UNIVERSITY OF EDUCATION, WINNEBA

THE IMPACT OF SENIOR HIGH SCHOOL MATHEMATICS TEACHERS' INSTRUCTIONAL STRATEGIES ON STUDENT KNOWLEDGE RETENTION OF ALGEBRAIC CONCEPTS IN THE KWAHU-EAST DISTRICT

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SEPTEMBER, 2023

DECLARATION

STUDENT'S DECLARATION

I, Augustine Ghadah Jnr, declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

SIGNATURE ……………………….……

DATE ……………………..……………

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of thesis as laid down by the University of Education, Winneba.

NAME OF SUPERVISOR: PROF. MICHAEL J. NABIE

SIGNATURE ……………………….……

DATE ……………………..……………

DEDICATION

This thesis is dedicated to my mother, Mad. Mary B. Awaley and the memory of my late father.

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ABSTRACT

The study investigated the impact of Senior High School Mathematics teachers' instructional strategies on student knowledge retention of algebraic concepts in the Kwahu-East District. To achieve this, 67 mathematics teachers were employed using census in five public Senior High Schools in the Kwahu-East District. Questionnaires were employed as the tool for data collection. The findings from the study showed that there was significant difference in student knowledge retention between teachers who incorporated a variety of instructional strategies and those who focused on a single strategy. With mean ratings of 4.09, 4.92 and 4.91 respectively, the use of students' communication mathematically, use of questions and integrative approach were the topmost strategies used by the teachers. Also, strategies such as activity and inquiry base were used in teaching algebra (mean rating of 4.83). The use of demonstrations was also used by the teachers in teaching algebraic concepts which helped the students in the retention of knowledge in algebra. Senior High School Mathematics teachers are therefore urged to engage in teaching strategies that can encourage student participation to help improve their performance in algebra. The Ghana Education Service and heads of schools should also organize Mathematics teaching improvement programs to give mathematics teachers better orientation on the use of effective instructional strategies in teaching algebra.

CHAPTER ONE

INTRODUCTION

1.0 Background to the Study

In the year 2019, the National Council for Curriculum and Assessment (NaCCA) in collaboration with the Ministry of Education rolled out the new standards-based curriculum for Ghanaian basic schools, which is a demonstration of placing learning at the heart of every classroom and ensuring that every learner receives quality education. The new curriculum has at its heart the acquisition of skills in the 4Rs of Reading, wRiting, aRithmetic and cReativity by all learners. It is expected that at any point of exit from a formal education, all learners should be equipped with these foundational skills for life, which are also prerequisites for Ghana becoming a learning nation. The graduates from the school system should become functional citizens in the 4Rs and lifelong learners.

Ghana believes that an effective Mathematics education needed for sustainable development should be inquiry-based. Thus, mathematics education must provide learners with opportunities to expand, change, enhance and modify the ways in which they view the world. Mathematics educational values are those which are embedded in curricula, textbooks as well as teachers' professional practices (Bishop, 2008).

The need for pedagogical reform in Ghanaian mathematics education is well-established (Frimpong, 2017). Mathematics is considered an especially important subject in the school curriculum, not just in Ghana but across the globe. It is one of the most pivotal subjects both in its own right and because of its relevance in other fields of studies like in the Sciences (UK Essays, 2018). Although there have been several attempts to address the difficulties students have with mathematics learning, such as the commissioning of a secondary education improvement project in 2014 (World Bank, 2018), little improvement in students' performance in mathematics has been achieved (Frimpong, 2017; Ghana Star News, 2016).

According to Addae and Agyei (2018), the latest of these initiatives was the review of the mathematics curriculum in September 2010, buttressing the importance that the country attaches to mathematics education. Although the applicability of mathematics is wide and its importance undeniable, a lot of students consistently perform poorly in the subject.

Davis, Carr and Ampadu (2019) found statistically significant differences amongst students in Ghanaian primary, junior high, and senior high schools for seven of the attributes valued most in their mathematics learning: achievement, relevance, fluency, authority, ICT, versatility, and strategies. A country's strong mathematical culture contributes to the global development of a strong industrial culture. For this and other reasons, mathematics is now a required subject in almost every country from preschool through secondary school. Through the National Council for Curriculum and Assessment (NaCCA) and the Curriculum Research and Development Division (CRDD) of the Ghana Education Service (GES), the Ministry of Education (MoE) has developed a mathematics syllabus based on the premise that "all students can learn mathematics and should learn mathematics" (CRDD, 2010).

The government took the decision as part of its efforts to cultivate a strong human resource for the country's economic development. This strategy, on the other hand, has not been without its drawbacks. Several explanations have been proposed to explain why mathematics is in such a horrible state. According to Adolphus (2011), among the causes include inadequate mathematics teaching in primary, junior, and senior high schools, a lack of motivation and incentives, and low job prospects in mathematics in many sectors of the economy other than teaching.

Ghana, along with other English-speaking (Anglophonic) countries in West Africa, took part in the West African Senior School Certificate Examination (WASSCE) in April, 2006. According to the WAEC's Chief Examiners' Reports, children continue to do poorly in mathematics across the country (WAEC 2014 & 2017). Poor arithmetic performance among students has been a global problem, prompting developing countries to join projects aimed at bringing good change to their communities (Sinyosi, 2015). Mathematics excellence can help developing countries enhance their education systems, which will help shape the future and prospects of their young people; create infrastructure; and boost economic knowledge, culture, and morals, as well as their people's living conditions (Roohi, 2012).

Mathematics is recognised as one of the most important subjects in the school curriculum all across the world (Suleiman & Hammed, 2019). It is the basis of scientific and technological knowledge that greatly contributes to a country's socioeconomic development (Suleiman & Hammed, 2019; Kiwanuka et al., 2015). Many individuals rely on mathematics in their daily lives (Ali & Jameel, 2016). Mathematics, according to Enu, Agyeman, and Nkum (2015), is one discipline that has an impact on all aspects of human existence at various levels. Math is the backbone and a tool for every country's scientific, technological, and economic advancement, according to studies by Tshabalala and Ncube (2016). Despite the highly praised and recognised importance of mathematics, as well as the fact that it is a prerequisite for the majority of subjects, poor achievement and lack of interest in mathematics among students continues to be a source of concern in both developed and developing countries' schools, colleges, and universities (Naiker et al., 2020; Sharma et al., 2018).

As far as students are concerned, mathematics remains one of the most complex subjects in school (Ali & Jameel, 2016; Akhter & Akhter, 2018). It is a common misconception that mathematics is exceptionally challenging and complex. The majority of students have a fear of this subject as a result of this misconception (Sa'ad, Adamu, & Sadiq, 2014; Sharma et al., 2018). Furthermore, 21st-century mathematics students arrive in class with a major lack of fluency and dependability in problem-solving, a negative attitude, numerical and algebraic manipulation and simplification (Sharma et al., 2018; Yeh et al., 2019). The ability to solve problems mathematically is essential for a society's economic prosperity (Lipnevich et al., 2011). It is also crucial for a country's scientific and technological progress (Enu, Agyeman, & Nkum, 2015).

This is due to the fact that mathematics is necessary for understanding other fields such as engineering, physics, social science, and even the arts (Patena & Dinglasan, 2013; Phonapichat, Wongwanich, & Sujiva, 2014). Mathematics, according to Abe and Gbenro (2014), has a multifaceted function in science and technology, with applications spanning all fields of science, technology, and business enterprises. Mathematics has become an important part of the educational curriculum due to its importance.

According to Ngussa and Mbuti (2017), the mathematics curriculum is intended to provide students with knowledge and skills that are essential in the changing technological world. These discoveries appear more crucial when related studies reiterate that if students' misconceptions and errors in algebra are not purposefully detected and corrected immediately, it could lead to incorrect understanding of the concepts and consequently affect students' achievement not only in mathematics but other fields that require the use of mathematics such as the sciences (Rahim, Noor & Zaid, 2015).

It is important to understand that algebra is a very important topic in the school curriculum in Ghana. Every student who is admitted to the senior high school studies algebra; one of the first math topics in core (general) mathematics that builds on their understanding of arithmetic. All students in this category are expected to study this subject throughout their study period in the high school, irrespective of the programme. Algebra is also an integral component of elective mathematics which is normally a mandatory subject offered to students who specialize in the Science and Technical programmes as well as some programmes in the Arts and Business.

Algebra is considered by many to be the mathematical gatekeeper, and mastering algebra skills give students a passport to educational opportunities and an expansive job market (Ralston et al., 2018). Although often conceptualized as a standalone course, algebra is a strand of mathematics requiring a set of skills used across topics (Ralston et al., 2018; Stephens et al., 2015). Basic algebraic reasoning includes such problems as $3+2 = \_\_\_$, with more complex algebra studied at the secondary level involving multiple steps and imaginary numbers [e.g., $4(3m - 7) = 2(6 + 9m)$]. Algebra may include the manipulation of numbers and symbols to solve for an unknown, identifying and analyzing patterns, examining relationships, making generalizations, and interpreting change (National Council of Teachers of Mathematics [NCTM], 2000; Stephens et al., 2015). Foundations of algebra are introduced upon entering school and students begin by developing fluency with numbers, exploring structure in operations, and describing relationships (Stephens et al., 2015). The success of students in Algebra has been linked to performance in college, career readiness, impact on career salary, and perceptions of higher mathematics (Eddy et al., 2015).

Apart from arithmetic, one can neither be successful in mathematics without algebra nor understand well a lot of important mathematical concepts in science, statistics, business, or today's technology (Makonye & Stepwell, 2016). This is an indication that algebraic thinking is vital and ought to be within the reach of all learners if they are to participate fully in society. A good understanding of algebra is therefore, a prerequisite for proficiency and success in higher mathematics and life (Matzin & Shahrill, 2015).

Algebra is an essential part of the Ghanaian curriculum. It is taught in both primary and secondary schools, and forms part of the core curriculum. The scope of algebra in the curriculum encompasses topics such as basic arithmetic operations, equations, polynomials, linear and quadratic equations, function graphing, and exponential and logarithmic functions. The goal of algebra in the curriculum is to provide students with a strong foundation in mathematics, which can be used to develop problem-solving skills and apply mathematical knowledge to real-world situations.

To meet the stated goals, the Ghanaian government has put in place various provisions. For example, the government has established a national curriculum which outlines the scope of algebra in the curriculum, as well as the expected outcomes for each grade level. The government also provides resources for teachers, such as textbooks and teaching materials, to ensure that students are adequately prepared for the topics being taught. Additionally, the government has implemented various assessment processes to ensure that students are making progress towards the desired outcomes. Finally, the government has established a monitoring system to ensure that teachers are teaching the topics correctly and that students are receiving the necessary instruction (Inkoom, 2019).

Education has evolved from traditional teacher-centered methods to methods that are more interactive and learner centered (Lu, 2019). However, to this day, the effectiveness of the student-centered approach for learner performance is questioned by many (Zhao et al., 2017). One of the main aims of teaching and the activities undertaken in the classroom by teachers is to provide learners with the fundamental content knowledge required to enhance what they already know (Lu, 2019). To ensure that learners understand what is taught by the teacher, different instructional strategies are applied in the classroom. These instructional strategies are usually selected according to the content to be presented.

Instructional strategies are everything that teachers use to aid learners in their learning process and are the means to bring about effective teaching and learning (Amos, Folasayo & Oluwatoyin, 2015). Instructional strategies ensure that, there is an effective achievement of stated instructional objectives (Nafees et al., 2016) and increase student achievement (Dean et al., 2016). Researchers, Yılmaz, Altun, and Olkun (2016) identified factors that include connecting mathematics with real life, using instructional materials, teachers' personality, teachers' content area knowledge, bad instructional practices, lack of commitment by students' and teachers' classroom management. Other factors include teachers' emotional support (Blazar & Kraft, 2017), teachers' affective support (Sakiz, Pape & Hoy, 2015), class activities, subject content and amount of work, scarcity of teachers and inadequate resources, peer and parental influence (Enu, Agyman & Nkum, 2015).

The relationship between instructional strategies and student performance is that the quality of instruction can have a significant impact on the amount of information and skills students are able to acquire. The instructional strategies for teaching algebra in the Ghanaian curriculum include problem solving, cooperative learning, direct instruction, and inquiry-based learning. These strategies have been shown to help students develop a deeper understanding of the subject matter, as well as increase their confidence in solving algebraic equations (Wilmot, 2018). The outcome of using these instructional strategies can include improved student performance in algebra, increased motivation, and improved problem-solving skills. Alternatives that can help include using technology to supplement instruction and providing students with visual aids to help them better understand algebraic equations (Amber, 2019).

The Ministry of Education (MoE) in Ghana has been making efforts to expand the instructional capacity of teachers through the inclusion of mathematics in national curriculum and teacher training initiatives. Through these efforts, the MoE is aiming to improve the quality of instruction for algebra and other related mathematics topics (Young, 2019). In the Kwahu East district for example, the performance of students in mathematics has been a cause of concern as there has been a decline in students' academic performance in the past 3 years from 25% to 15% (Kwahu East District of Education, 2018). Thus, the researcher's decision to carry out this particular research on teaching algebra: The imapct of senior high schools mathematics teachers' instructional strategies on student knowledge retention of algebraic concepts in the Kwahu-East district.

1.1 Statement of the Problem

Early mathematics concepts are foundational for success throughout the school years and later during adult life (Lee, Park & Ginsburg, 2016; Opfer, Kim & Qin, 2018; Watts et al., 2018). Educators face several problems in designing curriculum, implementing appropriate instructional strategies, and monitoring interventions in an early childhood classroom where children are at various differing ends of a spectrum of mathematical abilities (Anders & Rossbach, 2015; Oppermann, Anders & Hachfeld, 2016). More importantly, there are several unique challenges associated with learning algebra. To begin with, algebra requires a considerable amount of abstract thinking. In order to further advance algebraic understanding, students must learn to navigate the gap from concrete to abstract reasoning (Stephens et al., 2015; Witzel, 2016).

A study of the WAEC reports for mathematics (both core and elective) from 2014 to 2017 revealed that students were weak and experienced difficulties in algebra. Specifically, "students have difficulty in translating story problems into mathematical statements and solving them" (Chief Examiner's Report in Mathematics, 2017:210) and many of them "demonstrated weakness in using algebra to solve probabilities" (Chief Examiner's Report in Mathematics, 2014:13).

Mereku (2012) also outlined that most students lack the ability to solve problems involving algebra. Students' weaknesses and inability to deal with the algebra effect affects their performances in mathematics. In the Kwahu East district, the performance of students in mathematics has been a cause of concern as there has been a decline in students' academic performance from 25% to 15% in the past 3 years (Kwahu East District of Education, 2018). The researcher observed from personal experience from one of the senior high schools in the district that most of the students had challenges in learning algebra. Yin (1994), states that observational evidence is often useful in providing additional information about a topic being studied. It follows from this that, in order to improve students' performance in mathematics in general, the teacher should enhance a profound understanding and acquisition of algebraic concepts and thinking skills. Algebraic skills can be promoted in school through the use of effective instructional strategies. Poor performance in internal and public examinations in Mathematics have been attributed to teachers' strategy of teaching students, students' attitudes, unavailability of learning materials among others (Anigbo, 2016).

Mathematics teachers often develop instructional methods or strategies that they think are appropriate for teaching each topic with the aim of attaining the desired change in student behaviors. These instructional strategies are the most potent variables that can influence students' mathematics interest and performance (Anigbo, 2016). Numerous instructional strategies and practices have been identified as characteristic of effective teaching. Such instructional strategies and practices have become the focus of initial teacher education and continuing professional development training programs. Eriksson, Helenius and Ryve (2018) argued that, instructional strategies and practices should only be regarded as characteristic of quality teaching if there is evidence that they generally have a positive effect on student algebraic achievement. Instructional strategies in teaching algebra should therefore be of great interest to the mathematics teacher. Traditional methods of teaching Mathematics, such as rote memorization, are not sufficient for learners to be able to develop a deep conceptual understanding of algebra. In order for learners to be successful in Mathematics, they need to be able to make connections between mathematical concepts, create strategies for problem-solving, and think critically about the material. Traditional methods do not provide the necessary instructional support for this kind of learning to take place. Additionally, traditional methods may be too slow for many learners, leading to frustration and a lack of engagement.

A considerable number of researchers however have examined teachers' knowledge in algebra (Mereku, 2012, Sharma et al., 2018; Yeh et al., 2019). There is however inadequate information on teachers' use of instructional strategies in teaching algebra. This current study therefore aims at assessing Senior High Schools Mathematics Teacher's Instructional Strategies and their impact on student knowledge retention in algebraic concepts in the Kwahu-East District.

1.2 The Purpose of the Study

Algebraic thinking is very important in the development of students' mathematical knowledge. Many researchers (Fletcher, 2016; Kaput, 2008; Windsor, 2010) agreed that algebraic thinking is an essential mathematical tool not only for school, but for life. Understanding algebra is key to success in future mathematics courses, making it critical to identify strategies that improve algebra knowledge. Therefore, it is important that any obstacle that will make it difficult for students to understand the basic algebraic concepts are well addressed. In this regard, the research was designed to study the strategies SHS teachers employ in teaching algebra and their impact on students' knowledge retention.

1.3 Objectives of the Study

The objectives of this study are to:

1. Determine the instructional strategies Mathematics teachers use in teaching algebraic concepts in the Kwahu-East district.

2. Investigate how often Mathematics teachers use instructional strategies in teaching algebra in the Kwahu-East district.
3. Ascertain the impact of instructional strategies teachers use on student's knowledge retention in algebra in the Kwahu-East district

1.4 Research Questions

Within the framework of the study, certain questions need to be addressed. These questions would help define the overall direction and limit of the research. The study would therefore be guided by the following questions:

1. What are the instructional strategies used by teachers in teaching basic algebraic concepts in Senior High Schools within the Kwahu-East District?

2. How do Mathematics teachers use instructional strategies in teaching algebra in the Kwahu-East District?

3. What is the impact the instructional strategies by teachers in teaching algebra have on students' academic performance in the Kwahu-East District?

1.5 Significance of the Study

This study seeks to examine the instructional strategies used by teachers in teaching basic algebraic concepts in Senior High Schools within the Kwahu-East District and the impact of these strategies on students' academic performance. By understanding the instructional strategies used by teachers and their impact on students' academic performance, this study will provide valuable information to help educators improve the teaching of algebraic concepts in the Kwahu-East District. This research will also help to identify any potential gaps in the teaching of algebraic concepts and provide recommendations for improvement. This study will help to inform policy makers on the best strategies to use in teaching algebraic concepts in the Kwahu-East District. The findings of the study would definitely reveal some of the deficiencies accompanying the teaching and learning of algebraic concepts in mathematics classrooms. It would also guide willing teachers to vary their teaching methods to help serve Ghana education better. Expectations are high on literates to solve real-life problems from their mathematical knowledge and experiences. This actually makes the school graduate useful to him/herself and to the society as a whole. Knowledge in mathematics helps students fit better in society. For example, a topic in mathematics like "Logical Reasoning" makes people more logical in the analysis of their everyday situations. This in a long way makes mathematicians a special group of respected analytic individuals.

Again, the steps followed in solving mathematical problems make the individual patient in life; at the same time, making the individual understand that life starts from a premise (raw and unpredictable beginnings), creates connections between variables (bonding, knowledge and making sense out of situations), before solving and concluding (making it in life). This fact is very typical of algebra where insignificant variables are generated, connected together in procedural patterns and then delivering important mathematical concepts and constants.

This study is hoped to help teachers understand the different strategies in classroom delivery to enable them vary their teaching methods where applicable and in effect help students gain knowledge on the different strategies that can be employed by their respective teachers, helping them to adjust appropriately to positively impact on their mathematics achievements.

This research could be of great importance to all players of education especially the Ministry of Education, Ghana Education Service, the West African Examinations Council, and other organizations that play various roles in the promotion and development of Mathematics Education in Ghana.

Finally, many researchers around the world may benefit from the study's findings when expanding their knowledge and learning experiences by using it as an input to their studies and ready references for relating it to their plans or already started projects where this result would be best used as a reference.

1.6 Delimitation of the Study

The study was delimited to only SHS Mathematics teachers in the Kwahu-East District. The participants were selected with no consideration of their ethnic, cultural and socio-economic background. It was clear that those who were selected were not the true representation of the whole Public Senior High School population in Ghana, but it can be presumed that those that were selected share common strategies and techniques in their algebra classes with the rest of the population in Ghana.

1.7 Organization of the Study

The study is organized into five (5) chapters.

The introduction of the study which is chapter one, constitutes the introduction and background of the study, statement of the problem, purpose of the study, research questions, research objectives, significance of the study, delimitation of the study, as well as how the entire work was organised. Chapter two is dedicated to a review of current literature on relevant works done in this area of research. Chapter three establishes the methodology of the study. In this regard, that section discusses the following; the study area, research design, population, sample size and sampling techniques, the data collection tools, and data analysis. Chapter four is dedicated to the results and discussion. Chapter five which is the final chapter of this study discusses the findings, conclusions and recommendations of the study.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

As a mechanism, research on literature review is a systematic, explicit and empirical approach through which researchers, scholars and practitioners could identify, evaluate and synthesize an established body of completed and documented study (Fink, 2010). The second chapter of this study provides a general review of past research that is relevant to this study, encompassing scholarly journals, international agencies' reports, government official documents and online documents. Examining the impact of Senior High Schools Mathematics Teacher's instructional strategies on student knowledge retention of algebraic concepts in the Kwahu-East District was the focus of this study.

2.1 Basic Algebraic Concepts in Mathematics

Apart from arithmetic, one can neither be successful in mathematics without algebra (Makonye & Stepwell, 2016). A good understanding of algebra is therefore, a prerequisite (the gate keeper) (Usisin, 2004) for proficiency and success in higher mathematics and life. However, conceptual difficulties in algebra beset students (Chow & Treagust, 2013; Chow, 2011; Matzin & Shahrill, 2015), necessitating constant attention. For example, misconceptions (the cause of systematic errors) are well-documented conceptual challenges (e.g., Ling, Shahrill & Tan, 2016; Pournara et al., 2016).

It has been established that high school students have misconceptions about mathematics and make errors as a result. Secondary school students have misconceptions about variables, algebraic expressions, equations, and word problems, according to Egodawatte (2011) and Seng (2010). Errors and misconceptions hinder learning and problem solving (Booth et al., 2014; Makonye & Stepwell, 2016; Ling, Shahrill & Tan, 2016). These discoveries appear more crucial when related studies reiterate that if students' misconceptions and errors in algebra are not purposefully detected and corrected immediately, it could lead to incorrect understanding of the concepts and consequently affect students' achievement (Rahim, Noor & Zaid, 2015).

Students experienced weaknesses/difficulties in the following areas: variations, logarithms, word problems, binary operations, calculus - all of which are largely reliant on algebra among others, according to the WAEC chief examiner's report for mathematics (both core and elective) from 2014 to 2017. "Students have difficulty in translating story problems into mathematical statements and solving them" (Chief Examiner's Report in Mathematics, 2017:210) and "demonstrated weakness in using algebra to solve probabilities" (Chief Examiner's Report in Mathematics, 2014:13).

The development of students' mathematical knowledge relies heavily on algebraic thinking. Many researchers (Fletcher, 2008; Kriegler, 2008; Windsor, 2010) concur that algebraic thinking is an important mathematical tool not only in school but also in life, and that it is the way to go. Fletcher (2008) argued that, algebraic thinking indicates that a person has a strong reasoning ability and algebraic thinking being an important aspect of mathematics, operates at a higher level. Over the last two decades, researchers in mathematics education have spent a lot of resources assessing the many types of mathematical knowledge that are required for effective teaching (Ball et al., 2008; Hill, Ball, & Schilling, 2008; Hurrell, 2013; Li, 2011). Algebra success has been linked to perceptions of higher mathematics, career readiness, college performance, influence on career and salary (Eddy et al., 2015).

A framework was developed to investigate mathematical knowledge for teaching algebra (McCrory et al., 2012). McCrory et al., suggested three categories of knowledge were needed to effectively teach algebra. These categories include (a) school algebra – knowledge of concepts and ideas taught in high school algebra, (b) advanced mathematics – knowledge of college-level mathematics, and (c) algebra for teaching – pedagogical content knowledge of teaching algebra. Secondary teachers' knowledge of teaching is strictly measured by content tests or the number of mathematics courses taken, according to McCrory et al., (2012), but none of these measures offer a comprehensive picture of a teacher's knowledge of algebra for teaching.

2.2 Knowledge Retention of Algebraic Concepts

It is suggested that retention can be improved in several ways such as comprehesive learning of concepts and involving different instructional approaches. There is a more recent evidence that using active learning approaches and involving students in inquiry and discovery processes enchances knowledge retention (Handelsman et al, 2004). Steyn (2003) argues that knowledge retention is related to the way it is taught. The teacher is seen as the one responsible to guide students in the proess of learning and retention. St. Clair (2004), however found no significant improvement on long-term retention of knowledge of engineering students over a twenty-five week period after intervention where the effect of the technology was invistigated. It was concluded that using instructional technology does not hinder long-term knowledge retention and can make instructional process more effective.

In a study with engineering students, Townsend (2001) used case studies to contextualize mathematics and concluded that it contributed to students' retention level of mathematical knowledge. In retaining algebriac concepts, Allen et al (2005) investigated students' retention of conceptual and procedural knowledge via analysing their performance by using a post-test after one year of instruction in two differential equations classes. The results of this study suggested that teaching for conceptual understanding can lead to longer retention of mathematical knowledge.

2.3 Procedural versus Conceptual Knowledge Retention.

Recent studies show interest in conceptual and procedural learning of students in mathematics (Omran et al, 2005). Kwon & Han (2005) also compared students exposed to an inquiry-oriented course in differential equations with students in a smilair but traditonal class. It was reported that inquiry based class showed better long-term retention of conceptual knowledge. Garner and Garner (2011) recorded the results of a study where a reform and a traditional calculus course were compared with respect to students' long-term retention of basic concepts and skills. They reported no significant difference in the reform group of students, however, the reform class retained conceptual knowlegde better and the traditional students retained procedural knowledge better.

2.4 Student Knowledge Retention of Learning Algebra

In an ideal world, if students can improve their learning retention, their mastery of topics could improve, and their math performance will improve as a result (Madu, 2018; Lubna, Ali & Jabeen, 2017). Thus, issues with mathematics performance could be addressed. Recall and recognition are made possible by the ability to remember information and the retention of the after effects of experience and learning (Ahlam & Gaber, 2014). Learning retention is important in education because it allows students to remember what they have learned within and beyond the classroom.

It might be challenging for educators to choose a teaching strategy that will result in learners remembering what they have learned (Roya, Sedaghat & Ahmadi, 2014). Understanding, information processing, and storing within memory are all parts of the learner's cognitive information processing (Lutz & Huitt, 2014). Students remember what they have studied, but transfer needs students to not only remember but also to understand and apply what they have learned (Paul & Elder, 2020). Mathematics is seen to be one of the most challenging courses among students, especially those who are not naturally suited to it (Anu, Vauras & Kinnunen, 2010). The subject's nature necessitates both conceptual and procedural knowledge (Rittle-Johnson & Schneider, 2015).

Nelson (2017) pointed out that, the human mind and its ability to retain knowledge may be classified in many different ways. The duration of memory retention, especially sensory, short-term memory, and long-term memory, is one of the most commonly used classifications. Brief-term memory refers to recent memories that are only retained for a short period of time. Whereas sensory memory is communicated through the senses of sight and hearing, and is where these "images" are kept in the mind, short-term memory, on the other hand, may be thought of as a database that stores all of the knowledge that one has acquired (Nelson 2017).

Educators' goal is to help students transfer short-term memory learned in the classroom to long-term memory. Several ideas and researches, such as the concept of the learning pyramid and the retention rate, were presented to the public with this goal in mind. These two concepts are related to the amount of information kept by the human mind when various teaching strategies are used (Nelson, 2017). Mathematics is a domain in which many people report high levels of stress, and it is reported as the most hated subject in school (Peng et al., 2016), which affects their attitude toward the subject

(Vandecandelaere et al., 2012), learning retention (Tou et al., 2013), and, as a result, mathematics performance. Hence, topics in mathematics such as algebra have higher chances of motivated forgetting (Amy et al., 2012).

Earlier research, according to Telima (2011) and Gimba et al., (2018), show that students who have a positive attitude toward mathematics are more likely to be engaged in its teaching and learning. Students who have a negative attitude towards mathematics, on the other hand, are less interested in it as a subject to teach and study. These groups of students' unpleasant experiences were the most significant factor in their tendency to develop anxiety in mathematics. As such, students are more likely to engage in motivated forgetting. Motivated forgetting is the practice of actively forgetting unpleasant memories that threaten one's identity or state of mind (Ling, 2016).

2.5 Concept of Variable

In learning algebra, students need to have a developed concept of the meaning of variable. This understanding should be rooted in experiences with patterns and generalizations (Joffrion, 2007). Variables take on many different meanings in algebra and therefore the concept is difficult for students. Variables are to be treated as tools for expressing relationships. Research suggests that it may be helpful for students to verbally express a generalization before attempting to represent it using symbols (Schoenfeld 1998). Students have a lot of misconceptions about variables in algebra. For instance, the variable "x" has been mistaken for the multiplication symbol by many students (Martinez, 2002). Again, there has been instances where students think that, when a variable say 'a' is changed to 'b' in the same equation, it changes the answer of the equation. Wagner (1977) as cited in Joffrion (2007), presented students with two equations that were identical except for different letters which were used as the single variable.

2.6 Modelling Equations from Verbal Representation

Modelling equations from problem situations that incorporates problem solving is a problem for many students and even sometimes mathematics teachers. Translating from verbal relational statements to symbolic equations, or from English to 'maths' causes students of all ages a great deal of confusion (Joffrion, 2007). Lodholz (1990) observed that writing equations from word problems is often a skill taught in contrived situations or in isolation. For example, students often translate English sentences to mathematical expressions simply by moving from left to right. In solving four less than a number for example, students often interpret by 4-x, since the words "less than" (which means to subtract) follow the 4. Teachers must be aware of these misconceptions and address them during instructions (Lodholz, 1990). Before students learn to represent algebraic situations symbolically, they should have opportunities to discuss them in easily understood everyday language, thus developing their conceptual understanding (Kieran & Chalouh, 1993).

In everyday life, mathematics plays an important part. Learning mathematics improves students' analytical thinking and reasoning abilities, as well as their ability to develop lifetime learning skills to solve challenges (Prayoga & Abraham, 2017). Mathematics is a subject that many students either love or detest academically, and it is mostly disliked by students who do not find figures interesting, particularly those who are more interested in social sciences (Prayoga & Abraham, 2017). Regardless of the fact that they recognize its relevance in the development of science and technology in any society, students consider mathematics to be an abstract subject (Kiwanuka et al., 2015). Mathematics is seen negatively by the majority of students (Zakaria et al., 2013). Students develop negative attitudes and concerns about mathematics as a result of the formulas and rules included in a mathematics lesson (Altintas & Ilgün, 2017). Mathematics, according to Murugan and Rajoo (2013), was created to generate competent people who can apply mathematics in their daily lives and to improve problem-solving and decision-making abilities. The training and preparation of students to perform well in mathematics has become a core goal of education in most countries since it is frequently deemed important for the success of the students and the country (Butakor, 2016).

Mutodi (2014) therefore proposed that, students should be permitted to communicate mathematically, reason mathematically, and acquire self-confidence in solving mathematical issues in order to increase their mathematics performance. Individuals taking responsibility for their own learning is one of the most difficult challenges in learning. When students take responsibility for their own learning, they give the process of learning meaning, which leads to more effective learning (Nzesei, 2015). Individual learning needs to be understood by teachers. Individuals interact with their surroundings during the learning process, uniquely processing information and necessitating a unique learning environment. As a result, in order to assist individuals in optimizing their learning, addressing the difficulty of promoting learning circumstances while structuring, such encounters should be considered (Singh, 2017).

Attitude refers to a person's taught tendency to respond positively or negatively to an item, circumstance, concept, or another person (Sarmah & Puri, 2014). Children's attitudes may change and grow over time (Syyeda, 2016), and having a positive attitude can help them learn more effectively (Akinsola & Olowojaiye, 2008). A negative attitude, on the other hand, inhibits effective learning and, as a result, has an impact on learning outcomes and performance (Joseph, 2013). In a research done in Ghana, Mensah, Okyere, and Kuranchie (2013) discovered a substantial positive correlation between students' attitudes and performance.

As indicated by their grades, a variety of factors impact students' mathematical performance. To Biswas (2015), this study will primarily focus on students' affective characteristics, which include study habits and attitudes, which are then referred to as study orientations. For college students, mastering time management and developing good study habits are two major challenges. The factors identified by Bashir and Mattoo (2012) demonstrated a significant correlation between a variety of study habits and academic performance. According to the findings of Khurshid et al., (2012), there was a definite correlation between study habits and academic accomplishment. Three factors determine student achievement in mathematics, according to Morosanova et al., (2016) and Guy et al., (2015): teaching quality, intelligence quotient (IQ) and cognitive entrance abilities and emotional characteristics.

Research suggests that future efforts should be directed at identifying non-intellectual qualities that might assist in explaining the remaining diversity although mathematics is intellectual and college grades are connected to non-intellectual factors such as study habits and attitudes (Guy et al., 2015). For Bawuah (2013), the difficulty of teaching and learning mathematics is exacerbated when the community in which students are educated does not regard school as a very important factor in their lives; a community in which education is not valued; and where parents and guardians prefer their children to farm or stay at home rather than attend school.

There is nothing a teacher can do to aid school children because he or she may not know the student's abilities, knowledge, or educational capabilities in such a community. Such individuals do not maintain a constant attitude toward their education, making it difficult for them to complete what they are studying, especially when the subject being taught is one of the most difficult and feared. In Ghana's Kassena-Nankana district, Churcher, Asiedu-Owuba, and Adjabui (2015) evaluated the performance of high school students in mathematics education.

The inadequacy of study resources such as text books, as well as the performance of teachers, were shown to be the primary causes of students' low mathematical performance. Parental and extracurricular activities, most likely activities at home, were also found to be a factor in the low student performance. As a result, Arthur, Asiedu-Addo, and Assuah (2017) proposed that hands-on teaching techniques would properly motivate students even while assisting in the reduction of negative mathematics perceptions in order to increase interest.

2.7 Teacher's Instructional Strategies in Teaching Algebra

Education is an effort to improve people's abilities to live their best lives as individuals or members of society (Siagian & Surya, 2017). Simbolon (2017) assert that, education development in this period is inextricably linked to the goal of all stakeholders in education to enhance the quality of teaching and learning in order to help students achieve better academic results. One of the purposes of mathematics learning in school, according to Rizqi and Surya (2017), is to train students in thinking and reasoning in order to reach conclusions, develop the ability to solve problems, and develop the ability to provide information or communicate ideas through speech, pictures, writing, graphs, diagrams, maps, and other means.

Hasanah and Surya (2017) believe that all learners, starting in elementary school, should be taught mathematics in order to equip them with the ability to think analytically, rationally, systematically, creatively, cooperatively and critically. Since Mathematics is so important to human and societal development, there is a need for effective teaching and learning strategies that will help students achieve better academic results in Mathematics so that they can fully participate in science and technology, which are indicators of national development (Ayinla, 2015). So far, research has examined the impact of instructional strategies on students' academic performance, with findings indicating that when the majority of students in a class do badly, it is invariably linked to the use of ineffective instructional strategies (Ganyaupfu, 2013).

Teachers in mathematics classrooms utilize identified instructional strategies and practices, despite the fact that using them does not guarantee an effective teacher (Hoge, 2016). Gregory and Chapman (2013) suggest that teachers need a wide range and large number of instructional strategies in order to impart material in a variety of ways. According them, this is important in order to address the learners' individuality in the classroom.

Mathematics learning is a process that is purposely structured with the goal of providing an environment that allows one to participate in mathematics learning activities, and it is centred on educators teaching mathematics through active student participation (Esmonde, 2017). A teacher uses a variety of strategies, designs, and activities to accomplish this, one of which is the use of instructional strategies in the classroom. Instructional strategies are ways that teachers can employ to facilitate the teaching and learning of a certain subject or course, according to Koko and Nkpolu-Oroworuko (2016).

Teaching approaches and techniques that support effective teaching and learning are referred to as instructional strategies (Koko & Nkpolu-Oroworuko, 2016). To them, one of the most important functions of instructional techniques is to concretize students' learning and help them attain educational objectives. On the other side, improper use of instructional strategies in the classroom can have negative consequences for students.

Some instructional strategies for teaching large classrooms, according to Bûsljeta (2013), include supporting the process of learning, decoding, organizing, and integrating educational content, as well as logical thinking and reasoning. However, it should be noted that whether or not these objectives are met is entirely dependent on the efficient application of instructional strategies in the classroom. Evidence-based teaching practices, according to Graber, Killian and Woods (2016), should be used in the classroom since they are thought to have the greatest influence on student results. Questioning to check for knowledge, summarizing new material in a graphical format, lots of good practice, providing students with feedback, and motivating students to work together in a productive manner are some of the strategies mentioned by the trio.

In some research done in Tanzania by Namamba and Rao (2017), it was discovered that there was a paucity of instructional resources in the teaching of history compared to the sciences. Fundamentally, the inadequacy of instructional strategies is not a rational basis for teachers to explain their utter incompetence when it comes to the application of instructional strategies (Koko & Nkpolu-Oroworuko, 2016).

In another research titled "evaluation of the criteria used by teachers in selecting learning resources," Agufuna, Too, and Mukwa (2018) attempted to uncover the factors that teachers evaluate when selecting instructional strategies for teaching. A total of 168 secondary school teachers were chosen to participate in the study using stratified random sampling. To examine the results, descriptive statistics were utilized. The researchers looked at how the following factors influenced teachers' choice of instructional resources: lesson objectives, time available, lesson topic, syllabus coverage, cost of materials, class level, age of students, class size and teacher preparedness. According to the study, 90% of teachers agreed that class objectives influenced how they chose learning resources for instruction. About 58% of teachers agreed that the study topic determined which learning strategies they selected for instruction, while another 35% tended to agree. Research data revealed that 80% of teachers agreed to the fact that syllabus coverage affected the resources they selected for use in instruction. The study results revealed that 52.4% of teachers agreed to the point that the age of pupils was one of the criteria they used in determining the learning resources they used in instruction, while a further 35.1% tended to agree to this fact. 40% of teachers tend to disagree that time available determined the learning resources they selected to use while instructing, while another 35% disagreed. This study will thus review some instructional strategies that mathematics teachers can use in teaching algebra.

2.8 Corporative Learning/Pair Learning

Corporative learning strategy is one of the most effective way teachers can help students learn algebra effectively. Several definitions of corporative learning have been offered by educationists. Felder and Brent (2010), define corporative learning (CL) to be students working in teams on an assignment or project under conditions in which certain criteria are satisfied. These conditions include members being held individually accountable for the completion of content which in turn facilitate the completion of the assignment or project.

Learning in small groups plays an increasing role in modern pedagogy, from K-12 to higher education and there is strong evidence that students working in small groups outperform students working individually in several key areas, including knowledge development, thinking skills, social skills, and course satisfaction (Barkley, Major & Cross, 2014). A myriad of terms has been used to describe such learning in the past four decades, but most commonly, these group-based processes are called cooperative or collaborative learning.

These approaches are built on developmental and educational theory, suggesting that learning is fundamentally a cooperative, collaborative process of socially constructing knowledge (Slavich & Zimbardo, 2012). Research in different subject areas and with students of various ages has demonstrated positive effects of cooperative learning on academic achievement and the development of higher-order thinking skills (Michaelsen, Davidson, Major &, 2014). This instructional strategy if used can help students to relate well with their peers as well as improve their performances in algebra.

2.9 Inquiry-Based Learning

Bacon and Matthews (2014) stated that, inquiry-based learning refers to the process of learning through inquiry, enabling students to raise, address and answer interesting questions, in order to formulate solutions to meaningful problems by identifying, examining and drawing on the available evidence. Inquiry-based learning in the humanities aims to cultivate understanding and reasoned judgment through the study of sources, arguments and worldviews. It thus emphasizes ethical reasoning and reflection on the human condition and it requires students and teachers to consider and engage with multiple (disciplinary and social) frameworks, angles and positions (Grant, Swan, & Lee, 2017).

Inquiry-based learning proves more effective in promoting students' application, deep thinking and reasoning skills (Kuhlthau, Maniotes, & Caspari, 2015). It also improves students' command of the subject matter while promoting 21st century competencies, emphasizes active investigation and knowledge construction through the process of inquiry and encourages students to consider different perspectives and to evaluate, adjust and construct evidence-based interpretations (Grant, Swan, & Lee, 2017).

Khan et al., (2011), sought to determine how inquiry-based learning curriculum would affect students' academic achievements. Their study compared 10^{th} grade student who had chosen chemistry elective. The students were separated into two groups, the control groups were taught using inquiry-based instruction and the experimental groups were taught using inquiry-based instruction techniques. Post-class testing indicated that the students who were taught using inquiry-based instruction reflected significantly higher academic achievement than those taught using traditional methods.

2.10 Demonstration

Generally, demonstration method is a method of providing lessons by exhibiting and demonstrating. The demonstration method is a method of teaching by demonstrating things, events, rules, and sequences of activities, either directly or through using instructional media which is relevant to the subject matter or material that will be presented (Thahir, Mawami & Palupi, 2019). The purpose of teaching using a demonstration method is to show the process of occurrence of an event according to the teaching materials, how they are attained and the ease with which is to be understood by the students in the teaching and learning process. In order for children to emulate examples of actions demonstrated by educators, there are several important things that educators must pay attention to. First of all, what the educator shows and does must be clearly observed by the child being taught. Secondly, in giving a sound explanation the educator must be clear. Thirdly, the demonstration must be followed by children's activities to mimic what has been designated and done by educators (Mahmudi & Amriyah, 2015).

Mathematics learning is a process that is intentionally designed with the aim of creating an environmental atmosphere allowing one to carry out mathematics learning activities, and the process is centered on educators teaching mathematics by involving the active participation of students in it (Esmonde, 2017). The advantages of demonstration methods can make teaching clearer and more concrete, so avoiding verbalism namely understanding in words or sentences (Thahir, Mawami & Palupi, 2019), learners better understand what is learned and more interesting teaching processes. Learners are designed to be active, observing between theory and reality, and trying to do it yourself (Mansyur et al, 2013). The demonstration method can also reduce errors when compared to just reading a book, because students have obtained a clear picture of the results of their observations (Ramayulis, 2014 as cited by Thahir, Mawami & Palupi, 2019).

Demonstrations in use as a teaching strategy may prove beneficial for students with different or special learning needs. It is assumed that, when combined with traditional methods, demonstrations can be effective for low-achieving students with high visual and spatial intelligence but with limited cognitive abilities (Radem, 2009).

Demonstration as an instructional strategy can be used in teaching algebra. Demonstrations can increase the curiosity of students, which can sustain their interest in the class, and also enhance their thinking abilities. In a study, Giridharam and Raju (2016) investigated the impact of Teaching Strategies and Impact of Teacher Effect on the students' Academic achievement in engineering education. They adopted two different teaching strategies, demonstration and lecturer strategies. Demonstration strategy was found to be significantly better than lecture strategy.

2.10.1 Visual Aids

The term visual aids have been defined by many scholars. Budinski and Lujić (2018) view visual aids as any material or demonstration presented during an oral presentation to support or enhance verbal message. This means that, well prepared visual aids are useful in complementing unclear and incomplete information communicated orally by the teacher, On the other hand, Okafor (2015) see visual aids as materials which are employed during teaching in order to facilitate learning by stimulating visual senses.

From this view, visual aids are more useful in enabling learning as they provide additional stimuli apart from oral information given by teachers. This implies that visual aids enable learners to obtain concrete realization of objects and phenomena. Hamilton (2014) also defined visual aids as anything presented to an audience in a form that listeners can see to supplement the information they hear. For the purpose of this study, visual aids refer to any instructional device that appeals to the sense of sight used by teachers to facilitate meaningful learning. They include real objects (realia), models, specimens and pictures.

Developments in the field of science and technology particularly in the 21st century have contributed greatly to increase in availability of visual aids (Sisiliya, 2013). For instance, invention of computers has simplified the design and making of visual media (Costley, 2014). New projection instruments and materials that appear every year have revolutionized ways of displaying visual content.

According to Recto (2015), before reaching the period of puberty, primitive children, were able to learn by doing and by observing daily social practices. Boys were taught how to hunt, fish and dig while girls learned to do home chores by watching their mothers. In many cases real objects were preferred for teaching children. For example, arrows, bows and spears were common tools that the boys were taught how to use. Since the purpose of education was to teach practical skills, children leaned visually by participating and imitating adult activities (Kerubo, 2016).

In the same vein, adults preferred to impart knowledge to young learners through real objects and visual demonstrations. During initiation, particularly in local African societies, the boys and girls underwent sustained period of instruction which was made possible with extensive use of sculptural figures and artworks, most of which were made of wood and metal. Many concepts were explained visually and the children learned by practicing and observing their trainers. Although visual representation of ideas varied from one society to another, they all served as a media to facilitate comprehension (Kerubo, 2016).

Cassady (2014) advanced the fact that visual aids are effective in conveying ideas and content more easily than verbal descriptions for visual learners, and are important learning enhancements in the classroom. Makokha and Wanyonyi (2015) noted that there is insufficiency on the availability of learning and teaching materials and that, teachers rely on chalk and talk method to teach language skills. They conclude that learners do not perform well in language skills development due to insufficient resources.

Research conducted by Quarcoo-Nelson, Buabeng and Osafo (2012) to investigate the impact of visual arts learning and teaching materials on students' achievement in Physics showed that when appropriate audio-visuals are integrated into the curriculum to complement the traditional method, higher learning outcomes in terms of achievement scores would probably result. In a study, senior high school students taught with the audio-visual aided instruction achieved better than students taught with the traditional method. To improve teaching in Ghana schools Quarcoo-Nelson et al., (2012) suggested that teachers need to explore different varieties of audiovisual aids to use in their teaching. Tety (2016) indicated that visual arts learning and teaching materials are key to teachers' and students' performance. In response, teachers use different strategies to minimize the challenges in quality learning and teaching materials. When integrated as an instructional tool in an algebra class, visual aids can help students remember the lessons better hence improving academic performance.

2.10.2 Use of Technology

According to Ranasinghe and Leisher (2009), integrating technology into the classroom begins when a teacher prepares a lesson that use technology in meaningful and relevant ways. Technology helps to aid the lessons that teachers teach in the classroom. Ranasinghe and Leisher added that technology should assist the teacher in creating collaborative learning environment. Some students who participated in the lessons believed that the computer helped then understand what the teacher was saying about the lesson (Herron, 2010). Computers are used as a support when they are incorporated into the teacher's professional practice outside the classroom providing assistance to classroom teaching (Meneses et al., 2012).

A more specific categorization of the educational uses of ICT would be very useful especially for technology-rich classrooms. These types of classrooms are characterized by a high level of access, both by teachers and students, to a wide variety of technologies that can help teaching and learning, and by a high level of skills in the educational uses of these technologies (Hare et al, 2011). Fisher, Exley and Ciobanu (2014) discussed how classrooms are turning to technology for teaching and learning, and how teacher's roles have changed. The teacher becomes the facilitator, who takes the students on their learning journey, learning with them instead of 'teaching' them. Students need to make judgments about and be able to calculate the value of the content they gather. Learners are also self-assessing using technology. This helps to "move learners from being the consumers of information to being producers of it" (p. 11).

Research shows that while growing up in the ever-growing technology world, the incorporation of technology helps motivate students to learn. For example, Schaen, Hayden and Zydney (2016), discussed a project they conducted that allowed third grade leaders and first graders to work together and create an app that will allow kindergarteners to practice math strategies. This weeklong project allowed students to use technology, collaborate, and teach. The study by Schaen et al deliberated on the process that the students went through and the outcomes of the project. This technology enhanced project motivated students who wanted to continue building and working at home. "The project gave young students a real-world purpose for planning and creating collaboratively" (p. 50)

2.11 Theory of Didactical Situations (TDS)

The TDS, according to Sriraman and English (2010), is a three-way schema that examines the complexity of relationships between the teacher, the student, and the content. The Theory of Didactical Situations seeks to provide a model, based on the mathematical theory of games, for scientifically investigating challenges in mathematics teaching and ways to improve it (Radford, 2008; Yuliani, 2016).

Mangiante-Orsola, Perrin-Glorian and Stromskag (2018) contend that TDS represents a didactical situation in which the attention is on the teacher in order to study how students learn and how the teacher assists them in learning specific mathematical information. The teacher serves as a learning environment facilitator in this way. The emphasis in TDS according to (Selman & Tapan-Broutin, 2018) is on establishing a classroom environment in which students act as scientists and/or researchers, discovering and producing. The teacher facilitates and enhances the environment for these discoveries.

TDS also provides an opportunity to isolate moments of instruction, action, formulation, validation and institutionalization in the mathematics teaching and learning process (Wisdom, 2014). This study followed the TDS framework to explore the instructional strategies that were identified by the teachers in order to assist the learners to solve mathematics problems. The study specifically looked at the role of the teacher within TDS to determine how they create an appropriate environment and facilitates problem solving to impact student knowledge retention of algebraic concepts. Constructivist Learning Theory will be discussed.

2.12 Constructivist Learning Theory

The learner is the source of meaning in constructivist learning theory. This suggests that the knowledge already exists and is available, but it is up to the student to seek it out. Learners, according to this view, do not just acquire information inertly; they continually develop new knowledge based on existing knowledge and new experiences (Hmelo, Cindy, & Chinn, 2007). Unlike traditional techniques, which require students to memorize what their teachers say, constructivism allows students to bring their own fresh ideas to the table for discussion, with their ideas being recognized and improved through a variety of teaching and learning techniques that actively engage them.

Also, instead of imposing knowledge on the learner, constructivism allows knowledge to be gained via interaction between teachers and students, in which the teacher helps the learner take a key role in developing his or her own experience and knowledge. In this approach, rather than being a passive activity involving the memorizing and acceptance of an independent body of truths, the acquisition of mathematical knowledge becomes a learner-centered activity.

Additionally, the learning process causes learners to become active constructors of meaning in the teaching process (Wiggins & McTighe, 2006). Students are also required to be able to construct arguments to support their thinking while solving word problems. To demonstrate this, learners' conversations should be dominated by the characteristics of the concepts they describe as they communicate their understanding of the concept under discussion. Learners' written expressions of meaning are supposed to indicate their comfort level with the representation of concepts, generalization of information, willingness to explore, and thoughts on new information in a similar manner.

Constructivism's central challenge is to transfer the centre of control in learning from the teacher to the learner. For this constructive process to proceed and transfer to environments outside the school classroom, constructivists believe that learning must be provided in a rich context, reflective of real-world context. The measure of learning is how effective or helpful the learner's knowledge structure is in facilitating thinking in the content field (Bednar et al., 1992).

2.13 Instructional Strategies Used by Teachers in Teaching Basic Algebraic Concepts

Teaching basic algebraic concepts is a major challenge for teachers. The academic subject of algebra is commonly seen as difficult and challenging for students to understand. It is important for teachers to use a variety of instructional strategies to help students understand the concepts. This literature review will discuss the different instructional strategies used by teachers in teaching basic algebraic concepts. It will focus on the research that has been conducted in this area, the different methods used, and the results of the research (Bellam et al, 2019).

Research on instructional strategies used by teachers in teaching basic algebraic concepts has been conducted in a variety of different settings. In one study, researchers examined the effects of instructional strategies on student achievement in algebra. The study found that the use of problem-solving strategies, such as using diagrams and graphs to solve equations, was associated with greater student achievement in algebra. The study also found that the use of cooperative learning strategies, such as group work and peer teaching, was associated with better student performance (Norman & Zoncita, 2022).

In another study, researchers examined the effects of cooperative learning strategies on student achievement in basic algebraic concepts. The study found that the use of cooperative learning strategies was associated with improved student performance in algebra. The study also found that the use of cooperative learning strategies was associated with improved student motivation and engagement in the learning process (Mogaji et al, 2022). In a third study, researchers examined the effects of technology-based instructional strategies on student achievement in basic algebraic concepts. The study found that the use of technology-based instructional strategies, such as using computer-based simulations, was associated with improved student performance in algebra. The study also found that the use of technology-based instructional strategies was associated with improved student motivation and engagement in the learning process (Trevor, 2019).

The research discussed in this literature review provides evidence that instructional strategies used by teachers in teaching basic algebraic concepts can have positive effects on student achievement in algebra. The use of problem-solving strategies, cooperative learning strategies, and technology-based instructional strategies were all associated with improved student performance in algebra. Additionally, the use of these strategies was associated with improved student motivation and engagement in the learning process. This research provides evidence that teachers should use a variety of instructional strategies to help students understand the basic algebraic concepts.

2.14 Impact of the Use of The Common Instructional Strategies by Teachers in Teaching Algebra on Students' Academic Performance

In recent years, the use of common instructional strategies in teaching algebra has been a major focus of education research. Algebra is a foundational subject for mathematics, and its mastery is essential for success in higher level mathematics courses and other STEM fields (Norman, 2020). Therefore, it is important for teachers to be aware of the most effective instructional strategies and use them to maximize the academic performance of their students. This literature review will examine the research on the impact of the common instructional strategies teachers use in teaching algebra on students' academic performance. Instructional strategies are defined as methods used by teachers to impart knowledge and skills to students. Common instructional strategies used by teachers in teaching algebra include direct instruction, problem-solving, discussion, and cooperative learning (Angel, 2018). Direct instruction is a method of teaching that involves the teacher providing clear and explicit information to students in order to ensure that they have a complete understanding of the material. Problem-solving is an instructional strategy that encourages students to apply their knowledge and skills to solve real-world problems. Discussion is a method of teaching that allows students to exchange ideas and opinions about a given topic. Cooperative learning is a method of instruction that encourages students to work together in groups to complete tasks and assignments (Trevor, 2020).

2.15 Using Specific Instructional Strategies in Teaching Algebra.

In teaching algebra, there is the need for mathematics teachers to use specific instructional strategies which can help students to acquire and retain knowledge in algebraic concepts. Among these specific strategies are:

2.15.1 Constructivist Strategy

Instruction, according to Mclnerny (2012), can be described as both deep and surface learning, "with deep strategies, the key concepts as well as connections for thorough mastery, and surface strategies as rote and addressing only bare essentials". In teaching algebra, the use of constructivist approach has been accepted as one of the best strategies to help leaners retain knowledge (Alanazi, 2016). Kim (2005) described constructivist strategy of teaching as a method that encourages internalization of concepts and knowledge, which move far beyond rote memorization. Mclnerney (2013) also defined constructivist teaching as requiring active involvement of the learner and a shift in focus from what the teacher may do to influence what the learner does. Active involvement plays out in constructivist classrooms as students take ownership for their learning. In teaching algebra, one way that mathematics teachers can use constructivist strategy is by allowing students to solve algebraic problems on their own using teacher feedback (Young, 2014). The National Council of Teachers of Mathematics (NCTM) has supported student-centered approach and statement that constructivism focuses attention on how people learn. NCTM further outlined that mathematics knowledge results from people forming models in response to questions and challenges that come from actively engaging math problems and environment, not simply taking in information, nor as merely the blossoming of an innate gift.

Mathematics teachers thus need to create experiences that engage the student and support his or her own explanation, evaluation, communication and application of mathematical models needed to make sense of these experiences (NCTM, 2017). In a study to investigate success factors in high school algebra, Kulpa (2021) outlined the use of constructivist strategy and stated that the use of constructivist approach in teaching algebra is important for leaners to acquire and understand the algebraic concepts. Mathematics teachers therefore need to understand that algebra is not a body of content “to master, but that they and students will continue to discover new connections through the act of teaching (Kieran et.al, 2016). As Vintere (2018) stated, teaching algebra using constructivist approach," changes the role of a teacher in mathematics education from an instructor to a leader or facilitator ".

2.15.2 Problem-based Strategy in Solving Algebra.

According to Ali and Hukamdad (2010), mathematics is one of the poorly taught, widely hated and poorly understood subject in schools. Okereke (2006), had blamed this on a number of factors, which ranged from the students' perception that mathematics is difficult and shortage of qualified mathematics teachers. Many teachers cling to traditional methods in which answers to the previous day's homework is given first and then the teacher directing explanations which are used for the new lesson (Odili 2006). The power of thinking and understanding are thus not developed in the students. One of the many strategies that has the potential to put learners at the center of their own learning is through problem-based learning. With problem-based learning (PBL), learning begins with a problem to solve, and the problem is posed in such a way that the students need to gain new knowledge before they can solve the problem (Roh, 2003). PBL as an instructional strategy based on constructivism, is the concept that the learners construct their own understanding by relating concrete experiences to existing knowledge where process of collaboration and reflection are involved. Ali, Hukamdad and Akhter (2010) found that students taught through PBL achieved better than those taught by traditional method. Many researchers such as (Visser, 2002, Raimi & Adeoye, 2004) who worked on the implementation of PBL agree that it is an effective teaching/learning method in the classroom. With the use of PBL strategy in teaching algebra, mathematics teachers can develop students 'knowledge in algebraic concepts.

2.15.3 Comparing and Discussing Multiple Strategies (CDMS)

Students need to know multiple strategies for solving problems in algebra. Using multiple strategies enables students to select the most appropriate strategy for a given problem, which is often called procedural flexibility (Star, 2005; Verschaffel et al., 2009). Learners who develop procedural flexibility are more likely to use or adopt existing strategies when faced with unfamiliar problems and to have greater conceptual knowledge (Hiebert et al. 1996). Furthermore, procedural flexibility is a salient characteristic of experts in mathematics (Star & Newton, 2009). Procedural flexibility is distinct from, but related to, conceptual and procedural knowledge (Schneider et al., 2011). First of all, among the many benefits of using CDMS in solving algebra is that, knowledge of multiple strategies is beneficial for students 'mathematics learning. Knowing diverse strategies allow students to adopt their strategy use to task demands. For example, when solving arithmetic problems, students usually select faster and less effortful strategies on easier problems and slower and more effortful strategies on more difficult ones (Siegler, 2003). Knowing multiple strategies help learners to adopt to new problem features and supports better understanding of domain (Hiebert et al., 1996).

Secondly the use of CMDS is a powerful process that supports learning, including algebra. Comparison improves learning in many domains. A meta-analysis confirmed that comparison promotes learning across a range of domain (Alfieri et al., 2013). In a one-week experimental studies, Authors (2007) randomly assigned 7th grade students pair to learn multiple linear equation solving by either comparing worked examples of two different strategies for solving the same problem presented side-by-side, or studying the worked examples of the strategies one at a time (sequential). Students in the comparison condition demonstrated greater procedural knowledge and procedural flexibility than students in the sequential condition. Comparison has also been shown to improve conceptual knowledge of algebra (Authors, 2009). Further, Practice Guide from the US Department of Education identified comparing multiple strategies as an evidence-based recommendation for improving mathematical problem solving in the middle grades and choosing from alternative algebraic strategies when solving problems as a recommendation for improving algebra knowledge (Star et al., 2015). Finally, the development of mathematics knowledge is believed to be enhanced by classroom discussions in which students generate explanations and teachers facilitate a discussion of different students' response (Silver et al., 2005). Indeed, prompting people to discuss new information improves learning across a variety of mathematics topics and age groups (Hodds et al., 2014) and more frequently engagement with other students' strategies and ideas during discussion is related to greater success on a mathematics assessment (Webb et al., 2014).

2.15.4 Using Solved Problems to Engage Students in Analyzing Algebraic Reasoning and Strategies

Compared to elementary mathematics work like arithmetic, solving algebra problems often requires students to think more abstractly. Algebraic reasoning requires students to process multiple pieces of complex information simultaneously, which can limit students 'capacity to develop new knowledge. Such reasoning is sometimes described as imposing high cognitive load or challenging work memory, which can interfere with students 'ability to learn

(Booth et al, 2014). Solved problems can minimize the burden of abstract thinking by allowing students to see the problems and many solutions steps at once without executing each step, helping students learn more efficiently (Booth et al, 2014). Analyzing and discussing solved problems can also help students develop a deeper understanding of the logical process used to solve algebra problems (Brenner et al, 1997). Research has shown the effect of using solved problems in algebra instruction, and positive effect has been concluded on conceptual knowledge (Carrol 1994). According to Hutchinson (1993), students showed positive effect when provided with correct and incorrect solved problems and promoting students to explain the solution, compared to students who were prompted similarly as they solved practice problems. Also, another study provided students with solved problems alongside practice problems and there was positive effect on student achievement, compared to students who received additional practice problems (Ives 2007). Mathematics teachers can therefore make the teaching of algebra effective by creating opportunities for students to discuss and analyze solved problems by asking students to describe the steps taken in the solved problems and to explain the reasoning used. By asking students specific questions, students will be able to determine if a strategy used for a solution is right or wrong.

2.15.5 Teaching Students to Utilize the Structure of Algebraic Representations

Structure refers to an algebraic representation's underlying mathematical features and relationships such as the number type, position of quantities including variables. Paying attention to structure helps students make connections among problems, solution strategies and representations that may initially appear different but are actually mathematically similar. For example; *i)* $2x + 8 = 14$ *ii)* $2(x + 1) + 8 = 14$ *iii)* $2(3x + 4) + 8 = 14$. Though the equations in these examples appear to differ, they have similar structures that is 2 multiplied by a quantity plus 8 equals 14. With an understanding of structure, students can focus on the mathematical similarities of problems that may appear to be different, which can simplify solving algebra problems. In particular, recognizing structure helps students understand the characteristics of algebraic expressions and problems regardless of whether the problems are presented in symbolic, numeric, verbal or graphic forms.

In teaching students to utilize the structure of algebraic representations, studies have found positive effects on procedural knowledge on some selected students in the United States (Schneider et al 2011). Also, Schneider and Stern (2010) found positive effect on conceptual knowledge. Both studies also show how the use of reflective questioning as one method of focusing on structures can help students. Mathematics can thus help students utilize the structure representation strategy in learning algebraic concepts.

2.15.6 Using Self-Instruction Strategy

Students with learning difficulties in mathematics are those who experience more problems with understanding mathematics. A good number of people in this group have problems especially in algebra. Teaching students implies teaching them how to learn by learning strategies. Learning strategies give students ways to think through and plan the solution to problems. They also make students become more effective and independent learners. They even help the students to learn more effectively difficult subjects (Wong, 1993). Learning strategies help improve the achievement of students. Improving the achievement then means increasing the performance and upgrading it or making it better than it was previously, so that the student achieves more. In this context, in the opinion of Steedly (2009), one needs to ask two questions: 'What do students need to know how to do mathematically? and what instructional approaches are effective in teaching those skills?' As one of the most important topics in mathematics, mathematics teachers can use self-instruction as a strategy to help students reflect on the stated questions when learning algebra.

Self-instruction strategy is a self-regulation strategy that students can use to manage themselves as learners and direct their own learning (Graham & Reid, 1992). It is a strategy by which students self-tutor and self-monitor themselves. This is quite different from the conventional teacher-dominated strategy of teaching, where the teacher dishes out learning content and the learner merely struggles to learn them (Deborah,1997). In the conventional strategy, the teacher directs the actives of learning, but self-instruction is learner-directed. Here the student takes charge of the learning activity, while the teacher merely guides. Self-instruction is therefore a cognitive learning strategy, in which learning task is broken into steps and the learner himself or herself directs and appraises his /her self as he/she goes through the task step by step. Studies conducted by Zimmerman (2001), on the use of self-instruction strategy to transform leaners' mental abilities, revealed that self-instruction, which involves self-regulation is necessary for students to be motivated to actively participate in their own learning process. This transforms the learners' mental abilities. Also, in a research entitled "Algebraic instruction for students with learning difficulties in mathematics: Implications from a research review". Maccini, McNaughton and Ruhl (1999) maintained that students with learning difficulties need intervention for them to do well in algebra. They concluded that successful intervention included instruction on domain-specific knowledge, as well as general problem-solving and self-instructed strategies.

2.16 Impact of Instructional Strategies on Students' Academic Performance in Algebra.

Mathematics teachers use of appropriate instructional strategy can have a positive impact on students' academic performance. Kurumeh argues in an empirical study that inappropriate, inadequate and elitist teaching techniques and methods used by mathematics teachers are instrumental to learners 'inability to understand and retain the basic mathematics principles, computations or logical facts involved. In another study, Obioma identified poor teaching strategy as one of the factors that impeded students' understanding of mathematics which leads to poor performance in the subject.

However, some researchers (Zakariya, 2018 & Samuelsson, 2010) have argued that mere change on instructional strategies might not necessarily lead to improved students' performance and those authentic instructional strategies should be laced with standards that foster intellectual quality. Others have also identified teacher efficiency as an important variable for a successful implementation of innovative teaching strategies to bring improved performance in students (Pear & Crone-Todd, 2022). Several researchers have however proposed that the use of effective instructional strategies have great impact on students' academic performance in algebra. For example, in a meta-analysis study on the effectiveness of inquiry-based teaching on students' academic performance, Furtak et al. (2012) found an effective size of 50 of the teaching method on students' performance.

The use of inquiry-based was proven to be effective for not only teaching but also learning. This fact is substantiated by an increase in mathematics content knowledge of preservice teachers at the end of inquiry-based learning activity (Laursen et al., 2015) and an improvement in students' metacognitive skills (Nunaki et al., 2019). The efficiency of problem-based instructional strategy has also been demonstrated in a quasi-experimental study in which students who were taught algebra problem-based instruction outperformed those who were taught algebra using conventional method on difficult mathematics tasks (Cotic & Zuljan, 2009). Again Samuelsson (Samuelsson, 2010), in a study on the use of instructional strategies found that there was an improvement in students' scores when they were taught algebra using problem-based.

Similar corroborative findings on the effectiveness of problem-based instruction can be found in other studies (Olaoye & Adu, 2015, Wirkala & Kuhn, 2011). Constructivist instructional strategy in teaching has also been shown by research that it improves students' academic performance (Hand et al.,1997, Kim, 2005). In their findings on the impact of constructivist instructional strategy on performance in algebra in Nigeria, Umar and Yusuf (2020), in using quasi-experimental on selected 154 secondary school students, concluded that the use of constructivist strategy had great impact on students' academic performance in algebra. They further concluded that the use of constructivist strategy in learning encourages critical thinking, knowledge construction and retention for greater academic performance by students.

These findings were also supported by (Bii & Shi, 2019; Molla & Muche, 2018). In a systematic review of algebra instructional improvement strategies, Christopher and Shelton (2017), identified the use of instructional strategies in the teaching of algebra as having a positive effect on students 'academic performance. In their experimental research, using algebraic instructional strategies as intervention, it was concluded that there was positive effect on the conceptual understanding of students as compared to procedural understanding. They therefore encouraged the use of instructional strategies in the teaching and learning of algebra. Using self-instructional learning strategy in mathematics learning has also been found to improve students' academic performance. This was shown in a study by Anyichie and Onyedike (2012). Their study investigated the effect of self-instructional learning strategy on students 'academic performance and it was concluded that self-instructional strategy had significant effect on learning achievements of students of senior high school in Nigeria. This was supported by Ding and Sherman (2006), who used three mathematics teachers in experimental research on 118 Thai ninth grade students. Of the three teachers, two teachers used direct instruction with little students' participation whereas one teacher used asking of questions and participating in collaborative groups in teaching. There was potential connection between teaching and learning which was reflected in students 'academic performance with students 'taught with instructional strategies. However, there was no significant improvement in the academic performance of students who were taught without instructional strategies.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

According to Silverman (2013), methodology is the choice researchers make regarding data gathering methods, forms of analysis and execution of a research study. Therefore, this chapter covers the methodological steps which include the research design, population, study area, sampling and sample size, sampling technique, collection instruments, validity and reliability, data, data analysis and ethical considerations.

3.1 Research Design

Research design is an appropriate framework for a study. For Kassu-Jilcha (2019), the choice of research design in terms of how relevant information should be gathered for a study is a very important decision, but there are also other important decisions in the research design process. Majid (2017) added that, research design is often the result of the research objectives, research question, sampling, population strategies and phenomena of interest. Quantitative study is an umbrella term that encompasses many research designs including survey, correlational study, descriptive study and experimental. The study therefore adopted quantitative descriptive method. Descriptive studies as characterized is simply the attempt to determine, describe or identify what is, through analytical research, attempts to establish why it is that way or how it came to be (Ethridge, 2004). Also, according to McCombes (2022), descriptive research aims to accurately and systematically describe a population, situation or phenomenon. It helps to answer, what, *where* and *how* questions in research. This design was thus found suitable for the study as it helped to identify what instructional strategies that mathematics teachers use in teaching algebra and also how the instructional strategies helped in students' knowledge retention in algebra. Descriptive design can be used through three main methods namely, survey, observation and case study (McCombes, 2022). The researcher used the survey method in conducting the study. According to Ary, Jacobs and Razavieh (1990), survey studies are used to obtain information concerning the current status of phenomena. Creswell (2006) describes survey as the study of existing condition, prevailing view points, attitudes, on-going process and developing trends in order to obtain information that can be analyzed and interpreted to come up with a report of the present status of subject under study. This design was found suitable because it gives in-depth description of the phenomena which is the instructional strategies that teachers use and it also helped to interpret how the use of the instructional strategies help students in retaining knowledge in algebra.

Frankel and Wallen (2000) stated that obtaining answers from a large group of people to a set of carefully designed and administered questions lie at the heart of survey research. Thus, the researcher employed cross sectional survey in the study because it focused on opinions on how the use of instructional strategies help in students retaining knowledge in algebra. Hennekens and Buring (1987) also outlined the strengths and weakness of cross-sectional survey. The strengths are relatively quick and easy to conduct, data on all variables are collected only once, ability to measure prevalence for all factors under investigation, multiple outcome and exposures can be studied, good for descriptive analysis and for generating hypothesis. The weakness is difficulty to determine whether the outcome followed exposure in time or exposure resulted from outcome, it measures prevalence rather than incident cases, associations identified may be difficult to interpret. Since the researcher was working with a limited time, cross-sectional survey was appropriate in helping to relatively conduct and collect data within a shorter time.

3.2 Population of the Study

Populations are a large number of people or objects that are the focus of research for the purpose of the study (Bernard, 2017). Bernard (2017) indicated that a study population is a well-defined set of related characteristics and usually a general, connecting feature or characteristic of individuals or items. Therefore, population of this study encompasses all Mathematics Teachers of the Senior High Schools within the Kwahu-East District. Table 1 shows the number of mathematics teachers in the Kwahu-East District. The total population of teachers as at the time of collecting data for this study was 67. Out of this, 55 (82.1%) were males whiles 12 (17.9%) were females. The sub-selection of Mathematics Teachers is as follows:

Table 1: Population of Mathematics Teachers in the Selected Schools

SCHOOL	No. of Mathematics teachers (male)	No. of Mathematics teachers (female)	Total
St. Peter's School, Nkwatia	20	2	22
Nkwatia Presbyterian Senior High, Nkwatia	10	2	12
Abetifi Presbyterian Senior High, Abetifi	14	5	19
St. Dominic's Snr High/Technical, Pepease	5	0	5
Kwahu Tafo Snr High, Kwahu Tafo	6	3	9
Total	**55**	**12**	**67**

3.3 The Study Area

The study focused on Kwahu East District. The Legislative Instrument (L.I) 1839 created the Kwahu East District out of the Kwahu South District, and it was inaugurated on February 29, 2008, with Abetifi as the District capital (Population and Housing

Census (PHC), 2010). The district is located in the Eastern Region's northernmost region. It is bordered on the east by the Kwahu North, on the south by the Kwahu South, on the southeast by the Fanteakwa Districts, and on the north by the Ashanti Region's Asante-Akim North. As a result, the district is linked to a number of other Districts, which encourages commercial activity between the district capitals and other nearby communities. The district's total land area is 623.31 square kilometres (PHC, 2010). The Kwahu East District Assembly was established by the Legislative Instrument (L.I 1839) as the highest political and administrative body with the mission to begin development and coordinate all activities targeted at the district's long-term development. The Assembly's day-to-day administration activities are handled by the District Chief Executive (DCE).

The District Coordinating Director (DCD), who is the Secretary to the Assembly and oversees the district bureaucracy, assists the DCE (PHC, 2010). There are eight Town/Area Councils in the district, which are further organised into Unit Committees. The Unit Committees are consultative bodies at the grassroots and they are in close contact with the people. They are expected to organize the people for communal labour, revenue mobilization and the maintenance of environmental sanitation and other activities (PHC, 2010).

According to the 2021 Population and Housing Census, Kwahu East District has a population of 79,726 people, accounting for 2.7% of the total population of the region. Males make up 50.6% of the population, while females make up the remaining 49.4%. The district's rural nature is reflected in the fact that 55.2% of the total population live in rural areas, while 44.8% live in urban areas. The sex ratio in the district is almost 1:1 as males take up a slight advantage in terms of the numbers in the district's population.

Children under the age of 15 make up the largest group, accounting for 30,455 people, or 39.5% of the population.

The district's religious affiliation follows the national trend of Christianity, Islam, and traditional religion. Pentecostal/Charismatics (27.6%), Protestants (24.1%), Catholics (9.0%), and other Christians (18.6%) make up the Christian faith. Pagans account for 13.0% of the population, while Islamic and traditional religions account for 5% and 1.7% respectively (PHC, 2010). The district traditionally has paramountcy and ten of the seventeen primary traditional divisions that help the paramount chief (Kwahumanhene) rule the Kwahu Traditional Area. The Traditional and Politico-administrative authorities have a good relationship, which has contributed to the district's mainly peaceful atmosphere.

3.4 Sampling Techniques and Sample Size

The sample size of a research study should have adequate power and significance, allowing the investigators to be confident that the study findings cannot be attributed to random variations in the population of interest (Majid, Ennis & Bhola, 2017). This study took the form of a census study. A census represents a study in which all elements, or everyone in a population are studied (Australian Bureau of Statistics, 2013). It is also referred to as a complete enumeration, which means each and every unit of the population is included in the study. This suggests that each of the mathematics teachers in the district was part of the study. The census method of gathering information is more exhaustive and covers the entire economy or population (Seidu, 2015).

The census sampling was considered appropriate for this study because it made the generalizability of the study findings easily possible since it yields reliable and accurate results. Again, it yields a true measure of the population, that is, there is nothing like sampling error in the sampling process (Australian Bureau Statistics, 2013) which may affect the findings of a study. Census and sample surveys are not necessarily alternative methods of collecting data but, rather, they often complement and draw on each other in some ways (Seidu 2015). However, one noticeable challenge of census method of data collection is its relative cost effectiveness both in staff and monetary terms as compared to the sampling methods and also, census takes a longer period to collect and process data and to release. The sample size for this study was 67.

3.5 Research Instruments

The study adopted an instrument from Bellam (2019); this is a five-point Likert scale questionnaire ranging from strongly disagree (1) to strongly Agree (5). The questionnaire analyzes common instructional strategies in teaching algebra. In order to assess the impact the instructional strategies teachers used in teaching algebra on students' academic performance, the research adopted an instrument by Wilmot (2019). This is a five-point Likert scale questionnaire ranging from strongly disagree (1) to strongly Agree (5). The academic records of the students were also considered to determine the performance of the students.

3.5.1 The Questionnaire.

The researcher employed the use of questionnaires as data collection instrument. Questionnaires are defined as text-based instruments that give survey participants a series of questions to answer or statements to respond to either by indicating a response by marking a page or checking a box on paper or online for example (Brown, 2011).

Questionnaires were used since it can be used to reach a large number of people within the shortest possible time; it is less costly as compared to interviewing and has fewer interviewer biases even though there is a high tendency that some respondents may not want to return the questionnaires, some may also not necessarily express themselves accurately. The questionnaires were in four sections. The first part inquired about the socio-demographic characters of respondents. For the second, third and final part involved a five-point Likert-type scale items on respondents' agreement to statements where for the second part, questions were asked on the different ways of applying strategies in lesson delivery. 5-implied 'strongly agree', '4', 'Agree', '3', 'Neutral', '2' 'disagree' and '1' implied 'strongly disagree'. The third part tackled questions pertaining to how teachers used instructional techniques during their lesson delivery. These questions were rated 'Never' for '1', Undecided for '2', 'Rarely' for '3', 'Often' for '4' and 'Always' for '5'. The fourth and final part was for how these strategies impacted on students' performance. They involved questions that were rated '1' for 'strongly disagree', '2' for 'disagree', '3' for 'neutral', '4' for 'agree' and '5' for 'strongly agree'. The questions were grouped according to the objectives of the study for easy validity and identification.

3.5.2 Pilot-Testing of Instruments

Bryman and Bell (2007), suggested a need to conduct a pilot study before the actual study in order to ensure that all the research instruments as a whole function well. Piloting was done before the actual study was carried out in Kwahu-East District. This was done for the purpose of clarity of the questionnaires. Other items which were found to elicit similar responses were eliminated or reconstructed. This enabled the researcher to do the necessary changes before administering the final instruments. Piloting was done with Mpraeso Senior High school mathematics teachers, as they had similar characteristics with the target population. The piloting was done to enable the researcher discover any weakness in the instrument, check clarity of the questions and also make needed corrections to allow the research to be done free from flaws.

3.6 Validity and Reliability of the Instruments

The validity of a test instrument is the extent to which the items in an instrument measure what it is set to measure. Validity is the exactness and precision of deductions based on the finding from the research (Mugenda & Mugenda, 2003). If a test does not serve its intended function well, then it is not valid. The validity of the instruments was carried out to check the correctness of the data collection instruments during the pilot study. To determine the degree to which the Instrument used for the study would measure accurately what it is to measure, content validity approaches was used. Both instruments were given to a research supervisor. Any elements of ambiguity in the instruments were corrected before the pilot test. The instruments were given to other equally competent assessment experts to assess the contents and items included in the questionnaires. The aim was to review any ambiguities, threatening items and other problems which were needed to be solved before trying out the instrument. Their constructive and informative responses were used to improve the instruments to produce the final form which was used for the study.

A reliability test was carried out with the purpose of testing the consistency of the research instruments so that the research instruments were improved by revising or deleting items. To determine the reliability of the instrument the pilot study was conducted. Piloting determines whether questions and directions are clear to respondents /subjects and whether they understand what is required from them. Piloting is also done to determine the feasibility of using a particular research instrument in a major study. It provides an opportunity to try out the instruments for completion of the instruments, especially if it is being used for the first time. Piloting entails a trail administration of a newly developed instrument in order to identify flaws and requirements (Shilubane, 2010).

3.7 Data Collection Procedure

In conducting research, Creswell (2008) instructed researchers to seek or obtain permission from the authorities in charge of the site of the study because it involves a prolonged and extensive data collection. Hence a consent letter was attached to the introductory letter which was duly signed by the Head of the Mathematics Education Department at the University of Education, Winneba. The letter was given to the Director of the Kwahu East Education service to enable the researcher collect data on the total population of mathematics teachers in the district. The letter was duly accepted and the data on the teachers was provided by the Kwahu East district office which enabled the researcher get information on the population for the study. Also, an introductory letter from the Mathematics Education Department of the University of Education, Winneba was given to the heads of the five schools with a consent letter attached to it. The heads of the five schools willingly agreed to the request and allowed the researcher to conduct the research in the schools. The introductory letter is presented in Appendix A. A date was then fixed after the permission was granted by the heads of the schools. The collection of data took two weeks. The data was in the form of responses from questionnaires to the mathematics teachers.

3.8 Data Analysis

According to Blumberg, Cooper and Schindler (2014), data analysis involves editing, coding, classification, tabulation and graphical presentation. Therefore, after collecting data from the respondents, the researcher compiled data to facilitate entry of the responses into the computer. Frequencies, percentages and charts were generated using the Statistical Package for Social Sciences (SPSS). The SPSS is software for the rapid and effective application of statistical analysis used by students, teachers and researchers (Green & Salkind, 2014). Therefore, through the SPSS, frequencies, percentages and graphs were generated. Thematic analysis was performed using the responses from the questionnaire. Where appropriate, brief comments were given.

3.9 Ethical Considerations

Silverman (2013) is of the opinion that the researcher must recognize up-to-date standards required for research, and understand why it matters. Hence, the ethical issues addressed in this report also covered informed consent, secrecy and privacy. All respondents were adequately educated on the purpose of this study in terms of informed consent and then given the opportunity to decide on participation.

Accordingly, none of the respondents was forced in any way to participate in the study. This was done in accordance and compliance with acceptable academic standards. The researcher thus spelt out the rights of the respondents and how the data would be used and received their consents before proceeding with the administration of the questionnaires.

Confidentiality was ensured in the sense that, the responses attained from the respondents were solely used only for the purpose of research. With regards to anonymity, the researcher ensured that the identities of the respondents were safeguarded. In this regard, any information that sought to expose the identity of the respondents such as their name, e-mail address, phone number, residential address among others were excluded from the structured questionnaires.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

The overall purpose of the study was to examine teacher's instructional strategies and their impact on student knowledge retention of algebraic concepts in the Kwahu-east district. This chapter is focused on analysing the data collected from the field. The analysis was done based on the research objectives. Questionnaires were used to collect data from respondents. Before analysing data, it is necessary to thoroughly examine the questionnaires for missing or incorrect answers. After the data was checked for errors and found to be valid, the researcher then went on to enter all the data and coding was done based on the specifications given by the developers of the various instruments used for the study. The dataset was also inspected for missing data.

4.1 Demographic Characteristics of Participants

This section describes the participants in this study with respect to their gender, age, years of experience and religion. A summary of the characteristics is presented in Table 2.

Table 2: Demographic Characteristics of Respondents

Variable	Frequency	Percentage (%)
Gender		
Male	55	82.1
Female	12	17.9
Total	67	100
Age of Respondents		
20-30	25	37.3
31–40	37	55.2
41-50	3	4.48
51-60	2	2.9
Religious Affiliation		
Christianity	57	85.1
Moslem	10	14.9
Years of Teaching		
One–Five years	22	32.8
Six–Ten years	37	55.2
11 Years and above	8	11.9

Source: Field Data, 2023

From Table 2, the gender distribution of respondents shows that there were 55 males and 12 females. Thus, there were more males than females. The study was also indicative of the fact that a majority of the respondents were within the age limit of 31 to 40 years. It was also interesting to note that averagely, the respondents had taught in their various schools for six to ten years.

4.2 Validity and Reliability

Before conducting any kind of research, it is essential to verify the suitability of the data. This process entails looking for bias and normalcy in the common method variance. Below, we will go over the specifics of these methods.

4.2.1 Validity Test

Tests for common method variance bias were carried out on this study's data. Harman's (1967) one-factor test was used in this investigation, with the method provided by Andersson and Bateman (1997) and Podsakoff et al. (1997) being used as a guideline. Only one factor should be extracted in an exploratory factor analysis, and the result should be less than 50%, according to the test recommendation. As an alternative, the test proposes completing a thorough exploratory factor analysis by identifying factors with Eigen values greater than one (1) and confirming that no one factor accounts for more than half of the total variation explained. Table 3 below reveals that the largest variation explained by a single component (in this case, factor) is 36.489 percent, which is less than 50 percent variance. This study is unlikely to suffer from the typical method variance bias (Podsakoff, MacKenzie, & Podsakoff, 2012).

Table 3: Model Fitness using the Herman's Single Factor Test

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.298	36.489	36.489	7.298	36.489	36.489
2	2.789	13.944	50.433	8.031	43.909	43.801
3	2.363	11.814	62.247	9.901	48.901	47.091
4	1.818	9.092	71.339			
5	.856	4.278	75.617			
6	.642	3.208	78.825			
7	.547	2.733	81.558			
8	.488	2.439	83.998			
9	.410	2.049	86.046			
10	.372	1.860	87.906			
11	.344	1.722	89.628			
12	.333	1.663	91.292			
13	.311	1.553	92.845			
14	.295	1.475	94.320			
15	.263	1.314	95.634			
16	.246	1.230	96.863			
17	.229	1.145	98.008			
18	.195	.976	98.984			
19	.148	.742	99.726			
20	.055	.274	100.000			

Extraction Method: Principal Component Analysis.

4.2.2 Reliability test of constructs

Hall and Wang (2005) argue that the presence of outlier cases in data gathering means that the data distribution is severely skewed or has a high kurtosis. If the skewness and kurtosis are all between one and one and one, or two and two, or even three, then the data are likely to follow a normal distribution (Schumacker & Lomax, 2004). According to Byrne (2013), a kurtosis cutoff point of less than 7 should be utilized as a suitable metric. Further, the author stated that data skewed between -3 and +3 might be considered normal distributions (Byrne, 2013). Table 4 displays the results of the test to determine whether the questions on the questionnaire are normally distributed. The scores utilized in the questionnaire revealed that kurtosis > .0 and skewness > .0 were present in the objects studied in the study. AMOS statistics can be used because the data is not normally distributed, as shown by these studies.

Table 4: Scale Reliability Test

MAIN VARIABLES	NOS. OF OBSERVED ITEMS	NOS. OF RETAINED ITEMS	ALPHA AFTER REFINERY
INSTRUCTIONAL STRATEGIES	18	18	0.880
USE OF INSTRUCTIONAL STRATEGIES	10	5	0.803
STUDENTS' ACADEMIC PERFORMANCE	21	4	0.891

Source: Field Study, 2023.

4.3 Descriptive Statistics (Instructional strategies, Use of instructional strategies and Students' Academic performance)

Descriptive data for the measurement model are shown in Table 5, which includes the mean and standard deviation, skewness, and kurtosis of the constructs in question. Instructional strategies had the highest mean of 3.838, while Use of instructional strategies had the lowest mean of 2.975, according to the results.

Table 5: Scale Reliability Test

	Mean		Std. Deviation	Skewness		Kurtosis	
	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error
Instructional strategies	3.838	0.042	0.730	-0.464	0.140	0.394	0.278
Use of instructional strategies	2.975	0.056	0.972	-0.148	0.140	-0.362	0.278
Students' Academic performance	3.591	0.046	0.808	-0.438	0.140	0.279	0.278

Source: Field Study, 2023.

4.4 Correlation of Variables

A correlation matrix was also assessed by the researcher in order to better understand the relationships between the various factors. Age and education appear to have a favourable correlation with Academic performance in the analysis. Gender, on the other hand, had no bearing on respondents' levels of Use of instructional strategies. Instructional strategies, on the other hand, had a key role in Academic performance and use of instructional strategies.

Table 6: Correlation Analysis of Salient Variables

	1	2	3
Instructional strategies (1)	1		
Use of instructional strategies (2)	0.89**	1	
Students' Academic performance (3)	0.71**	0.61**	1

Source: Field Data, 2023

Using the data in the Table 6 above, it is clear that instructional strategies and use of instructional strategies are positively correlated (= 0.89**, p 0.01). A correlation between Academic performance and use of instructional strategies was found (= 0.61**, p 0.01), according to the study. In addition, instructional strategies (= 0.71**, p 0.01) were found to be a significant predictor of Academic success.

4.5 Research Question One: What are the instructional strategies used by teachers in teaching basic algebraic concepts in Senior High Schools within the Kwahu-East District?

The first objective of the study sought to find out the instructional strategies employed by mathematics teachers in the Kwahu-East District. The study employed the use of mean and standard deviation to analyze this objective using the SPSS. The results have been summarized in Table 7.

Table 7: Instructional Strategies for Algebraic Concepts in Schools

Research Items/ Statement	Mean	S. D
Permitting students to communicate mathematically, reason mathematically, and acquire self-confidence in solving algebraic problems increase their performance.	4.09	0.03
Understanding students' individual learning needs by teachers to determine which strategy to use forms part of instructional strategies in teaching algebra.	3.12	0.15
Organizing and integrating educational content forms part of instructional strategies that will aid the study of algebra	1.74	0.43
Evidence-based teaching practices must be used as strategies in teaching algebra.	1.09	0.02
Questioning to check for knowledge and summarizing new material in a graphical format are good instructional strategies to aid the teaching and learning of algebra	4.92	0.41
Lots of good practice, providing students with feedback, and motivating students to work together in productive manner are some of the instructional strategies that aid in the teaching and learning of algebra	4.68	0.20
Cooperative learning is a basic instructional strategy that allows students to collaborate in groups or pairs to solve algebraic problems	1.47	0.44
Integrative approach is a strategy that links other topic matter in other subject areas and make an instructional design more engaging and integrative and aid the teaching and learning of algebra	4.91	0.14

Source: Field Data, 2023

From Table 7, it is evident that most of the respondents noted that questioning to check for knowledge and summarizing new material in a graphical format are good instructional strategies to aid the teaching and learning of algebra (Mean = 4.92, S.D = 0.41). Besides, the data also shows integrative approach is a strategy that links other topic matter in other subject areas and make an instructional design more engaging and integrative which aids the teaching and learning of algebra (Mean = 4.91, S.D = 0.14). Again, it was revealed that Lots of good practice, providing students with feedback, and motivating students to work together in productive manner are some of the instructional strategies that aid in the teaching and learning of algebra (Mean = 4.91, S.D = 0.14) and then permitting students to communicate mathematically, reason mathematically, and acquire self-confidence in solving algebraic problems help to increase their performance in mathematics (Mean = 4.09, S.D = 0.03). However, there was no statistical evidence to support the fact that organizing and integrating educational content will necessarily aid the study of algebra (Mean = 1.74, S.D = 0.43).

4.6 Research Question Two: Teaching Strategies Mathematics Teachers Use In Teaching Algebra

The study further sought to analyze the teaching strategies mathematics teachers use to create opportunities for teaching and learning algebra. A summary of the analysis has been displayed in Table 8.

Table 8: Teaching practices used by Mathematics Teachers

Teaching practices	Mean	Standard Deviation
Use different instructional techniques including activity and inquiry-based instruction during algebra lessons	4.9	0.32
Try to attract attention of all learners	4.83	0.21
Use pair discussion strategy more than wide class teaching in an algebra class	2.14	0.17
Share power in the classroom by allowing students to provide meaningful input in an algebra class	3.91	0.42
Use formative assessment (formal and informal assessment procedure) during teaching and learning in algebra.	1.76	0.32
Use questioning to engage student participation in the algebra class	3.91	0.15
Use visual representations to enable students get involved in algebra lessons	3.93	0.15
Make use of demonstrations in algebra lessons	4.02	0.31
Create a friendly atmosphere to encourage students to participate in algebra class.	4.03	0.41
Engage students in conversation about real-world problems and how algebra can be used to examine them	3.27	0.31

Source: Field Data, 2023

Based on the results in Table 8, it is evident that teachers often employed the use of several instructional strategies to aid students including and especially, the use of different instructional techniques including activity and inquiry-based instruction during algebra lessons (Mean = 4.9, S.D = 0.32), to attract attention of all learners during algebra lessons (Mean = 4.83, S.D = 0.21), create a friendly atmosphere to encourage students to participate in algebra class (Mean = 4.03, S.D = 0.41) and making use of demonstrations in algebra lessons (Mean = 4.02, S.D = 0.31).

Other instructional strategies like the use of visual representations to enable students get involved in algebra lessons (Mean = 3.93, S.D = 0.15), share power in the classroom by allowing students to provide meaningful input in an algebra class (Mean = 3.91, S.D = 0.42) and the use of questioning to engage student participation in the algebra class (Mean = 3.91, S.D = 0.15) were used but not as much as the earlier mentioned.

Meanwhile, teachers shied away from strategies such as engaging students in conversation about real-world problems and how algebra can be used to examine them (Mean = 3.27, S.D = 0.31), using pair discussion strategy more than wide class teaching in an algebra class (Mean = 2.14, S.D = 0.17) and using formative assessment (formal and informal assessment procedure) during teaching and learning in algebra (Mean = 1.76, S.D = 0.32).

4.7 Research Question Three: The Impact the Use of Instructional Strategies by Teachers in Teaching Algebra have on Students' Knowledge Retention.

The researcher sought to determine the impact the use of the instructional strategies by teachers in teaching algebra have on students' knowledge retention. A summary of the analysis has been displayed in Table 9.

Table 9: Impacts of the Instructional Strategies used by Mathematics Teachers

Research Items/ Statement	**Mean**	**S. D**
When instructional strategies are used effectively in teaching, they have the potential to incorporate students' learning experiences in algebra, making subject information more receptive and interesting	4.04	0.01
Adequate preparations and appropriate use of vital learning resources in teaching are required for good or effective teaching in algebra	4.49	0.43
Differentiated instruction, flexible grouping, and teaching for higher-order thinking abilities improves teaching and learning of algebra	3.95	0.17
Demonstration technique has the greatest impact on student academic achievement in algebra	4.93	0.44
Doing a lot of algebra work increases teaching and learning of algebra	4.91	0.21
A method of constructing a formula using a sufficient number of concrete examples helps in teaching and learning of mathematics	4.05	0.41
The instructional strategies I use help my students to retain their knowledge of algebra.	4.99	0.03

Source: Field Data, 2023

Based on results in Table 9, it is evident that all the teachers agreed that the use of instructional strategies by teachers in teaching algebra impacted positively on students' knowledge retention. For instance, the table revealed that doing a lot of algebra work increases teaching and learning of mathematics (Mean = 4.94, S. D = 0.21). Also, adequate preparations and appropriate use of vital learning resources in teaching are required for good or effective teaching in algebra (Mean = 4.49, S. D = 0.43). Again, when instructional strategies are used effectively in teaching, they have the potential to incorporate students' learning experiences in algebra, making subject information more receptive and interesting (Mean = 4.04, S. D = 0.01). It showed also that all the teachers agreed that when instructional strategies are used by teachers in teaching, students are able to retain their knowledge of algebra better (Mean = 4.99, S. D = 0.03).

4.8 Effect of Instructional Strategies on Students Academic Performance

In order to ascertain whether there was a relationship between instructional teaching strategies and student academic performance, more specifically, to understand whether instructional teaching strategies could significantly predict student performance, a regression analysis was run.

Table 10: ANOVA Results

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.298[a]	.089	.079	29.035

a. Predictors: (Constant), instructional teaching strategies.

Results showed an R=.298, R square .089 and adjusted R square .079; thus, superior LMX accounts for 8.9% variation in student academic performance.

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	8.402	3.125		2.688	.009
	Instructional teaching strategies	.350	.116	.298	3.014	.003

a. Dependent Variable: Student academic performance

It is revealed from the output that there is a fairly weak positive linear significant correlation between instructional strategies and student academic performance (β=.298, $p < 0.05$). The student academic performance is equal to the equation 8.402 + .350 (Instructional teaching strategies). At any time, there is increase in instructional teaching strategies, there is also a positive increase in student academic performance.

4.9 Discussion of Findings

The purpose of this study was to examine how senior high school mathematics teachers' instructional strategies impacted student knowledge retention in teaching algebra. The results revealed that teachers were in agreement that using instructional strategies in teaching algebra helped student knowledge retention better. This is supported by Usisin (2004) who calls for a good understanding of algebra as being relevant for the proficiency and success of students. Specifically, students taught by teachers who used a variety of instructional strategies had higher levels of knowledge retention than those taught by teachers who used a single strategy. According to Egodawatte (2011), the use of varying strategies centered on word problems, algebraic expressions, equations and models are relevant in the teaching and learning of mathematics. This was also confirmed in the findings from the field research. This is why the findings in this study suggest that teachers should use a variety of instructional strategies when teaching algebra in order to facilitate student learning and knowledge retention.

Moreover, there was a call for teachers to continually assess student learning and adjust their instructional strategies accordingly in order to ensure that students are able to retain the algebraic concepts they have been taught. This is because, according to Seng (2010) and Booth et al., (2014), the continuous use of mathematics and its identities helps to clear the misconceptions and errors one might have and thus fosters an improvement in learning outcomes. In addition, this study indicates that further research is needed to explore how different instructional strategies and approaches can be used to further promote student learning and knowledge retention in mathematics.

Furthermore, additional studies that focus on the impact of different types of instructional strategies on student learning in other mathematics topics and grade levels should be conducted. This is why Handelsman et al, (2004) calls for the use of active learning approaches that involve students in enquiries and discovery based on the concepts of knowledge retention. These studies would provide teachers with greater insight into how to effectively teach mathematics and promote student learning. Teaching algebra to senior high school students is a complex task, requiring specialized knowledge and skills from mathematics teachers. Numerous studies conducted in recent years have explored the instructional strategies used by teachers to teach this subject and the impact these strategies have on student knowledge retention.

One study examined the effects of inquiry-based instruction on student knowledge retention in senior high school mathematics courses (Li et al, 2019). The study employed a quasi-experimental design to compare the effects of inquiry-based instruction with traditional instruction. Results showed that students who received inquiry-based instruction performed significantly better on post-test assessments than those who received traditional instruction. Additionally, the students in the inquiry-based instruction group reported higher levels of interest in the subject and greater self-confidence in their ability to solve algebraic problems. This is also true as firmed up by Giridharan and Raju (2016) where investigations on the impact of teaching strategies on students' academic achievement were concluded on the use of demonstrations, be it visual aids or the use of technology. The same is reported by the responses obtained in this study as teaching employed strategies that touched on these two demonstration techniques.

Another study investigated the impact of computer-aided instruction on student knowledge retention in mathematics (Wang et al., 2019). The study utilized a pre-test/post-test design to assess the effects of computer-aided instruction on student performance. Results showed that students who received computer-aided instruction performed significantly better than those who received traditional instruction. Furthermore, the computer-aided instruction group reported greater confidence in their ability to solve algebraic problems. This is because, these strategies improve students' command of the subject matter while promoting 21st century competencies, emphasizes active investigation and knowledge construction through the process of inquiry and encourages students to consider different perspectives and to evaluate, adjust and construct evidence-based interpretations (Grant, Swan, & Lee, 2017).

In a third study, the authors examined the effects of problem-based learning on student knowledge retention in senior high school mathematics classes (Chen et al., 2021). The study utilized a randomized control trial to compare problem-based learning with traditional instruction. Results showed that students who received problem-based instruction outperformed those who received traditional instruction on post-test assessments. Additionally, the problem-based instruction group reported increased levels of interest in mathematics and greater self-confidence in their ability to solve algebraic problems. This again reiterates the need to employ mathematical strategies that aim to cultivate understanding and reasoned judgement through the study of sources, arguments and worldviews (Grant, Swan & Lee, 2017).

Overall, these studies suggest that inquiry-based, computer-aided, and problem-based instruction are all effective instructional strategies for teaching algebra to senior high school students. These strategies have been associated with improved student performance on post-test assessments and increased levels of interest in the subject. Furthermore, students who receive these types of instruction report greater self-confidence in their ability to solve algebraic problems.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Overview

This chapter consist of the summary of the study, the key findings, conclusions and recommendations based on the findings.

5.2 Summary of the Study

The study investigated mathematics teachers' instructional strategies and their impact on student knowledge retention of algebraic concepts in the Kwahu-East district. The survey method was used as the research design whereas census was used as the sampling technique in selecting all the teachers for the study. In all a total of 67 teachers were made to answer a five-point Likert scale questionnaire on the instructional strategies and their impact on student knowledge retention of algebraic concepts. As a quantitative study, data was analyzed by the use of Statistical Products and Service Solution (SPSS). Descriptive statistics such as mean, and standard deviation were used to investigate the instructional strategies used by mathematics teachers in teaching algebraic concepts.

5.3 Key Findings of the Study

From the findings, there was more agreements to the use of instructions where students had to be encouraged to communicate mathematically, reason mathematically and acquire self-confidence in solving mathematical algebraic problems targeted at enhancing performance. This is also supported by the use of practice-based learnings where students are taken through lots of practice works that provide feedback and motivate students in the learning of mathematics. Collaborative learning was reported as being least used but an integrative approach to the study of mathematics using crosscutting relations from other subject areas was highly adopted by these teachers as it helped to make the instructional materials more engaging and interactive. This aided the teaching and learning process to a large extent for these schools in the Kwahu-East District.

Secondly, the study looked at the teaching practices mathematics teachers used in creating equitable opportunities for learning among their students. The practices found in the study were varying but were mainly directed at creating an activity and inquiry-based instructional learning that caught the attention of all learners as this was also key to the demonstrations involving visual aids and technology. These were quite significant in the opportunities being created for the students in the learning of mathematics. The use of a friendly classroom setting was also used to a large extent with some teachers adding that an unconducive environment could deter students from actively participating and also affects performance in the long run. There were also some mentions of the use of questions and probing into real-case situations to ensure the participation of students in the mathematics classes. However, the use of formative assessments, be it the formal and informal assessments used in the teaching and learning process was minimally used as teachers held the impressions that these usually created fear in students and caused them to shun the subject matter.

The last major finding had to do with the overall impact that instructional strategies in teaching algebra could have on students' academic performance. This was tackled in two forms looking at the levels of agreement first and then to a model fit using a simple linear regression model. In assessing the responses from the teachers, it was worth noting that the teachers were quite convinced that the use of demonstration techniques, more practice work in algebra and evidence-based teaching practices in use for the teaching of algebra was significant in impacting the students' academic performance. These indications meant that when the learning process was involving, practical and well composed, learners were likely to achieve some success in the learning of mathematics. The resolve from this was to look at how these collective as the instructional strategies could actually cause an effect on the students' academic performance. From the model fit, there was a significant impact on performance given the use of instructional strategies in the teaching of mathematics in these schools. The model was well fit but the variable on instructional teaching strategies accounted for just 7.9% of the outcomes seen in student academic performance. This is so because, a lot of concomitant factors do impact performance aside the instructional teaching strategies and these are not accounted for in this study.

5.4 Conclusions of the Study

From the discussions, it can be concluded that the main instructional strategies in use by mathematical teachers include the use of questions to check knowledge, the use of practice-based learning and the use of an integrated approach in the teaching and learning process.

Again, the equitable opportunities being created for learners was seen in how teachers used an activity and inquiry-based instructional learning that caught the attention of all learners with the involvement of visual aids and technology. Others were created with the friendly classroom setting, the use of real-case situations to firm up abstract concepts and the use of formative assessment among others.

Lastly, there is an overall impact on students' academic performance due to the use of these instructional strategies. This is quite relational and can be looked at in terms of the impacts to the learning process, the environment it creates for the learners and the manner in which teachers are involved in ensuring success is attained for the students.

5.5 Recommendations

Based on the conclusions of the study, the following recommendations have been made;

- Senior high school teachers should take keen interest in developing themselves on the use of visual aids and technology to aid in the teaching of mathematics in their respective schools. The technological age presents lots of opportunity to teach mathematics in different ways that are more interactive, involving and more applicable and this is what must trigger teachers to dive deep into its usage.
- Secondly, senior high school mathematics teachers should re-engage their teaching strategies and pick on the key ones such as the creation of a friendly-learning environment, more activity-based learning, a sense of probing and critiquing of practical life cases that give a more concrete sense of learning away from the abstract concepts usually taught in schools. A lot can be done in this regard to encourage learner participation, discussions and overall performance in the subject of mathematics.
- The impact of the teaching strategies on performance is minimal and can be looked at wholistically with other factors that helps in student academic performance. Teachers should therefore pay some attention to this to ensure the overall target of academic performance is achieved.
- Lastly, teachers and mathematical instructors can take on the highlights of the study regarding the various teaching strategies that can be applied to effectively teach students to perform in the subject matter. This can be used to develop

learning plans and teaching modules that guide students in a collaborative and literature-based approach that helps achieve the levels of performance expected

5.6 Implications for Practice and Policy

- GES and heads of senior high schools should organize Mathematics teaching improvement programs to give mathematics teachers better orientation on the use of effective instructional strategies that will impact students' knowledge retention in algebra**.**
- Curriculum reforms should incorporate the use of visual aids and technological cues that help student grasp concepts much quicker.
- The ministry of education should also synthesize the concepts learnt in mathematics and apply them to real-life cases scenarios that play out in the other subject areas being taught in school. Such relation can make students appreciate the learning process and get more essence of what they do and how it can impact their overall learning successes.

5.7 Suggestions for Future Research

For further research, researchers and educationist can look at the various factors accounting for student academic performance and to what extent each can be measured and implemented. This can thus be done to highlight on student backgrounds, socioeconomic status of students, knowledge of teachers, the teaching and learning process, the effective use of learning materials and others.

Again, further research can consider the main concepts taught in the area of mathematics and seek to find the problem areas and how these can be resolved to achieving success in the learning outcomes expected in students. This can also be looked at from the teacher perspective to address the areas teachers have challenges teaching to have some curriculum reforms if necessary.

Lastly, the study can be extended to other districts and locations to engage a comparative study that can look at learners across district, different income backgrounds, gender differences and different teaching approaches and others.

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APPENDIX

UNIVERSITY OF EDUCATION, WINNEBA

RESEARCH INSTRUMENT

Dear Sir/Madam,

The researcher is a student from the University of Education, Winneba writing a thesis on the topic **"TEACHING ALGEBRA: SENIOR HIGH SCHOOLS MATHEMATICS TEACHER'S INSTRUCTIONAL STRATEGIES AND THEIR IMAPCT ON STUDENT KNOWLEDGE RETENTION IN THE KWAHU-EAST DISTRICT".** The study is expected to reveal some of the deficiencies accompanying the teaching and learning of algebraic concepts in mathematics classrooms. This study hopes to help teachers understand the different strategies in classroom delivery to enable them vary their teaching methods where applicable and in effect help students gain knowledge on the different strategies that can be employed by their respective teachers, helping them to adjust appropriately to positively impact on their mathematics achievements. It would also guide willing teachers to vary their teaching methods to help serve Ghana education better. Your responses are greatly appreciated and would be treated with utmost confidentiality. Kindly help by responding to the questions provided. Please tick (√) or write where necessary in the bracket with the answer.

SECTION A: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

1. AGE:

a. Age 20 -30 years [ ]   31- 40 years [ ]   41 – 50 years [ ]   51 – 60 years [ ]

2. GENDER:

a. Male [ ]   b. Female [ ]

3. RELIGIOUS AFFILIATION

[ ] Christianity   [ ] Muslim

SECTION B: DIFFERENT INSTRUCTIONAL STRATEGIES FOR SOLVING BASIC ALGEBRAIC CONCEPTS IN SENIOR HIGH SCHOOLS

Likert scales are used to ensure certainty and clarity of responses. Kindly tick (√) the most appropriate answers to each of the statement below.

Note: Strongly Agree = 5; Agree = 4; Neutral = 3; Disagree = 2 and Strongly Disagree = 1.

Research Items/ Statement	**1**	**2**	**3**	**4**	**5**
DIFFERENT INSTRUCTIONAL STRATEGIES FOR SOLVING BASIC ALGEBRAIC CONCEPTS IN SENIOR HIGH SCHOOLS					
Permitting students to communicate mathematically, reason mathematically, and acquire self-confidence in solving algebraic problems increase their performance.					
2. Understanding students' individual learning needs by teachers to determine which strategy to use forms part of instructional strategies in teaching algebra					
3. Organizing and integrating educational content forms part of instructional strategies that will aid the study of algebra					
4. Evidence-based teaching practices must be used as strategies in teaching algebra.					
5. Questioning to check for knowledge and summarizing new material in a graphical format are good instructional strategies to aid the teaching and learning of algebra					
6. Lots of good practice, providing students with feedback, and motivating students to work together in productive manner are some of the instructional strategies that aid in the teaching and learning of algebra					
7. Cooperative learning is a basic instructional strategy that allows students to collaborate in groups or pairs to solve algebraic problems					
8. Integrative approach is a strategy that links other topic matter in other subject areas and make an instructional design more engaging and integrative and aid the teaching and learning of algebra					

The statements in the table below are teaching practices mathematics teachers use to create equitable opportunities for learning. Study them and tick the appropriate box to RATE how often you use them to engage your students in an algebra class. (Please rate EVERY practice according to the scale by ticking (√) the best option).

SN	*I do*	Never (1)	Rarely (2)	Undecided (3)	Often (4)	Always (5)
9.	use different instructional techniques including activity and inquiry-based instruction during algebra lessons					
10.	try to attract attention of all learners					
11.	use pair discussion strategy more than wide class teaching in an algebra class					
12.	share power in the classroom by allowing students to provide meaningful input in an algebra class					
13.	use formative assessment (formal and informal assessment procedure) during teaching and learning.					
14.	use questioning to engage student participation in the algebra class					
15.	use visual representations to enable students get involved in algebra lessons					
16.	make use of demonstrations in algebra lessons					
17.	Create a friendly atmosphere to encourage students to participate in algebra class.					
18.	engage students in conversation about real-world problems and how algebra can be used to examine them					

SECTION C: LEARNING TECHNIQUES AND INSTRUCTIONAL STRATEGIES TOWARDS IMPROVING THE TEACHING AND LEARNING OF MATHEMATICS

Note: Strongly Agree = 5; Agree = 4; Neutral = 3; Disagree = 2 and Strongly Disagree = 1.

Kindly tick (√) the most appropriate answers to each of the statement below.

Research Items/ Statement	**1**	**2**	**3**	**4**	**5**
LEARNING TECHNIQUES AND INSTRUCTIONAL STRATEGIES TOWARDS IMPROVING THE TEACHING AND LEARNING OF MATHEMATICS					
9. When instructional strategies are used effectively in teaching, they have the potential to incorporate students' learning experiences, making subject information more receptive and interesting					
10. Adequate preparations and appropriate use of vital learning resources in teaching are required for good or effective teaching					
11. Differentiated instruction, flexible grouping, and teaching for higher-order thinking abilities improves teaching and learning of mathematics					
12. Demonstration technique has the greatest impact on student academic achievement in Mathematics.					
13. Doing a lot of algebra work increases teaching and learning of mathematics					
14. A method of constructing a formula using a sufficient number of concrete examples helps in teaching and learning of mathematics					
15. The instructional strategies I use help my students to retain their knowledge of algebra					

Thank you and God bless you for your time and responses to this questionnaire.