard deviation also makes it possible for comparison between or among groups or individuals. In descriptive research, the fundamental premise of the quantitative approach is to employ numerical analysis for hypothesis formulation, testing, or framing research questions and subsequently seeking answers (Cresswell, 2014).

The methodology of quantitative research aligns with the empiricist paradigm, allowing the objective measurement of reality through data (Creswell, 2012). Quantitative research addresses questions about the relationships between variables, with the aim of establishing, confirming, or validating these relationships and generating generalizations that enhance theory (Leedy & Ormrod, 2005). Conclusions can be drawn objectively by referring to the data analysed from both the control and experimental groups. Such conclusions are equally verifiable to ascertain the reliability or otherwise of this study.

Rationale for the Design

Quasi-experimental research designs, as their name suggests, rely on naturally occurring variations in the primary independent variable, simulating experimental scenarios where some individuals are randomly exposed to a treatment while others are not. These designs leverage nonprobability but plausible external changes in critical parameters through methods such as regression discontinuity, instrumental variables, differences-in-differences,

two-way fixed effects, and other Quasi-Experimental Designs to establish causation.

The validity of making causal claims and estimates varies based on the degree of similarity between the study settings and a true experiment. Emphasizing internal validity, which assesses whether the policy or intervention under examination genuinely induced a significant alteration in the observed outcome and quantifying the magnitude of that change, Quasi-Experimental Designs offer valuable insights into the causal effects of various instructional strategies and interventions. According to Campbell (1957), this approach provides an unbiased assessment of the typical treatment impact making it a justifiable choice when conducting research where experimental conditions are challenging to implement.

Quasi-Experimental Designs aim to address several internal validity challenges through diverse approaches, depending on the specific design chosen. One of the primary concerns that Quasi-Experimental Designs strive to mitigate is selection bias. This bias arises from the potential differences between students, districts, or schools assigned to the treatment group (experimental group) and those not included in it (control group).

Crucially, the reasons guiding the assignment to the treatment group often have connections to educational outcomes, rendering it challenging to untangle causal effects. In essence, the use of Quasi-Experimental design in this study was to counteract selection bias and provide a more robust foundation for assessing causation in educational research settings.

Control of extraneous variables

Extraneous variables are factors in a research study that are unwanted and, if not properly managed, can introduce undesirable influences, leading to

confounding effects on the collected data. These extraneous variables encompass any factors apart from the independent variable that hold the potential to exert an impact on the dependent variable. The level of control exerted over extraneous variables directly determines the validity of an experimental investigation (Gay, Mills, & Airasian, 2009). These extraneous variables act as unintended independent variables that the researcher might not have a particular focus on. However, they have the potential to significantly impact the experiment's results, making it challenging to attribute the conclusions solely to the specific influence of the independent variable(s).

Extraneous variable, according Gay, Mills, and Airasian (2009), have two distinct categories that necessitate careful management: environmental variables and participant variables. Participant variables, in turn, encompass both organismic and intervening variables. Organismic variables refer to inherent participant characteristics that remain unalterable but are amenable to control, such as the gender of the participants. These variables represent traits or attributes intrinsic to the individuals under study.

Conversely, intervening variables present a different facet of participant variables. They are factors that impede the progression of the independent and dependent variables, often eluding direct observation but susceptible to control. Examples of intervening variables include phenomena like fatigue and anxiety, which have the potential to disrupt the treatment of the independent and dependent variables and thereby warrant vigilant management in the research process.

To counteract the influence of environmental variables, a series of measures were put in place. Firstly, consistent exposure to learning materials was ensured for all participants. Furthermore, treatment sessions were administered uniformly within a standardized timeframe. Subsequently, during the data analysis phase, the researchers utilized Analysis of Covariance (ANCOVA) as a statistical technique. ANCOVA was employed to control for any potential influence from extraneous variables on the outcome variable. This approach effectively mitigated the impact arising from exposure to the pre-test, as explained by Gay, Mills, and Airasian (2009), aligning with the methodology advocated by Pallant (2005).

Study Area

From the capital city of Ghana, the municipality of Nsawam-Adoagyiri is 23 kilometers close to Accra, Ghana's capital. It comprises a land area of around 175 square kilometers and is located in the South Eastern section of the Eastern Region between latitude 5.45'N and 5.58'N and longitude 0.07'W and 0.27'W. It is lined toward the north by Suhum Municipal Assembly, Akuapem South District to the east, West Akim District to the west, and toward the south by Ga West Municipal Assembly as far as spatial connection. It imparts a line to Adoagyiri, which is set apart by the Densu River. The Densu River is the primary supply of water for residents in and around Nsawam for both home and industrial needs. Nsawam Medium Security Prison is located in Nsawam.

The Municipality's proximity to Accra and Tema provides opportunities. The Accra–Tema metropolitan area, for example, is the country's largest single market, providing a good demand for the Municipality's farm goods and industrial items. As a result, the municipal council might focus on agricultural

growth through market gardening, for example. Nsawam, the capital of the Municipality, is a gap suburb on the Accra–Kumasi Road, which connects the country's coastline lands to the north. Nsawam is served indirectly by a railway station on Ghana's national railway network that connects Accra and Kumasi. The coaches, on the other hand, have been running on the Accra-Nsawam route for the past decade as the only relic from the glory days of rail travel. Nsawam is the main commercial hub for most farming communities, including Pakro, Fotobi, Asiaw-Krom, Dobro, Nkyenekyene, Ahodjo, and others. This opens up prospects for economic operations in the town, particularly bread and pastry marketing.

The age and sexual orientation of the populace affects reproduction, death, movement, and other segment factors that drive populace increment and, thus, financial turn of events. The number of inhabitants an expected populace of 86,000 individuals, with 42,733 (49.7%) men and 43,267 (50.3%) females the Nsawam-Adoagyiri Municipality. The metropolitan populace is 50,864 (59.1%), while the provincial populace is 35,136 (40.9%) (Ghana Statistical Service, 2019). The area is heavily populated, with a population size of 465 people per square kilometer.

Akuapems, who make up around 63 percent of the population, are the majority in the municipality. Ewes account for around 9% of the population, Ga-Adangbes for 7%, and other Akans other than Akuapems for 17%. Other ethnic groups account for the remaining 4%. The Akans' supremacy has generated a sense of social cohesion that is good for community development. The largest populace of 32,531 comes from Nsawam, the Municipal capital. The

town has such conveniences like a clinic, banks, channeled water, power, post office and media communications.

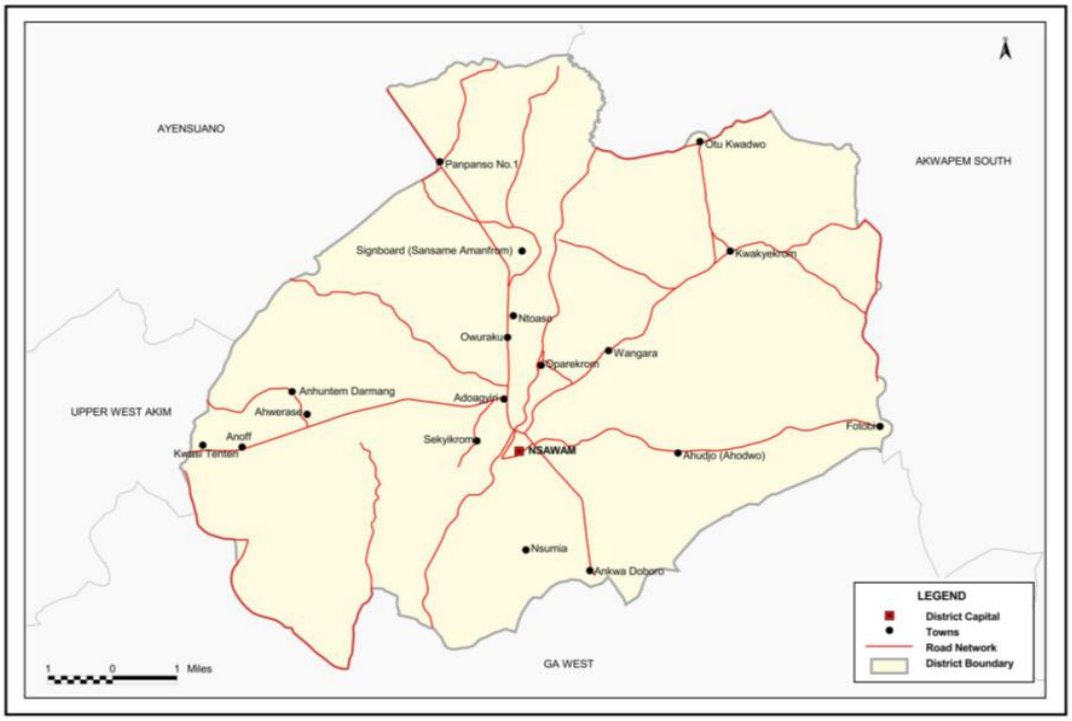

Figure 1 : Source: Ghana Statistical Service (2014)

Population

All second (2nd) year public junior high school pupils in Ghana's Eastern Region's Nsawam-Adoagyiri Municipality served as the study's target population. In the municipality, there are currently 34 public schools with a total population of 2,673 students (Education Management Information system, 2021).

The second-year students were deemed appropriate because they have been in senior basic level for at least a year. Through this period in school has exposed them to series of class tests or examination that they should have developed some kind of psychosocial adjustments. As the study was conducted before the students received instruction on the chosen topics, and because the

knowledge acquired in the first year served as a foundation for comprehending these topics, it's important to note that the students began their classes following a significant interruption due to the Covid-19 pandemic. Consequently, the project presented a valuable opportunity to actively involve students and acquaint them with academic pursuits. Furthermore, unlike their peers in the third year of education, second-year students were not constrained by the necessity to exert intense effort in preparation for the final Basic Education Certificate Examination.

Sample and Sampling Procedures

Two schools from the thirty-four public junior high school in the Nsawam-Adoagyiri Municipal assembly were selected randomly with the use of computer-generated random numbers. One intact Form 2 class from each of the selected schools were sampled randomly using computer-generated random numbers. Also, assignment of the two intact classes as the formative assessment group and conventional group were randomly done through the use of computer-generated random numbers. In all 140 students participated in the study.

The random selection of schools and the intact classes was to ensure that all students from the population had equal chance of participating in this research. The two selected intact classes were allocated to the two groups because, in a quasi-experiment of this nature, random assignment of participants to groups is unethical or not allowed. Also, only two classes took part in this research because the design involved one treatment and one control groups with the intact class that was exposed to the conventional approach serving as the control group.

As a result, the sampled schools were randomly assigned to either the experimental or control groups using the lottery approach. On pieces of paper, the names of the two sampled schools were written and placed in a container. One JHS student was assigned the task of picking the pieces of paper at random. This was done to ensure that the selection probability remained constant throughout the exercise. Bishop Ato Junior High School, the first school chosen from the box, was designated as the experimental group, whereas Nsawam Seventh Day Adventist JHS was designated as the control group.

Table 3 - *Number of participants in across selected schools*

	Bishop Ato JHS	Nsawam S.D.A JHS	
Boys	36	28	64
Girls	33	48	81
Total	69	76	145

Source: Field Survey (2021)

Data Collection Instrument

The study used the Mathematics Achievement Test (MAT), which was created by the researcher and functioned as the pre-test and post-test. The instruments were made to gather every one of the information needed for the study based on the topics discussed during treatment. For the period, the instrument was created using the JHS 2 scheme of work. Decimal Fraction, Linear Equation, Linear Inequalities, Statistics and Algebraic Expressions were among the topics addressed in the instrument. The Mathematics Achievement test had 40 questions. All of the tests were multiple-choice with opportunities to select the best answer. The researcher delivered the Mathematics

Achievement Test item to both groups as a pre-test toward the start of the term, and the scripts were graded and collated.

Validity

According to the American Educational Research Association, American Psychological Association and National Council on Measurement in Education (cited in Amedahe & Gyimah, 2004) validity refers to the degree to which evidence and theory support the interpretation of test scores entailed by proposed uses of tests. In other words, validity refers to the soundness or appropriateness of your interpretations and uses of students' assessment results.

The content validity of the study is related to how adequately the content of the items of the instruments (test) and the responses to the test sampled the domain about which inferences are to be made. Content validity was built into the test from the outset. Thus, at the planning stage a test specification table was drawn on the entire area of content. Also, the test items were constructed within the prescribed Mathematics syllabus and questions were generated referring to exercises in the form two (2) Aki Ola text book. The items of each test were therefore given to experienced Mathematics teachers from the participating schools for scrutiny.

A set of specifications was created to assure the instrument's content validity (see Appendix B). The sub-topics were matched to Bloom's cognitive taxonomy's knowledge, understanding, and application objectives. Following the original write-up, the researcher checked the items for grammar, clarity, and fit of material to the sample group's level and ability. The stems' ambiguity was also investigated. It was then edited by a mathematics expert with over ten years of teaching experience and mathematics instructors from the participating

schools. These measures were used to establish evidence of the instrument's content validity.

Pilot Testing of the Instrument

Students in an Akwamu L/A JHS at Adoagyiri in the Nsawam-Adoagyiri Municipality were given the achievement tests to see if they were reliable. This was done to see if pupils with similar traits may respond to the instruments in the same way. This was also to uncover any ambiguity, typographical errors, or flaws in the instrument. The school that was used for the instrument's pilot testing was part of the target demographic, but they were not included in the main study. Thirty Form 2 students were utilised for pretest pilot testing of the achievement test, and thirty Form 3 students were used for posttest pilot testing of the achievement test. The tests took about 60 minutes to complete, and the students' question papers and answer sheets were collected immediately following the test. This corresponds to the time allotted by BECE for 40 objectives on a test. The students' pretest scores ranged from 10 to 28, and their posttest scores ranged from 14 to 35.

Reliability

Following its re-assembly, the instrument was tested with a new JHS 3 class of 30 students. Because the items in the achievement tests had varied levels of difficulty and were evaluated dichotomously, the test's reliability was determined using the KR-20 method (Creswell, 2012). The pretest's reliability was found to be 0.89, while the posttest's reliability was found to be 0.91.

The researcher's supervisors at the University of Cape Coast's Department of Education and Psychology were shown the lesson plans that were produced for the formative assessment practices and the traditional techniques

to teach the selected topics in the scheme of work for their approval. There were two lesson plans each for formative assessment practices and the usual teaching approach in the total of eight lesson plans (APPENDIX F& G)

Ethical Issues that were considered in the Study

The ethical principles of upholding the right to privacy, ensuring voluntary participation, preventing harm to participants, safeguarding anonymity, and maintaining confidentiality held paramount significance in addressing ethical considerations within this research endeavor. It is essential to emphasize that both students and teachers possess a fundamental entitlement to privacy, a principle that was rigorously upheld throughout the study. In accordance with these ethical guidelines, the privacy rights of all participants in the study were diligently safeguarded. No respondents were subject to examination or research without their explicit knowledge and informed consent, thereby upholding the principles of ethical research conduct. Also, students were given unique codes other than their names that ensured that their identities could not be trace. The identity of the participating schools were also not known by either participating schools.

Also, one crucial aspect of ethical considerations in research pertains to the willingness of respondents to take part. Getting exposed to treatment within this particular study demanded a significant investment of time and energy from the participants, potentially disrupting their daily routines. To address this concern, the researcher transparently communicated the objectives of the study and its significance to the subjects, affording them the freedom to make a voluntary decision regarding their participation in the research.

Another ethical concern in educational research is that the activity should not cause injury to the study participants, regardless of whether they volunteer or not. The term "damage" in this context might refer to physical, psychological, or emotional harm. In order to do this, questions were structured in such a way that respondents had various options and the freedom to choose the answers that were most suited for them.

Moreso, as part of research ethics, the ultimate purpose is to preserve and safeguard the respondents' well-being, interests, and identities. In order to protect respondents, the researcher ensured anonymity and confidentiality, including the non-disclosure of respondents' identities. As a result, the respondents were guaranteed that the information they supplied would be kept private.

Furthermore, it should be noted that unethical behavior, such as plagiarism, is not tolerated in research. This usually occurs when a researcher fabricates, distorts, or plagiarizes another's work. To avoid plagiarism, the researcher adhered to the study's strict scientific conduct guidelines. Before drafting the study report, the researcher gathered information from the appropriate respondents and subjected the data to adequate analysis. Notably, ideas, works, and writings were properly acknowledged by including relevant references in the in-text and primary referencing styles used by the University of Cape Coast.

Data Collection Procedures

Before commencing the experiment, the researcher submitted an ethical clearance approval letter obtained from the Institutional Review Board at the University of Cape Coast. Additionally, an introductory letter addressed to the

heads of the chosen schools was presented, formally requesting their collaboration and participation in the study. Before the participants (students) were engaged in the study, the goal of the study was explained to them; hence, they were debriefed. The study underwent three stages:

Pre-treatment Stage

The researcher distributed a pre-test instrument to assess the students' baseline knowledge. All students were subjected to the Mathematics Achievement Test (MAT), which covered specific topics including fractions, algebraic expressions, linear equations and inequalities, percentages, and decimal fractions. These topics were integral components of the term's curriculum. The primary aim of the pretest was to evaluate whether the students in both schools exhibited comparable performance levels at the outset of the study.

Treatment Stage

a) The experimental group (Formative Assessment group) received instruction embedded with Formative Assessment techniques. For two weeks, the instructional units were taught to students in the experimental groups exposing participants to treatment via the lesson plan (see Appendix). The formative assessment practices used during instruction were designed to track the progress in learning made by students and identify their strengths and weaknesses. The assessment also entailed determining whether or not the pupils had met the set of teaching objectives. The practices were used at times before, during, and at the end every topic.

Feedback was provided to students on their scores on the test after each short activity. As a remedy, the feedback was followed by talks and test

correction. Students and teachers interacted more closely to detect, deliberate, reinforce, and make amends to difficulties as they answered issues and gave accurate replies to test items during the discussion.

b) Control Group: Students in the control group were taught and assessed using traditional methods. The teacher speaks and writes on the board while the pupils take notes in the lecture mode of instruction. Assessment practices that is formative was not used with these students. Despite the fact that all of the topics were instructed using lesson plans and assigned exercises or tasks, they received no feedback or remediation. Although students are engaged during the teaching period, the primary goal is to cover the material taught rather than to check for understanding and progress at their own pace.

Post-treatment Assessment

The alternate form of the MAT was administered at the end of the treatment programme to the students to determine the treatment's effects on them. To eliminate test-wiseness, statistical regression and maturation, the same posttest instrument was administered to both the control and experimental groups.

The second part of Mathematics Achievement test that served as the posttest was given to each group following two weeks of instruction. The teaching of the selected topics to the students, as well as the administration of the posttest to the students, took place over the course from August 2nd to August 20th, 2021. Some students from each of the participating classes were absent from school during the data collection period.

Data Processing and Analysis

The collected data underwent coding and analysis to ascertain the validity of the null hypothesis and to address the research inquiries. To ensure the accuracy of the statistical analysis, pretest scores without corresponding posttest scores and posttest scores without matching pretest scores were excluded from the dataset. This step was necessary due to instances where certain students were absent during the data collection period, resulting in missing test scores.

Research Question One

What is the effect of formative assessment practices on the achievement scores of students in Mathematics in the selected Junior High schools?

The first research question was to determine the impact of treatment on students' mathematics success scores. One categorical independent variable with two or more levels (control and experimental group), one continuous dependent variable (post test results), and one or more continuous covariates were required to execute this analysis (Pre-test scores). Consequently, the achievement scores from both the pretest and posttest were subjected to analysis employing the One-Way Analysis of Covariance (ANCOVA). This statistical approach has been established as valuable when evaluating the effects of an intervention or experimental alteration while accounting for pretest outcomes (Maxwell & Delaney, 2004).

Research Question Two

What is the difference between males and females means scores in achievement in Mathematics when exposed to formative assessment practices?

The second research question intended to determine if males or females fared better in mathematics when exposed to formative evaluation procedures. The results of the mathematics achievement test's pretest and posttest were used in this study. The 2 by 2 Analysis of Covariance was the statistical tool used to analyze data on the second research question.

Ho 1: There is no significant difference in the pre-test mean scores of students exposed to formative assessment practices (experimental group) and conventional method (control group).

H_A 1: There is a statistically significant difference in the pre-test scores of students exposed to formative assessment practices (experimental group) and the conventional method (control group).

Hypothesis One was tested to see if the experimental and control groups were on par or not when the experiment started. The pretest achievement test results were analyzed using the independent sample t-test, mean, and standard deviation. The data included one category independent variable with only two groups (experimental and control groups) and one continuous dependent variable (mathematics achievement test scores).

Ho 2: There is no statistically significant difference in the pre-test and post-test mean scores of students exposed to formative assessment practices or in the experimental group.

H_A 2: There is a statistically significant difference in the pretest and post-test mean scores of students exposed to formative assessment practices or in the experimental group.

The goal of this hypothesis was to see if the experimental group's pretest and posttest mean scores differed. The interval scale was utilised to analyze this research question's scale of measurement. The pretest and posttest mean and standard deviations were calculated. This hypothesis was tested using the paired samples t-test. Given that the hypothesis revolved around a single-factor achievement with two distinct levels, namely the pretest and post-test, this setup aligns with the principles of a within-subjects design (Field, 2017).

Chapter Summary

The research design, study population, sample processes, data collection tools, and data processing and analysis are all covered in this chapter. The sampling technique employed in this study was simple random sampling of four schools in the Nsawam-Adoagyiri Municipal Assembly, two of which were chosen as control and experimental groups. The statistical tools utilised to analyze the quantitative data were one-way analysis of covariance, 2 X 2 two-way analysis of covariance, independent samples t-test, and paired samples t-test.

Extraneous elements that could influence the study's outcome, such as the students' experience, ability, maturation, and age, were not controlled in this study. Because only entire classes from these schools were used in the study and not all Form two Junior High School pupils in the Nsawam-Adoagyiri Municipal Assembly were involved, the conclusions of this study can only be applied to the schools that participated in it. The study's findings and comments are presented in the next chapter.

CHAPTER FOUR

RESULTS AND DISCUSSION OF FINDINGS

Overview

This chapter unveils the outcomes of the research study and delves into the discussion of its findings. Within this chapter, the results are presented in alignment with the research questions and hypotheses. It encompasses the outcomes of the statistical tests, the determinations regarding whether to retain or reject each hypothesis, and the implications of these decisions. Moreover, the chapter engages in comprehensive discussions concerning the research findings. The chapter is organized into three distinct sections: descriptive statistics, addressing research questions and assumptions regarding the sampled groups, and a comprehensive exploration of the study's findings. Notably, a significance threshold of 0.05 was established for the study's analysis.

Demographic Characteristics of the Respondents

The study was conducted using a sample size of 140 pupils or participants in the Nsawam-Adoagyiri Municipality in Ghana. The means, standard deviations, and adjusted means of the Experimental (Formative assessment practices) and Control (Conventional approach) groups have been examined in order to provide a better understanding of the population sampled. Table 4 displays the distribution of respondents by Experimental Conditions.

Table 4 - *Distribution of participants according to Research Group*

Groups	Frequency	Percentage (%)
Experimental	69	49.0
Control	71	51.0
Total	140	100.0

Source: Field Survey (2021)

From table 4, 49% of the participants were in the experimental group (Bishop Ato JHS) whiles 51% of participants in the study were formed control group (Nsawam S.D.A. JHS).

Also, the distribution of respondents by gender engaged in the study can be found in table 5.

Table 5 - *Distribution of Respondents by Gender*

Gender	Frequency	Percent (%)
Male	62	44
Females	78	56
Total	140	100.0

Source: Field Survey (2021)

Table 6 shows that males made up 44.0 percent of the respondents, while females made up 56.0 percent. According to the findings, the Nsawam-Adoagyiri Municipality has more females than males. According to the Ghana Statistical Service report (2004) Ghana has higher proportion of females due to factors such as lower mortality rates among women, differences in life expectancy, and migration patterns. This could justify for the disparity in gender.

Test for Normality

This section presents test for normality assumption and outliers in the pre-test and post-test data. In order to advance the statistical analysis of the data, normality needed to be determined. The normal Q-Q plots for all the data, thus, pretest and posttest scores on the mathematics achievement test suggested the data were normally distributed (Appendix A).

In addition to the normality assumption, homogeneity of regression slopes assumption – a paramount assumption of ANCOVA, was tested. This assumption holds the premise that there should be no interaction between the pre-test scores and conditions. The results of the homogeneity of regression slopes are presented in Table 6.

Table 6- *Results of Homogeneity of Regression Slopes*

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5703.217[a]	3	1901.072	78.707	.000
Intercept	1525.031	1	1525.031	63.138	.000
Groups	551.201	1	551.201	22.820	.000
PRETEST	1037.394	1	1037.394	42.949	.000
Groups* PRETEST	43.072	1	43.072	1.783	.184
Error	3284.919	136	24.154		
Total	76265.000	140			
Corrected Total	8988.136	139			

a. R Squared = .635 (Adjusted R Squared = .626)

Source: Field work (2021) Dependent variable: Posttest scores

As shown in Table 6, there was no significant interaction between the pre-test scores and the conditions, $F(1, 136) = 1.78$, $p = .18$. This result implies that the relationship between the pre-test and the post-test scores on self-esteem

were the same across the various conditions, hence no violation of homogeneity of regression assumption, therefore, ANCOVA can be performed.

Results

Research Question One

What is the effect of formative assessment practices on the achievement scores of students in Mathematics in the selected Junior High schools?

Data on Research Question One was analysed using the one-way analysis of covariance. The dependent variable was participants' scores on the post-test scores whiles the covariate was pre-test mathematics scores. The independent variable was the experimental conditions. Tables 6 and 7 presented results:

Table 7- *Results from the pretest and posttest across the research groups*

		Pretest		Post-test		Mean
Groups	N	Mean	S.d	Mean	S.d	difference
Bishop Ato	69	14.51	4.122	27.77	5.732	13.26
Nsawam S. D. A	71	13.45	3.733	16.24	5.481	2.79
Total	140					

Source: Field survey (2021)

Table 7 shows that, prior to the training intervention, the students' mathematics performance was so similar as evidenced by their respective mean scores of 13.45 (SD = 3.73) for the control group and 14.51 (SD = 4.12) for the treatment group. The average performance of students in the control group improved marginally from 13.45 at pre-test to 16.24 (SD = 5.48) at post-test, resulting in a gain score of 2.79. Students who received instruction that included formative assessment practices saw a significant improvement in their

Mathematics performance, going from an initial average of 14.51 before the introduction of formative assessment practices to an outstanding performance as evidenced by a mean score of 27.77 (SD = 5.73) recorded after the treatment intervention. As a result, the mean difference between pre- and post-test was 13.26.

One-way ANCOVA was used to see if the differences in post-test Mathematics performance between the treatment and control groups were statistically significant, and the results are shown in Table 8.

Table 8- *ANCOVA Test of Difference in Post-test Mathematics Performance between Treatment and Control Groups*

Source	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2	2830.072	116.503	< .001	.630
Intercept	1	1551.280	63.860	< .001	.318
PRETEST	1	1009.228	41.546	< .001	.233
Groups	1	4009.247	165.045	< .001	.546
Error	137	24.292			
Total	140				
Corrected Total	139				

Source: Field survey (2021)

The results in table 8 demonstrate that after controlling for pretest results, the experimental and control groups had a statistically significant difference in posttest scores, $F(1,139) = 165.05$, $p < .001$, partial eta squared=.546. This implies that the experimental and control groups reacted to the intervention differently, with 55 % in mathematics achievement post-test scores of participants was as a result of they belonging to a research group or treatment. Table 9 presents the adjusted means.

Table 9 – *Adjusted Mean of the research Groups*

Research groups	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Nsawam SDA	16.598	.588	15.436	17.760
BISHOP Ato	27.399	.596	26.221	28.578

Source: Field survey (2021)

Table 9 displays that the experimental group (Bishop Ato JHS) had a mean of 27.40, while the control group (Nsawam SDA JHS) had a mean of 16.60. As a result, the experimental group outperformed the control group. The results demonstrated that students who underwent formative assessment practices in the classroom improved much more than their control group counterparts in Mathematics.

Research Question Two

What is the difference between male and female students mean scores in Mathematics when exposed to formative assessment practices?

Research Question Two looked into the gender differences in mathematics achievement between the experimental and control groups of students. A 2 x 2 Analysis of Covariance was used to compare the post-test Mathematics achievement of the two levels of experimental condition (treatment and control) and gender (male and female) as the independent variable and posttest scores as the dependent variable. Table 10 presents the test for the results.

Table 10- *Two-Way ANCOVA Tests of the Effects of Experimental Condition and Gender on Post-test Mathematics Achievement of Students*

Source	df	Mean Square	F	Sig.	Partial Eta Squared (n^2p)
Corrected Model	4	1423.776	58.369	.000	.634
Intercept	1	1525.373	62.534	.000	.317
PRETEST	1	1013.345	41.543	.000	.235
GENDER	1	12.325	.505	.478	.004
Groups	1	3874.594	158.842	.000	.541
GENDER * Groups	1	21.848	.896	.346	.007
Error	135	24.393			
Total	140				
Corrected Total	139				

Source: Field survey (2021)

Gender differences in mathematics achievement test scores of pupils in both the experimental and control groups were investigated using a 2 by 2 between-groups ANCOVA. Table 10 shows that after controlling for the pretest, there was no significant interaction effect between gender and the groups, $F(1, 139) = .896$, $p = .35$, partial eta squared =.007. There was no significant gender effect, $F(1, 139) = .505$, $p = .48$, with, according to Cohen (1988) a small effect size (partial eta squared =.004). The partial eta squared value of .00 (0.4%) implies that gender explains .4% of the level of posttest scores. The results further suggest that both males and females benefited from formative assessment practices. In order words, gender did not discriminate the effectiveness of the formative assessment practices. Table 10 presents the adjusted means.

Table 11- *Adjusted Means for Gender*

GENDER	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Male	21.724	.637	20.465	22.983
Female	22.330	.567	21.210	23.451

Source: Field Survey (2021)

Males (M=21.72) and females (M=22.33) were not significantly different in the table of gender adjusted means. This indicates that both male and female students gave equal effort.

After being subjected to formative assessment practices, the results of study question two confirm that male students' performance on the mathematics achievement test is not statistically significant when compared to their female counterparts. As a result, irrespective of participants' gender the use of formative assessment practices had no effect among pupils.

Hypothesis One

H_0: *There is no significant difference in the pre-test mean scores of students exposed to formative assessment practices and conventional method.*

H_1: *There is significant difference in the pre-test mean scores of students exposed to formative assessment practices and conventional method.*

The goal of this hypothesis was to see if there was a statistically significant difference in pre-test scores between students who were exposed to formative assessment practices and those who were subjected to traditional methods. The pre-test results on the Mathematics Achievement test were the dependent variable. The assumptions behind the use of the independent samples

t-test were validated prior to analysis. The Levene test also demonstrated that the data's normalcy did not violate the normality assumption.

Table 12- *Results of Independent Sample t-test for the research groups*

Variable	Group	N	Mean	t	df	*P*
Pretest	Control	71	13.45	-1.591	138	.114
	Experimental	69	14.51			

Not significant, since p > .05

There was no statistically significant difference in pretest scores between the experimental group (Bishop Ato) (*M* = 14.51, *SD* = 4.12) and the control group (Nsawam S.D.A) (*M* = 13.45, *SD* = 3.73), *t*(138) = -1.591, *p* =.114, according to the table 12. As a result, the null hypothesis, stating that there is no statistically significant difference in the pretest mean scores between the experimental and control groups, was not rejected. This means that the participating groups or schools were par on the mathematics achievement test when the study began or before the intervention was implemented.

Hypothesis Two

Ho: *There is no statistically significant difference in the pre-test and post-test mean scores of students in the experimental group or exposed to formative assessment practices.*

H1: *There is a statistically significant difference in the pretest and post-test scores of students in the experimental group or exposed to formative assessment practices.*

The goal of this hypothesis was to see if there was a statistically significant change between the pretest and post-test mathematics test scores of students in the experimental group who were given the treatment. As a result,

the researcher wanted to see if there was a difference in post-test scores after the individuals' pretest scores had been recorded. This hypothesis was tested using the paired samples t test, which was appropriate.

Table 13- *Results of Paired Samples t-test of Experimental Group on the Pretest and Posttest*

	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
PRETEST	69	14.51	4.122	.496	-19.82	68	< .001
POST TEST	69	27.77	5.732	.690			

Source: Field Survey (2021) significant since p < .05

A paired-samples t-test demonstrated that the experimental group or students exposed to formative assessment practices had statistically significant variations in their pre-test and post-test scores; $t(68) = -19.816$, $p < .001$, at .05 significance level. As shown in Table 13, the experimental group's pre-test mean ($M = 13.54$, $SD = 3.50$) was considerably lower than the post-test mean ($M = 21.87$, $SD = 6.12$). In favour of the alternative, the researcher dismissed the null hypothesis of no difference.

Discussion

The findings are discussed in this section in respect to:

1. Effects of formative assessment practices on students' academic achievement in mathematics
2. Difference between males and females when exposed to formative assessment practices

3. Difference between the pretest mean scores of students exposed to formative assessment practices (Experimental group) and the conventional method (control group).
4. The pre-test and post-test mean scores of students in the experimental group or exposed to formative assessment practices.

Academic Performance of Students in Mathematics and the Utilization of Formative Assessment Strategies

The goal of study question one was to see if formative assessment procedures had an impact on students' mathematics achievement. The results revealed that participants in the experimental group who underwent formative assessment procedures in the classroom improved much more than their control group counterparts in Mathematics performance. This suggests that the intervention was effective and so had an effect on the participants. Two (2) weeks after the treatment programme ended, a post-test was conducted. As a result, the treatment group's post-test results indicated that they were able to apply the numerous skills they learned in the training to their everyday life in the classroom which resulted in the in higher performance than the control group. Students actively took class lessons seriously by contributing and sharing ideas with colleagues. This made their lapses in knowledge or problem solving easily identified and appropriate assistance given. Student-teacher relationship was strengthened as students felt as ease to consult the researcher to readdress their challenges in understanding. Also, collaboration among students was seen to be in play as students collectively solved mathematics problems in a way that even helped struggling students to understand concepts rather than making them feel they are not academically good. This is consistent with the findings of Oti,

Ariya, and Salau (2020), who conducted a quasi-experimental study to investigate the effects of formative assessment strategies on the academic performance and attitudes of post-secondary students in Social Studies within the Katsina Metropolis, Nigeria. The outcomes revealed a notable enhancement in students' Social Studies achievement attributed to the implementation of formative assessment practices.

Moyosore (2015) evaluated the impact of formative assessment on secondary school mathematics success in two public schools in Iseyin Local Government, Oyo State, Nigeria. According to the researcher's findings, formative assessment has a substantial significant difference, as the mean achievement score of Math students who are exposed to it is greater than the mean achievement score of students who are not exposed to it. According to Ajogbeje (2013), effective use of formative assessment allows students to adequately prepare for the test, and frequent testing allows students to become more interested and dedicated to the teaching-learning process, consequently improving their academic achievement in the topic.

In addition, Ozan and Kincal (2018) investigate the effects of formative assessment procedures on fifth-grade social studies students' academic achievement, attitudes toward lessons, and self-regulation abilities. It was discovered that pupils in the experimental group who received formative assessment practices had considerably higher academic success levels than those in the control group. Similarly, using a quasi-experimental design, In Jos, Nigeria, Ugodulunwa and Okolo (2015) looked into the effects of formative assessment on mathematics testing anxiety and performance in second cycle school students.. Formative assessment enhanced pupils' mathematical

performance, according to the data. The control group's poor performance could be explained by the fact that they were not given the opportunity to discuss their concerns with the teacher.

In their study, James and Folorunso (2012) discovered that therapy (formative assessment with remediation and feedback) had a significant impact on students' mathematics achievement. In general, the outcomes of this analysis validated earlier findings and demonstrated the utility of the Formative Assessment Strategy developed and verified in this study.

On the contrary, research in the literature have found that formative assessment has no statistically significant impact on student academic success. According to Andrews (2011), Collins (2012), and King (2003), formative assessment did not have a favorable impact on students' academic achievement; nevertheless, the effect was not statistically significant. Formative assessment did not have a substantial impact on students' achievement, motivation, or conceptual changes, according to Yin et al. (2008); however, this was due to the difficulty of implementing formative assessment effectively rather than its effectiveness. Tuominen (2008) similarly found that formative assessment did not significantly improve student academic achievement, citing the study's short duration and the diversity of teachers' unique methods as reasons.

Difference between males and females when exposed to formative assessment practices

The purpose of study question two was to investigate whether male and female students responded differently when formative assessments were given. Based on the outcome of the study, there is no statistically significant difference between males and girls subjected to formative assessment procedures. As a

result, both male and female students performed equally well; neither male nor female students outperformed the other. As a result, both male and female students responded to the intervention on formative assessment practices in the same way. The findings of this study can be linked to the fact that both male and female participants took formative assessment procedures in the classroom seriously, resulting in both male and female participants demonstrating the same degree of proficiency on the mathematics achievement test. The exposure to formative assessment practices would now make students to be proud of themselves and feel useful at all time as critical thinkers and problems solvers who are not afraid of mathematics or any related subjects. The study's results indicate that the effectiveness of formative assessment is not influenced by gender, as both males and females performed equally. This highlights the valuable role of formative assessment practices in ensuring that neither males nor females are considered superior to the other, but rather in achieving the same level of mastery among all students as teachers impart knowledge.

Several studies have come to the same conclusion. This study is consistent with Olangunju (2015), whose study confirmed that the achievement scores of Math students who receive formative assessments do not differ by gender. As a result, their mathematical accomplishment scores are akin. Similarly, Ajobgeje (2013), found no significant difference in academic achievement between male and female students in the experimental and control groups. This is in line with Akorede (2021) whose findings suggested that gender has no bearing on the mean achievement scores of students taught using formative assessment versus those taught using the traditional technique. In addition, Mohammed and Okolo (2020) reported no significant major influence

of gender on student academic achievement in Economics in their study. This shows that regardless of whether a participant was male or female, their performance was same.

Esonomu and Eleje (2020) reported in their study that there was no discernible difference in student achievement based on gender. Because the p values were greater than.05, there was no significant difference between male and female student achievement in quantitative economics (p =.926,.527,.476,.272). As a result, male and female students in the groups equally benefitted from the treatment.

Moyosore (2015) conducted a study that indicating that male and female mean scores were nearly identical corroborated the outcomes of current investigation. Despite the fact that the results showed a difference, the difference is not statistically significant.

This conclusion, however, contradicts Raghavani, Rajput, Parchwani, and Vachhani's (2020) findings, which examined male and female students' performance in theory, practical, and combined (theory and practical) formative assessments in the subject of biochemistry in first-year MBBS. Female students outperformed male students in theoretical and combined formative assessment practices, according to the findings. Gender was examined as a moderating factor in students' performance in Economics when taught using formative assessment, as indicated by previous studies by Shaibu and Ameh (1982). However, the study's findings showed that there was no significant interaction effect between the intervention and gender on students' economic achievement.

Difference between the pretest mean scores of students exposed to formative assessment practices (Experimental group) and the conventional method (control group)

The goal of hypothesis one was to determine the difference between the experimental and control groups' mean scores. There was no statistically significant difference between the experimental and control groups' pretest mean scores, according to the study. This suggests that both the experimental and control groups were equivalent in ability or performance at the start of the experiment. This is consistent with the findings of Mehmood, Hussain, Khalid, and Azam (2012), who found no significant difference between the Control group (M=24.70, SD=3.18) and the experimental group (M=24.36, SD=3.02). As a result, before the treatment, the assigned group's performance was comparable, and any differences could be attributed to the treatment. In their study, Ali and Iqbal (2013) claimed that the lack of any significant difference demonstrated the experimental and control groups' similarity.

Moyosore (2015) also found a significant difference in the pretest score between the Experimental (M=21.1, SD=4.72) and the Control (M=14.48, SD= 6.38) groups. This suggests that the groups were not equal in ability even before the study began, which could have influenced the study's outcomes.

The pre-test and post-test mean scores of students in the experimental group or exposed to formative assessment practices.

The experimental group's pretest and post-test mean scores differed statistically significantly, according to the study. When the experimental group's pretest and posttest were compared, there was a difference that could be linked to the treatment they received. The mean score on the posttest was found to be

greater than the mean score on the pretest. This is consistent with the findings of Mehmood, Hussain, Khalid, and Azam (2012), who found that difference exist in the mean scores between the pretest (M=24.36, S=3.22) and posttest (M=26.86, S=3.22). It was shown that pupils who were examined via formative assessment not only maintained but also considerably improved their performance.

Moyosore (2015) further validated that the experimental students' mean pre-test score is 21.1 and their mean post-test score is 29.1. This means that the formative assessment had a significant impact on the students' mean score during the post-test, resulting in a higher mean score. Similarly, Ozan and Kincal (2018) found that the experimental group's pre-test academic achievement mean score was 22.42, whereas the post-test mean score was 34.13. After an average performance in the pretest, this statistically significant difference revealed a considerable improvement.

In their study, Ugodulunwa and Okolo (2015) found a significant mean difference between the students in the experimental group's posttest (M = 70.96; SD = 9.08) as against pretest (M = 26.6; SD = 4.53) mathematical performance scores. As a result, they came to the conclusion that teaching the experimental group with the formative assessment enhanced students' mathematics skills or proficiency.

Chapter Summary

At significance levels of 0.05, one-way analysis of covariance was used for data analysis as well as two-way analysis of covariance, dependent sample t-test, and independent samples t-test. The results of the data analysis revealed a statistically significant difference between the experimental and control

groups' posttest scores, F (1,139) = 165.045, p = 0.001. The experimental (M=27.399) group outperformed the control (M = 16.598). F (1, 53) =.741, p =.393, n^2p =.014, there was no significant gender effect. Males (M = 21.724) and females (M = 22.330) were similar. Also, there was no statistically significant difference in pretest scores between the experimental group (Bishop Ato) (M = 14.51, SD = 4.122) and the control group (Nsawam S.D.A) (M = 13.45, SD = 3.733), t (138) = -1.591, p >.114. However, there was a statistically significant difference in the experimental group's pre-test and post-test scores; t (68) = -19. The pre-test mean (M = 13.54, SD= 3.496) was lower than the post-test mean (M = 21.87, SD= 6.119).

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Overview of the Study

Conducted in the Nsawam-Adoagyiri Municipality, this study aimed to investigate the impact of formative assessment practices on the academic achievement of junior high school students in mathematics. The research was conducted using a quasi-experimental approach. Additionally, the study aimed to assess whether there were any gender-related differences in math performance among students when exposed to formative assessment techniques. The research randomly selected the participating schools as experimental and control groups as study samples. A pre-test and post-test quasi-experimental design was employed in this investigation. Two (2) Mathematics Achievement exams were used to collect data, both of which were alternative in nature and had a similar difficulty level. Mean, standard deviation, independent t test, paired samples t test, one-way analysis of covariance (ANCOVA), and two-way analysis of covariance were employed in the analysis (ANCOVA). At a significance threshold of 0.05, the tests were run to see if there were any significant differences.

Summary of Key Findings

The key findings of the data analysis are listed below.

1. It was discovered that experimental group participants who underwent formative assessment practices in the classroom scored higher on the posttest than their control group counterparts who were not exposed to

any intervention. This meant that the intervention was effective and so had an impact on the participants.

2. There was no statistically significant difference between genders who were treated to formative assessment practices, according to the findings of the current study. The intervention on formative assessment practices received by students had the same effect based on gender. Therefore, both male and female participants took both formative assessment procedures in the classroom seriously, resulting in both male and female participants demonstrating the same degree of competence on the Mathematics achievement test.
3. There was no statistically significant difference between the experimental and control groups' pretest mean scores, according to the study. On the pretest, the experimental and control groups had similar mean scores. This meant that both the experimental and control groups were equivalent in ability or performance before the intervention was introduced, as determined by the pretest. This further highlighted their equal baseline knowledge levels across groups.
4. It was discovered that the experimental group's pretest and post-test mean scores differed statistically significantly. When the experimental group's pretest and posttest results were compared, it was discovered that the posttest mean score was greater than the pretest mean score. This could be linked to the efficacy of the formative assessment practices that were rigorously used in classroom instruction. The students took it seriously, which shown in their improved performance on the posttest.

Conclusion

According to the findings of this research, cognitive outcomes are usually better when formative tests are utilised for diagnostic purposes rather than summative assessments. This was the case when the findings of formative assessments were utilised to identify the sources of problems in students understanding. This allowed the teacher to deliver the appropriate remediation and correctives. The regular diagnostic tests, as well as proper remediation and feedback for pupils, that was included in the teaching of mathematics led to the remarkable improvement in students' performance.

Furthermore, the results indicated that formative assessment approaches employed in mathematics instruction are equally effective for both male and female students. This suggests that the utilization of formative assessment techniques not only motivates students but also sustains their active involvement in classroom learning, ultimately resulting in a comprehensive grasp of the subject matter. These strategies not only enhance classroom engagement but also foster stronger teacher-student relationships. Consequently, this approach mitigates the disparities in academic performance based on gender.

Recommendations

The following recommendations for instructional practices and policies are provided based on the study's findings:

1. Teachers should employ formative assessment practices in their teaching to encourage students to actively construct their knowledge.
2. Curriculum developers can prescribe formative assessment practices of teaching as examples of constructivist teaching approaches when they

are developing mathematics syllabus for teachers to employ to teach mathematics concepts as a means to improve students‘ achievement in the subject.

3. To address gender-based disparities in students' math achievement, mathematics educators should introduce various formative assessment techniques to both male and female student.
4. They should allow and encourage teachers to attend seminars, workshops, conferences, and in-service trainings in order to improve their performance and learn how to create formative assessments and integrate them into classroom instruction methods.

Suggestions for Further Research

The following are some research ideas for the future:

1. Future research should be carried out on the effect of formative assessment practices on students’ academic achievement in mathematics between low achieving and high achieving schools.
2. Future research could also be carried out to focus on the effects of formative assessment practices on academic performance of students in subjects at the higher level of education.
3. Also, replication of the study could be done using mixed method research design. The qualitative component is expected to give deeper understanding on how and why these formative assessment strategies help, from the perspective of students, improve performance in mathematics.

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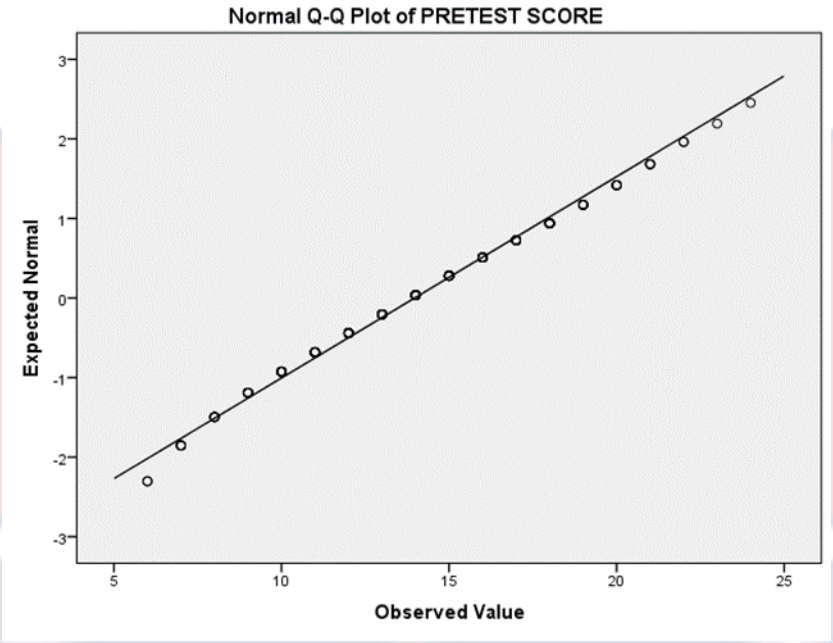
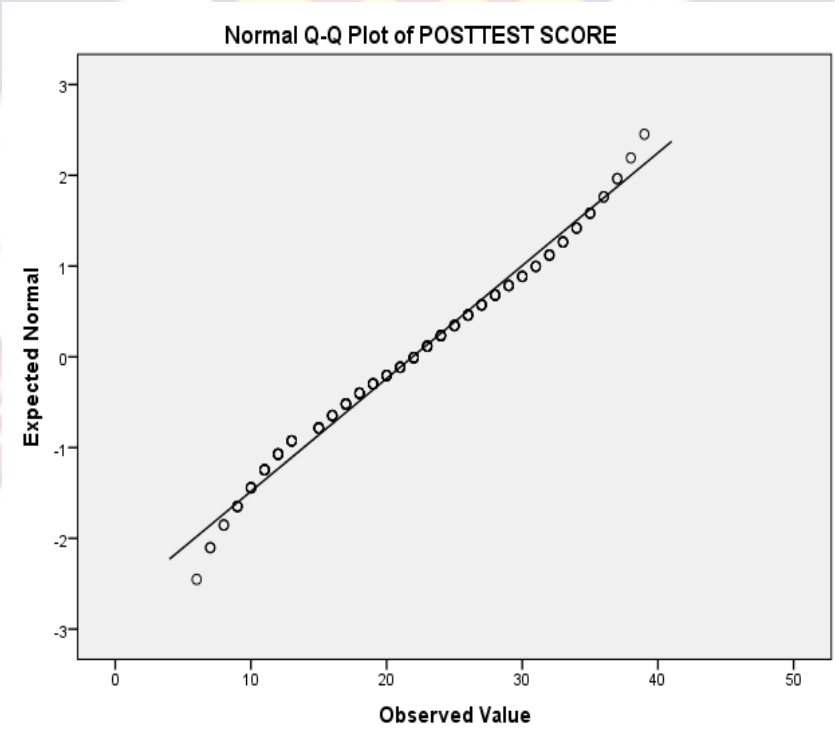
APPENDICES

APPENDIX A

Q-Q PLOT DISPLAY OF TEST FOR NORMALITY





APPENDIX B

TABLE OF TEST SPECIFICATION

CONTENT	BEHAVIOURAL OBJECTIVE		**TOTAL**
	COMPREHENSION	APPLICATION	
Decimal Fractions	3	4	**7**
Algebraic Expression	3	5	**8**
Linear Equation	3	5	**8**
Linear Inequalities	3	5	**8**
Statistics	3	6	**9**
	15	**25**	**40**

APPENDIX C

Mathematics Achievement Test (PRETEST)

Subject: Mathematics JHS Form 2

Student Number: …… Sex: Male/Female

For each of the questions, circle the correct answer from the four (4) options given.

Time allowed: 60 minutes

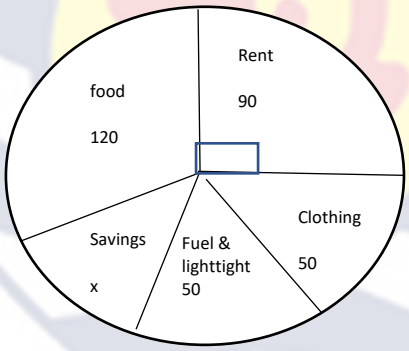
1. If 8.51÷2.3=3.7, find the value of 85÷2.3.
   A. 0.037
   B. 0.37
   C. 3.7
   D. 37
2. If 22% of a rope is 55 metres long, find the full length of the rope.
   A. 12.1m
   B. 35m
   C. 121m
   D. 250m
3. If 8x-3(2x-4) =4, find the value of x.
   A. -8
   B. -4
   C. 4
   D. 8
4. The product of 2x and 3 is 138. Find x.
   A. 23
   B. 33
   C. 63
   D. 43
5. Simplify $5w+7p^2-4w+3\ p^2$
   A. $9w+10p^2$
   B. $10+10p^2$
   C. $10+4p^2$
   D. $9w+4p^2$
6. A man has 6x sheep and 5y goats. He sells 3x sheep and 2y goats. How many animals are left after the sales?
   A. 3x-3y
   B. 3x+3y
   C. 9x-5y
   D. 9x+5y
7. Simplify (5m+3n) - (2m-n)
   A. 5m-4n
   B. 3m-4n
   C. 3m-2n
   D. 7m+4n
8. Expand 3(2a+3b)
   A. 2a+9b
   B. 5a+6b
   C. 6a+3b
   D. 6a+9b

9. Simplify 7a-3(b-a)
   A. 4a – 3b
   B. 4a – 3b
   C. 8a – 3b
   D. 10a – 3b
10. Simplify 3(6b – 9a) + 7(6a – 5b)
   A. 17b + 6a
   B. 7b + 6a
   C. 17b + 48a
   D. 15a – 17b
11. Multiply 0.014 by 0.2
   A. 0.00028
   B. 0.0028
   C. 0.028
   D. 0.28
12. Write 39.974km, correct to three significant figures.
   A. 39.9km
   B. 40km
   C. 39.975km
   D. 40km
13. Express 4037 in standard form
   A. $4.037x\ 10^{-4}$
   B. 4.037×10^{-3}
   C. 4.037×10^{3}
   D. 4.037×10^{4}
14. Express 0.68 as a fraction in the lowest term.
   A. $\frac{7}{25}$
   B. $\frac{17}{25}$
   C. $\frac{3}{5}$
   D. $\frac{7}{15}$
15. Round 8921465 to the nearest hundred
   A. 8921000
   B. 8921400
   C. 8921460
   D. 8921500
16. List all members of the set {x:2<x<8, x is an integer}
   A. {3,4,5,6,7}
   B. {2,3,4,5,6,7,8}
   C. $\{2,2^{1/2},3,4,5,6,7,8\}$
   D. {3,4,5,6,7}
17. Find the solution set of 2x+1<5 in the domain {-1, 0, 1, 2, 3}
   A. {-1, 1, 3}
   B. {-1, 1, 2}
   C. {-1, 0, 1}
   D. {0, 1, 2}

18. Solve 4x-6< -2
    A. x< 1
    B. x> 1
    C. x<-1
    D. x>-1
19. Solve the inequality: 7x-(10x+3)> -9
    A. X>2
    B. X>4
    C. x<4
    D. x<2
20. Solve the inequality 3x+6<5x-2
    A. x<2
    B. x<4
    C. x>2
    D. x>4
21. A tank contains 250 litres of water. If 96 litres is used, what is the percentage of the original quantity is left?
    A. 61.6%
    B. 59%
    C. 60.5%
    D. 54.2%
22. Express 3/8 as a percentage
    A. 0.375%
    B. $12\frac{1}{2}\%$
    C. 25%
    D. $37\frac{1}{2}\%$
23. Mensah obtained 150 marks out of 240 marks, in an English test. What was her percentage score?
    A. 16.5%
    B. 33.33%
    C. 62.5%
    D. 41.67%
24. In an experiment 154 out 175 candidates passed. What percentage failed?
    A. 6%
    B. 13%
    C. 12%
    D. 18%
25. Find $12\frac{1}{2}\%$ of GHc 80.00.
    A. GHc 8.00
    B. GHc 12.00
    C. GHc 10.00
    D. GHc 12.5
26. Ama is N years old now. How old will he be in 10 years?
    A. (N-10) years
    B. (N+10) years
    C. (10-N) years
    D. N10 years

27. If 4(m+4) =18, find the value of m
    A. ½
    B. 3/2
    C. 5/2
    D. 7/2
28. Solve the equation 13x-2(3x+4) =22
    A. 5
    B. 4
    C. $\frac{30}{7}$
    D. $\frac{26}{7}$
29. If $\frac{1}{X}$ = 1 ½, find x
    A. 3
    B. $\frac{3}{2}$
    C. $\frac{4}{3}$
    D. $\frac{2}{3}$
30. If a: 27 = 6:18, find a
    A. 4
    B. 9
    C. 51
    D. 81

The pie chart shows the monthly expenditure of Mr. Awuah whose monthly income is Ghc 1,800.00. use the chart to answer questions 31-33.

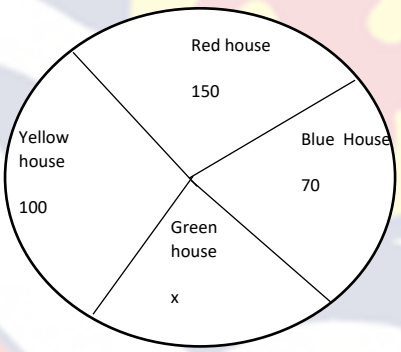


31. What fraction of Mr. Awuah's income is spent on food?
    A. $\frac{1}{6}$
    B. ¼
    C. $\frac{1}{3}$
    D. $\frac{2}{5}$
32. How much does Awuah spend on rent?
    A. GHc 900.00
    B. GHc 450.00
    C. GHc 9.00
    D. GHc 1,620.00

33. What is the size of the angle representing savings?
    A. 40
    B. 60
    C. 130
    D. 230

The marks obtained by 10 children in a mental drill are 0,1,3,3,5,7,8,9,9,9

34. What is the modal mark?
    A. 3
    B. 7
    C. 8
    D. 9
35. Find the median mark
    A. 3
    B. 5
    C. 6
    D. 7
36. Calculate the mean mark.
    A. -54
    B. 5.4
    C. 10
    D. 54
37. The marks obtained by 5 girls in a test are: 10,15,8, 18,12. Find the median mark.
    A. 10
    B. 11
    C. 12
    D. 15



The pie chart above shows the distribution of 360 pupils to various houses in a school. Use the it to answer questions 38 – 40.

38. Find the value of the angle marked x^o
    A. 30
    B. 40
    C. 100
    D. 150
39. How many more students are in Yellow House than in Blue House?
    A. 30
    B. 40
    C. 70
    D. 100

40. How many pupils are in Red House?
    A. 15
    B. 50
    C. 100
    D. 150

APPENDIX D

Mathematic achievement test

PRETEST Marking scheme

1.C	21.D
2.A	22.A
3.B	23.C
4.D	24.C
5.A	25.D
6.A	26.A
7.B	27.A
8.D	28.C
9.A	29.B
10.A	30.D
11.B	31.A
12.C	32.C
13.C	33.D
14.C	34.D
15.D	35.B
16.A	36.B
17.B	37.A
18.A	38.D
19.C	39.C
20.B	40.B

APPENDIX E

DISTRIBUTION OF PUBLIC JUNIOR HIGH SCHOOLS IN THE NSAWAM-ADOAGYIRI MUNICIPALITY

Name	Number of Students
Akwakupom Methodist JHS	68
Akuffokrom L/A JHS	70
Akramang JHS	82
Ahyiresu L/A JHS	98
Adoagyiri R/C Girls School JHS	118
Buri Amanfo L/A JHS	110
Al-Badar Islamic JHS	89
Anhuntem Darmang JHS	49
Ankwa Dobro L/A JHS	55
Bishop Atto L/A JHS	69
Bowkrom L/A JHS	102
Dobro Presby JHS	83
Duayeden L/A JHS	72
Dumpong L/A JHS	67
Fotobi M/A JHS	51
Kofisah L/A JHS	82
Methodist JHS	118
Nana Osae Djan JHS	86
Nkyenenkyene Presby JHS	55
Nsawam A.M.E Zion JHS	76
Nsawam Osaebo L/A	82
Nsawam Prisons JHS	66
Nsaba Presby JHS	69
Nsakye Presby JHS	63
Nsawam Anglican A&B JHS	128
Nsawam Presby A&B JHS	122
Nsawam S.D.A JHS	96
Obirkorang- Amandro L/A JHS	73
Oparekrom L/A JHS	69
Pakro Presby JHS	64
Panpanso Teshie Presby JHS	62
Sakyi Agyakwa M/A JHS	54
Tieku L/A JHS	66
St. Michaels Anglican 'C' JHS	59
TOTAL	2,673

Source: Field survey (2021) GES Office

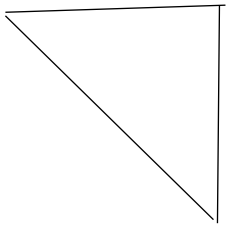
APPENDIX F

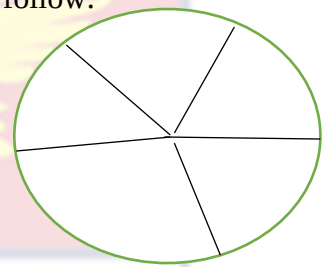
LESSON PLAN FOR CONTROL GROUP

DAY DATE DURATION 70 MIN	TOPIC: FRACTION SUB-TOPIC	RPK: Pupils have been dividing oranges into halves. OBJECTIVE By the end of the lesson a pupil will be able to (i)1.3.1 find the equivalent fractions of a given fraction (ii)1.3.1 compare fractions (iii)1.3.1 order fractions	TEACHER-LEARNER ACTIVITIES Strip of papers and chalk-board illustrations would be used. Introduction: revise pupils RPK by asking them questions State lesson objective in clear terms	CORE POINTS EQUIVALENT FRACTIONS $\frac{a}{b} = \frac{a}{b} \; x \; \frac{c}{c}$ Find the equivalent form of $\frac{2}{3}$. Compare and order fraction $\frac{1}{2}, \frac{3}{4}, \frac{1}{6}$ Find LCM $\frac{1}{2}$x12, $\frac{3}{4}$x12, $\frac{1}{6} \; x \; 12$ Ans: $\frac{1}{6}, \frac{1}{2}, \frac{3}{4}$	EVALUATION & REMARKS Find the equivalent fraction Compare fractions Order fraction Remarks: Lessons was successfully taught

DAY DATE DURATION 70 MIN	TOPIC: FRACTION SUB-TOPIC	RPK: Pupils have been dividing oranges into halves. OBJECTIVE By the end of the lesson a pupil will be able to add and subtract fractions with 2 digits denominators.	TEACHER-LEARNER ACTIVITIES Strips of papers and chalk-board illustrations Introduction Revise pupils RPK by asking them questions	Using the concept of equivalent fractions, guide pupils to add and subtract fractions with 2- digit denomination $\frac{2}{15}+\frac{1}{12}=\frac{8}{60}+\frac{5}{60}$ $\frac{2}{15}-\frac{1}{12}=\frac{8}{60}-\frac{5}{60}$ $=\frac{3}{60}$	Solve problems involving addition and subtraction of fractions
DAY DATE DURATION 70 MIN	TOPIC: FRACTION SUB-TOPIC	RPK: Pupils have been dividing oranges into halves. OBJECTIVE By the end of the lesson a pupil will be able to multiply fractions.	TEACHER-LEARNER ACTIVITIES Strips of papers and chalk-board illustrations Introduction Revise pupils RPK by asking them questions	Fractions by whole numbers (1) $\frac{3}{4}x\ 8$ = 6 (2) $12x\ \frac{2}{3}$ = 8 Fraction by fraction $\frac{a}{b}x\frac{c}{d}=\frac{ac}{bd}$ $\frac{2}{3}x\frac{4}{5}=\frac{8}{15}$	Solve word problems involving multiplication of fractions.

DAY DATE DURATION 70 MIN	TOPIC: FRACTION SUB-TOPIC	RPK: Pupils have been dividing oranges into halves. OBJECTIVE By the end of the lesson a pupil will be able to divide fractiions	TEACHER-LEARNER ACTIVITIES Strips of papers and chalk-board illustrations Introduction Revise pupils RPK by asking them questions	Whole number by a fraction $3 \div \frac{1}{4}$ Guide pupils to use the idea of multiplication and division $\frac{4}{9} \div \frac{5}{7} = \frac{4}{9} x \frac{7}{5}$ $=\frac{28}{45}$ Guide pupils to deduce the role that to divide by fraction, multiply the dividend by the reciprocal of the divisor. $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} x \frac{d}{c}$	Divide (i) A whole number by a fraction $10 \div \frac{2}{5}$ $3 \div \frac{6}{8}$ (ii) A fraction by a fraction $\frac{1}{3} \div \frac{2}{5}$ $\frac{7}{8} \div \frac{2}{4}$

DAY	TOPIC	RPK	TEACHER-LEARNER ACTIVITIES	CORE POINTS	EVALUATION AND REMARKS
DATE	ALGEBRAIC	By the end of the lesson the pupil will be able to do binomial operations	Introducation	Factorisation is the opposite operation of expansion when an expansion is factorised. It is written as the product of two or more simple expressions. Ex:	Factorize the following:
DURATION	EXPRESSION		Revise pupils RPK		(i) $p^2 + pq + 4p$
70 MIN			Expand and simplify		(ii) $5x^2 - 15x$
			(x +y) (x-y)	Factorize 3xy – 6xt	(iii) $z - z^2$
			TLM	Solution	
			Algebra files	3xy – 6xt	
				3x (y - t)	
DAY	TOPIC	By the end of the lesson a pupil will be able to solve algebraic expression	TEACHER-LEARNER ACTIVITIES	Plane shapes are types of shapes with only two-dimensional figures. Examples:	Write an expression equation for the perimeter of the triangle
DATE	ALGEBRAIC		Introduction		
DURATION	EXPRESSION		Revise pupils RPK	Rectangle, square, triangle etc.	
70 MIN			TLM		
			Cut-out shape (Triangle, rectangle etc)		 3z

DAY DATE DURATION 70 MIN	TOPIC STATISTICS SUB-TOPIC	OBJECTIVE By the end of the lesson the pupils will be introduced to Pie chart.	TLM Play diagram Introduction Revise pupils RPK A pair of compass and protractor	Use the pie chart below to answer the questions that follow:  The monthly salary of five employees in New Generation shop. What is the angle of sector that represents Kwame's monthly salary? Soln: Let x be the angle of the sector $115^o+65^o+60^o+55^o+x^o=360^o$ $295^o+x^o=360^o$ $x=65^o$	Pupils answer of Question 1 in page 17 of mathematics textbook2
DAY DATE DURATION 70 MIN	TOPIC LINEAR EQUATION SUB-TOPIC LINEAR INEQUALITIES	OBJECTIVE By the end of the lesson the pupils will be introduced to linear equations.	TLM Play diagram Introduction Revise pupils RPK	A father's age is four times that of his son. In five years' time, the father will be three times as old as his son. What are their present ages? Solution:	Exercise Yeboah is three times as old as Kofi. In 10 years time Yeboah will be twice as old Kofi. Find their ages

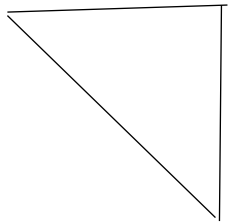
				Let the present age of the son be *y* and the father's age be *4y*. in five years their ages will be increased to *y+5* Therefore, 4y+5=3(y+5) 4y+5=3y+15 4y-3y=15-5 y=10	
DAY DATE DURATION 70 MIN	TOPIC LINEAR EQUATION SUB-TOPIC LINEAR INEQUALITIES	By the end of the lesson the pupils will be able to translate word problem to linear equation in one variable.	TLA Guide pupils to write mathematical sentences from word problem involving linear equation in one variable. Pupils write or translate word problem to linear equation in one variable.	The sum of the of the edges of a cube is 48cm. find the length of each of the edge. Solution A cube has twelve equal edges Let each edge be x cm. $\frac{12x}{12} = \frac{48cm}{12}$ x=4cm	Remarks The lesson was successfully taught.

APPENDIX G
LESSON PLAN EXPERIMENTAL GROUP

DAY DATE DURATION 70 MIN	TOPIC: FRACTION SUB-TOPIC	RPK: Pupils have been dividing oranges into halves. OBJECTIVE By the end of the lesson a pupil will be able to (i)1.3.1 find the equivalent fractions of a given fraction (ii)1.3.1 compare fractions (iii)1.3.1 order fractions	TEACHER-LEARNER ACTIVITIES Strip of papers and chalk-board illustrations would be used. Introduction: revise pupils RPK by asking them questions State lesson objective in clear terms	CORE POINTS EQUIVALENT FRACTIONS $\frac{a}{b} = \frac{a}{b} \; x \; \frac{c}{c}$ Find the equivalent form of $\frac{2}{3}$. Compare and order fraction $\frac{1}{2}, \frac{3}{4}, \frac{1}{6}$ Find LCM $\frac{1}{2}$x12, $\frac{3}{4}$x12, $\frac{1}{6}$ x 12 Ans: $\frac{1}{6}, \frac{1}{2}, \frac{3}{4}$	EVALUATION & REMARKS Find the equivalent fraction Compare fractions Order fraction Remarks: Lessons was successfully taught
DAY DATE DURATION 70 MIN	TOPIC: FRACTION SUB-TOPIC	RPK: Pupils have been dividing oranges into halves. OBJECTIVE By the end of the lesson a pupil will be able to add and subtract fractions with 2 digits denominators.	TEACHER-LEARNER ACTIVITIES Strips of papers and chalk-board illustrations Introduction Revise pupils RPK by asking them questions	Using the concept of equivalent fractions, guide pupils to add and subtract fractions with 2-digit denomination $\frac{2}{15} + \frac{1}{12} = \frac{8}{60} + \frac{5}{60}$	Solve problems involving addition and subtraction of fractions

				$\frac{2}{15} - \frac{1}{12} = \frac{8}{60} - \frac{5}{60}$ $= \frac{3}{60}$	
DAY DATE DURATION 70 MIN	TOPIC: FRACTION SUB-TOPIC	RPK: Pupils have been dividing oranges into halves. OBJECTIVE By the end of the lesson a pupil will be able to multiply fractions.	TEACHER-LEARNER ACTIVITIES Strips of papers and chalk-board illustrations Introduction Revise pupils RPK by asking them questions	Fractions by whole numbers (3) $\frac{3}{4} x\ 8$ = 6 (4) $12x\ \frac{2}{3}$ = 8 Fraction by fraction $\frac{a}{b} x \frac{c}{d} = \frac{ac}{bd}$ $\frac{2}{3} x \frac{4}{5} = \frac{8}{15}$	Solve word problems involving multiplication of fractions.

DAY DATE DURATION 70 MIN	TOPIC: FRACTION SUB-TOPIC	RPK: Pupils have been dividing oranges into halves. OBJECTIVE By the end of the lesson a pupil will be able to divide fractiions	TEACHER-LEARNER ACTIVITIES Strips of papers and chalk-board illustrations Introduction Revise pupils RPK by asking them questions	Whole number by a fraction $3 \div \frac{1}{4}$ Guide pupils to use the idea of multiplication and division $\frac{4}{9} \div \frac{5}{7} = \frac{4}{9} x \frac{7}{5}$ $=\frac{28}{45}$ Guide pupils to deduce the role that to divide by fraction, multiply the dividend by the reciprocal of the divisor. $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} x \frac{d}{c}$	Divide (iii) A whole number by a fraction $10 \div \frac{2}{5}$ $3 \div \frac{6}{8}$ (iv) A fraction by a fraction $\frac{1}{3} \div \frac{2}{5}$ $\frac{7}{8} \div \frac{2}{4}$

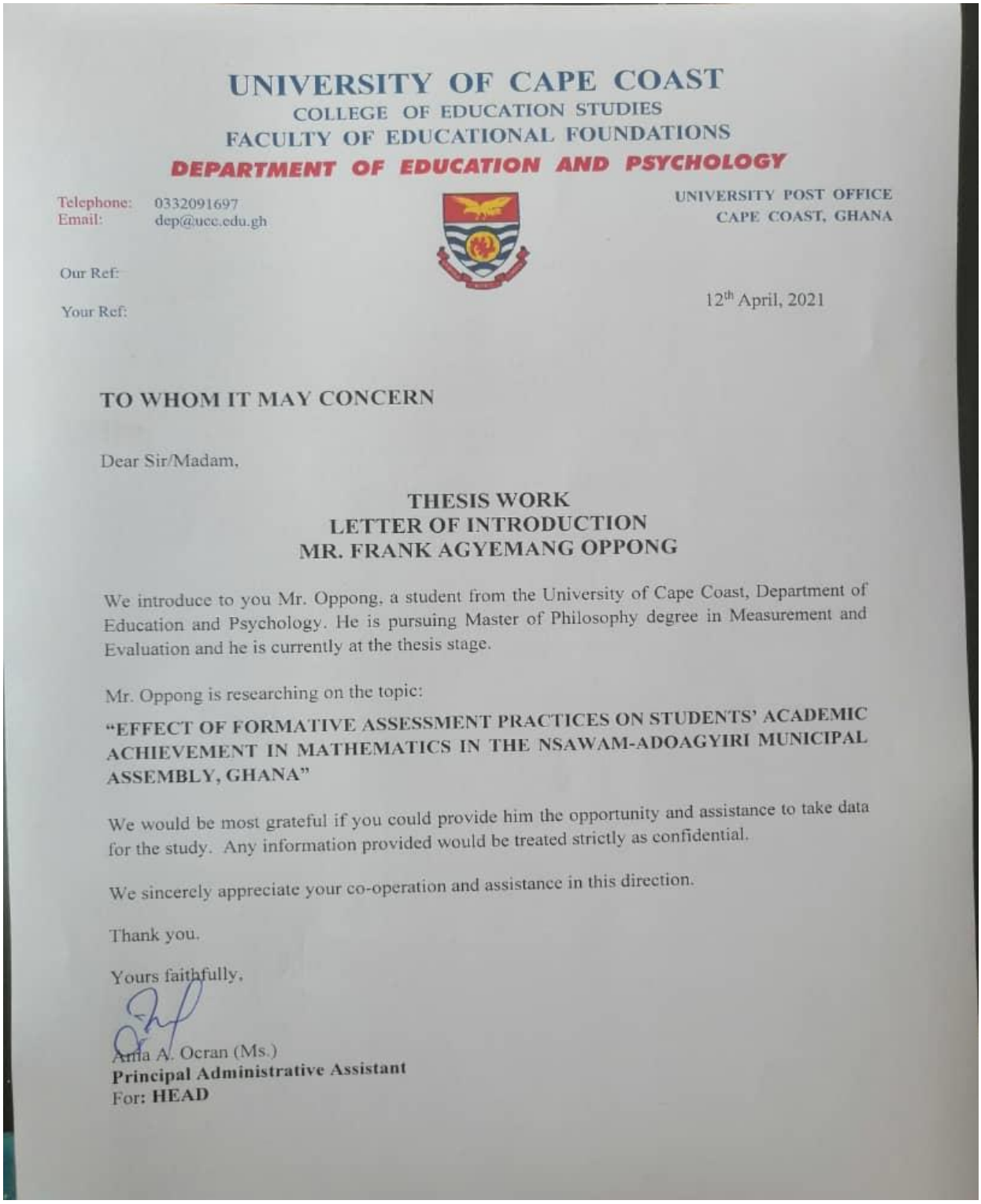
DAY DATE DURATION 70 MIN	TOPIC ALGEBRAIC EXPRESSION	RPK By the end of the lesson the pupil will be able to do binomial operations	TEACHER-LEARNER ACTIVITIES Introduction Revise pupils RPK Expand and simplify (x +y) (x-y) TLM Algebra files	CORE POINTS Factorisation is the opposite operation of expansion when an expansion is factorised. It is written as the product of two or more simple expressions. Ex: Factorize 3xy – 6xt Solution 3xy – 6xt 3x (y - t)	EVALUATION AND REMARKS Factorize the following: (iv) $p^2 + pq + 4p$ (v) $5x^2 - 15x$ (vi) $z - z^2$
DAY DATE DURATION 70 MIN	TOPIC ALGEBRAIC EXPRESSION	By the end of the lesson a pupil will be able to solve algebraic expression	TEACHER-LEARNER ACTIVITIES Introduction Revise pupils RPK TLM Cut-out shape (Triangle, rectangle etc)	Plane shapes are types of shapes with only two-dimensional figures. Examples: rectangle, square, triangle etc.	Write an expression equation for the perimeter of the triangle  3z

DAY DATE DURATION 70 MIN	TOPIC LINEAR EQUATION SUB-TOPIC LINEAR INEQUALITIES	OBJECTIVE By the end of the lesson the pupils will be introduced to linear equations.	TLM Play diagram Introduction Revise pupils RPK	A father's age is four times that of his son. In five years' time, the father will be three times as old as his son. What are their present ages? Solution: Let the present age of the son be *y* and the father's age be *4y*. in five years their ages will be increased to *y+5* Therefore, 4y+5=3(y+5) 4y+5=3y+15 4y-3y=15-5 y=10	Exercise Yeboah is three times as old as Kofi. In 10 years time Yeboah will be twice as old Kofi. Find their ages

DAY DATE DURATION 70 MIN	TOPIC LINEAR EQUATION SUB-TOPIC LINEAR INEQUALITIES	By the end of the lesson the pupils will be able to translate word problem to linear equation in one variable.	TLA Guide pupils to write mathematical sentences from word problem involving linear equation in one variable. Pupils write or translate word problem to linear equation in one variable.	The sum of the of the edges of a cube is 48cm. find the length of each of the edge. Solution A cube has twelve equal edges Let each edge be x cm. $\frac{12x}{12} = \frac{48cm}{12}$ x=4cm	Remarks The lesson was successfully taught.

APPENDIX H

INTRODUCTORY LETTER



UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
FACULTY OF EDUCATIONAL FOUNDATIONS
DEPARTMENT OF EDUCATION AND PSYCHOLOGY

Telephone: 0332091697
Email: dep@ucc.edu.gh

UNIVERSITY POST OFFICE
CAPE COAST, GHANA

Our Ref:

Your Ref:

12th April, 2021

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

THESIS WORK
LETTER OF INTRODUCTION
MR. FRANK AGYEMANG OPPONG

We introduce to you Mr. Oppong, 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. Oppong is researching on the topic:

"EFFECT OF FORMATIVE ASSESSMENT PRACTICES ON STUDENTS' ACADEMIC ACHIEVEMENT IN MATHEMATICS IN THE NSAWAM-ADOAGYIRI MUNICIPAL ASSEMBLY, GHANA"

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

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

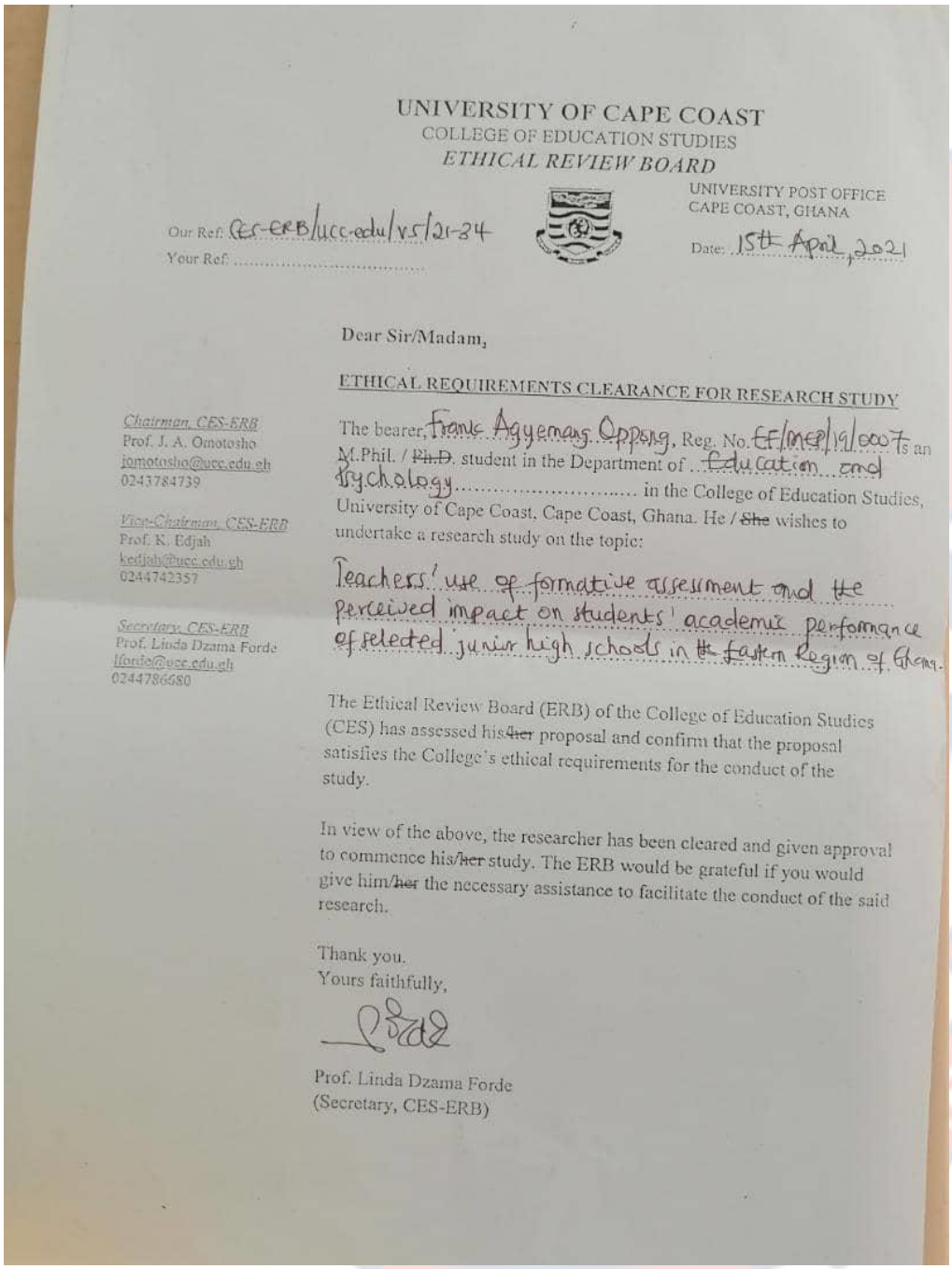
Thank you.

Yours faithfully,

Anna A. Ocran (Ms.)
Principal Administrative Assistant
For: **HEAD**

APPENDIX I

ETHICAL CLEARANCE



UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
ETHICAL REVIEW BOARD

UNIVERSITY POST OFFICE
CAPE COAST, GHANA

Our Ref: CES-ERB/ucc-edu/v5/21-24
Your Ref: .....
Date: 15th April, 2021

Dear Sir/Madam,

ETHICAL REQUIREMENTS CLEARANCE FOR RESEARCH STUDY

The bearer, Frank Agyemang Oppong, Reg. No. EF/ORE/19/0007 is an 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:

Teachers' use of formative assessment and the perceived impact on students' academic performance of selected junior high schools in the Eastern Region of Ghana.

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

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

Thank you.
Yours faithfully,

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

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

Vice-Chairman, CES-ERB
Prof. K. Edjah
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Secretary, CES-ERB
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0244786580