Effects of Case-based and Team-based Teaching Strategies on Word Problems in Primary School Mathematics in Ibadan, Nigeria

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Being a MSc(Ed) Thesis Presentation Submitted to the Department of Science Education, Faculty of Education, Lead City University, Ibadan, Oyo State, Nigeria

In Partial Fulfilment of the Requirements for the Award of Master of Science Education (MSc Ed) in Mathematics Education

2024

Certification

This is to certify that Stephen Sunday AWOTOYE with matriculation number LCU/PG/003151 carried out this research work titled "Effects of Case-based Team-based Teaching Strategies on Word Problems in Primary School Mathematics in Ibadan, Nigeria" in the Department of Science Education, Faculty of Education, Lead City University, Ibadan, Oyo State, Nigeria for the award of Master of Science in Education MSc(Ed) in Mathematics Education and that this has not been previously submitted to any institution for any award.

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Dedication

This research work is dedicated to Almighty God for His infinite mercy, wisdom and strength granted to me in the course of this research work. To Him alone be all the glory.

Acknowledgment

This thesis is a product of my personal efforts for a better society. I wish to express my unreserved gratitude to Lead City University, Ibadan for the opportunity given to me for undergoing this Master’s degree. I wish to acknowledge Ibadan North West Local Inspector of Education, for providing me relevant information to make my work easy and the support from the selected private primary school used – St. Mary’s Model School, Oke-Padre, All Saints’ Church School, Jericho and Sacred Heart Private School, Onireke to carry-out my field work.

I have to firstly acknowledge the encouragement I received from my supervisor – Dr. Waheed Azeez Ajani, the Head of Department of Science Education – Prof. Philias Yara, the Dean Faculty of Education, Lead City University, Ibadan – Prof. Donald Odeleye, whom I see as role model in the academics. I must also acknowledge the contributions of Prof. Afolakemi Oredein, Prof. Senimetu Ileuma, Associate Prof. Ukamaka Akuche, Dr. Christiana Sam-Kayode, Dr. Monilola Oyetade and Dr. Sabina Obi who really imparted me during the course of this programme.

My sincere appreciation goes to my research assistants for their contributions – Mrs. Mary Olowoseye, Mr. Ayoola Toriola, Mr. Sunday Adedewe from the above named private primary schools respectively and my data analyst – Dr. Sunday Adeboye.

I recognise the contributions of my dear brother – Mr. Simon Awotoye for his support morally and financially whenever the needs arise. I specially appreciate the contributions of my dear wife – Mrs. Abolade Awotoye and my children – Emmanuel, Anthony and Charles Awotoye, their encouragement during the course of this programme, your contribution means a lot to me. I alone stand responsible for the errors, if any, found in the work.

Abstract

Over the years, pupils' performance in external examinations such as National Common Entrance Examination (NCEE), State Common Entrance Examinations (SCEE) and other entrance examinations into secondary schools, is still very low and below expectation. This study investigates Effect of Case-Based and Team-Based Teaching Strategies on Word Problems in Primary School Mathematics in Ibadan North-West Local Government Area, Oyo State. Three hypotheses were formulated and tested at 0.05 level of significance. Quasi-experimental design was used. Multi-stage sampling procedure was adopted where three private primary schools from 11 wards in Ibadan North-West Local Government Area, Oyo State were stratified and purposively selected. A sample size of 86 pupils comprises each of 43 boys and 43 girls were involved in the study. Primary four intact classes were used in each of the three selected private primary schools. Instruments used for data collection were Primary Mathematics Word Problems Achievement Test (KR-20 = 0.86), and teaching instructional guides. Analysis of Covariance (ANCOVA) was used for data analysis. There was a significant main effects of Case-based Teaching Strategy on Achievement of Primary School Pupils in Mathematics[$F_{(1,51)}$=58.624, $P < 0.05$, η^2= 0.535] and Team-based Teaching Strategy on Achievement of Primary School Pupils in Mathematics word problems [$F_{(1,55)}$=45.008, $P < 0.05$, η^2= 0.450]. From the findings, it is concluded that Case-based teaching strategy, Team-based teaching strategy and combined Case-based, Team-based and Traditional Teaching Strategies were effective in teaching word problems in primary school Mathematics. Base on the results, it is recommended that both Case-based and Team-based teaching strategies should be adopted by the teachers in teaching word problems in Primary school Mathematics to enhance pupils' academic achievement.

Keywords: Case-based Teaching Strategy, Team-based Teaching Strategy, Primary Schools in Ibadan, Word Problems in Mathematics, Academic Achievement

Word count: 286

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List of Acronyms

Abbreviation	Meaning
JSS	Junior Secondary School
CBTS	Case-Based Teaching Strategy
TBTS	Team-Based Teaching Strategy
PBL	Problem-Based Learning
TBL	Team-Based Learning
ZPD	Zone of Proximal Development
CLT	Cognitive Load Theory
CSQ	Class Size Questionnaire
TATTQ	Teacher's Attitude towards Teaching Questionnaire
AEQ-M	Achievement Emotions Questionnaires – Mathematics
MTEBI	Mathematics Teaching Efficacy Belief Instrument
AMS	Attitude Towards Mathematics Scale
PMTE	Personal Mathematics Teaching Efficacy
EI	Emotional Intelligence
WM	Working Memory
CSCL	Computer-Supported Collaborative Learning
CMA	Comprehensive Meta-Analysis
STEM	Science, Technology, Engineering, and Mathematics
MANOVA	Multiple Analysis of Variance
TPT	Team Play Tournament
STAD	Student Teams and Achievement Divisions

PMWPAT	Primary Mathematics Word Problems Achievement Test
TIG	Teaching Instructional Guides
ANCOVA	Analysis of Covariant
VCBL	Visualized Case-Based Learning
CBL	Case-Based Learning
NCEE	National Common Entrance Examination
SCEE	State Common Entrance Examination

Chapter One

Introduction

1.1 Background to the Study

Mathematics affects every element of human life. Aspects of human life that are centered on numbers include social, economic, political, geographical, scientific, and technical. No matter what kind of employment or professional path a person chooses, Mathematics is still a necessary skill that will help them to be productive at their job[1]. Understanding Mathematics is essential for daily living and long-term planning; it is not only useful for one's career or the advancement of the country. Mathematical education has a major impact on national development even though it can enhance mental faculties and creativity. Any country's ability to improve technologically and scientifically is reliant on its ability to implement an efficient system of Mathematics education[2]. Well-designed Mathematics curricula and educational systems have been shown to benefit industrialised nations much because they are the cornerstone of advancements in science, technology, and the economy. Nigeria's government has made Mathematics a required subject from primary school through secondary school because it is dedicated to helping its citizens develop in this way[1, 3].

Primary education is described by the Federal Republic of Nigeria in her National Policy on Education as instruction provided to children between the ages of six and twelve[4]. Primary education serves as the foundation for the rest of the educational system and is crucial to its success or failure. It is clear from this that, fundamentally in primary education, sound attitudes and reading and numeracy abilities are developed in an appropriate manner. Every pupil in primary or secondary school is required to take Mathematics, English studies, and one of the three major Nigerian languages; Hausa, Yoruba, or Igbo as core courses[5]. Not only is Mathematics taught as a vital topic in primary schools, but it is also called the father of all science subjects. The government of Nigeria has made Mathematics a core subject and requires it for primary school pupils, demonstrating the value of the subject[6].

The main goal of Mathematics is problem solving. Every decision is made after translating every statement to a mathematical statement and determining what and how to answer these questions in order to find the optimum solution. Word problems are commonly described as verbal descriptions of problem situations that are presented in an academic setting. These problems pose one or more questions, the answers to which can be found by applying mathematical operations to the numerical data that is either directly from the problem statement or can be derived from it. Across the globe, word problems have traditionally played a significant role in Mathematics education[7]. Their historical contribution to Mathematics instruction goes all the way back to antiquity. One type of problem that Mathematics learners find particularly challenging is word problems. Base on this, it has been the focus of an enormous amount of research for the past fifty years[8].

Pupils' performance in both internal and external examinations, such as the National Common Entrance and State Common Entrance Examinations and other entrance examinations into secondary schools, is still very low and below expectation, despite efforts by the Federal and State governments to prioritise Mathematics in primary schools [9,10]. However, over time, primary school pupils' academic performance in the subjects' components has not improved[6].

Effectively teaching word problems in Mathematics requires the use of a variety of techniques to aid pupils in comprehending the process of problem-solving. It is possible to establish a supportive learning environment where pupils feel competent and confident in their ability to solve mathematical word problems by instructing pupils on how to read the problem carefully and comprehend it. Emphasise important details and indicate the question being asked. Assign pupils to the task of differentiating between the word problem's pertinent and irrelevant information. Urge them to concentrate on the specifics that are necessary to resolve the issue. To assist pupils in visualizing the problem, include visual aids like charts, graphs, and diagrams. This can help with comprehension and make difficult problems more approachable[9,11].

Case-based teaching involves presenting pupils with real-life scenarios or cases that are relevant to the subject matter. In the context of primary school Mathematics, this approach would entail using word problems that reflect practical situations, such as counting objects, sharing items among friends, or solving everyday Mathematics tasks. The goal is to engage pupils by relating mathematical concepts to their daily lives, fostering critical thinking, and encouraging problem-solving in context. Case-based teaching strategy in primary school Mathematics can be highly beneficial for several reasons such as: Case-based learning techniques give mathematical ideas real-world applications. By connecting mathematical ideas to real-world scenarios, pupils are able to make abstract ideas more approachable and clear. Pupils' attention can be piqued by real-world examples and situations. Pupils are more likely to be interested in and motivated to solve mathematical problems when they are presented in a relevant context[12].

Over the years, scholars and educators in Mathematics have conducted studies on factors that contribute to low Mathematics performance in primary schools. Inadequate facilities, lack of equipment and instructional resources for efficient teaching, huge class sizes, teacher shortages, teaching strategies and Mathematics phobia or fear are only a few of these reasons. Due to the persistence of low Mathematics word problems performance in primary schools over the years, this call for this study to investigate "Effects of Case-Based and Team-Based Teaching Strategies on Word Problems in Primary School Mathematics in Ibadan, Nigeria."

Case-based learning promotes using mathematical knowledge to address real-world issues. It facilitates pupils' understanding of the application of what they are learning in diverse contexts and its relevance. Pupils must analyse data, pinpoint pertinent details, and use critical thinking techniques to solve problems when working with case studies. This helps foster the growth of analytical and problem-solving abilities. Case-based learning frequently incorporates group projects in which pupils cooperate to find solutions to issues. This encourages cooperation, effective communication, and the capacity to explain and defend mathematical reasoning. It encourages a deeper comprehension of mathematical concepts as opposed to memorisation of formulas or procedures. When concepts are applied in real-world contexts, pupils are more likely to retain and understand them. It could be difficult for primary school pupils to recognise how Mathematics is used in real-world situations. By showing how Mathematics is applied in real-world contexts, case-based strategy close this gap and give the subject greater relevance and significance[12,13].

Information is better retained when learned through cases. Pupils are more likely to retain and use mathematical knowledge in the future when they can relate mathematical ideas to real-world scenarios or situations. A variety of learning styles and skill levels can be accommodated via case-based tactics. Varied approaches to the content can be used by pupils with varied degrees of mathematical skill by creating a more inclusive learning environment. Problem-solving abilities are crucial in real-world situations, and teaching Mathematics through examples equips pupils for these kinds of situations. It aids in the development of their capacity to use mathematical reasoning to solve problems that they might run into in their daily life and in their future careers. A common tactic used in case-based learning is to pose questions and give pupils the freedom to investigate and come up with answers on their own. This encourages inquiry-based learning, which is a useful strategy for cultivating an autonomous and inquiring attitude[14].

Pupils must be able to express their ideas clearly when presenting and debating situations. This helps with the development of communication skills, which are beneficial in many facets of life and in Mathematics in particular. Teachers may create a dynamic and engaging learning environment in primary school Mathematics that goes beyond rote memorisation and helps pupils to recognise the relevance and practical applications of Mathematics in their everyday lives by implementing case-based teaching strategy[12,14,15].

Various approaches to problem-solving should be taught, including working backwards, creating charts or tables, sketching pictures, and experimenting. Give each strategy some examples and opportunities for practice. Model the problem-solving process step-by-step. As a class, work through a few examples and show each other how to convert the given words into mathematical expressions or equations. Make connections between word problems and engaging, pertinent real-world scenarios for pupils. This aids in their understanding of the real-world applications of mathematical ideas. As pupils gain confidence, gradually increase the complexity of the problems from simpler ones. This scaffolding method aids in the gradual development of problem-solving abilities[15,16]. Encourage conversation in the classroom regarding various methods for resolving word problems. Pupils should be encouraged to share their strategies and rationale with their peers. Provide problems using a variety of methods, such as visual aids, mathematical formulas, and spoken explanations. Pupils gain a deeper comprehension of the relationships within the problem as a result of this. Connect word problems to ideas and abilities that pupils have already acquired. This strengthens their grasp of mathematical concepts and aids in their ability to make connections. Give pupils quick feedback on their attempts to solve problems[17,18].

In order to reinforce learning, clear up misunderstandings and recognise effective tactics. Incorporate technological resources to encourage pupils to solve word problems, such as interactive applications or web simulations. These resources can offer more practice and a visual depiction of issues. Gradually move pupils to independent practice so they can use the techniques they have learned for solving problems on their own. Evaluate pupils' comprehension of word problems via evaluations and promote introspection regarding their approaches to problem-solving and this can help identify areas for improvement. Teaching strategies that emphasise problem solving and active study are also being promoted more and more, also one example of a teaching strategy that combines elements of pupil-centeredness and problem-solving attributes is team-based learning. One of the global trends in education is the movement toward more integrated, pupil-centered, scientific application models[19].

Team-based learning is an active teaching technique and small group learning approach that gives pupils opportunities to apply theoretical knowledge through a set of tasks that involve both individual and group work as well as instant feedback[20]. In large classrooms with over 100 pupils or smaller ones with under 25 pupils, it is utilised. Pupils are separated into groups, with each group consisting of five to seven pupils in a single classroom. The following three stages are repeated in sequence when team-based learning is applied: First section: pupils hunt up information on their own and study outside of class; in the second section, learners complete an individual readiness assurance test to gauge their level of basic comprehension of the theories and data they have learned. A group of five to seven pupils is pre-assigned and given the same test. In this group readiness assurance test, each option is settled by the team bureaucracy. Third section: groups of pupils work on activities that provide chances to apply knowledge in challenging real-world scenarios. Team-based learning improves peer teaching and learning, encourages pupils to actively learn and participate with the course material and in-magnificence activities, motivates primary school pupils to take responsibility for their own learning, and makes it possible for pupils to effectively apply the principles they have learned in class to real-world situations[21].

Pupils are divided into small groups to collaborate on problems as part of team-based teaching, also referred to as collaborative or cooperative learning. Within the field of Mathematics, pupils might be given word problems that call for group work to solve. By encouraging collaboration, communication, and the sharing of ideas, this approach helps pupils learn from one another and develop their problem-solving abilities in a group setting. Using team-based teaching techniques in Mathematics classes in primary school has a number of advantages that add up to a comprehensive and successful learning process[22]. Pupils work together more when they use team-based tactics. They can exchange ideas, debate topics, and gain knowledge from one another when they work in teams. This cooperative strategy promotes a sense of belonging and assistance between individuals[21,23].

Pupils' social and emotional skills are enhanced through collaborative learning in groups. They gain skills in effective communication, dispute resolution, and teamwork toward shared objectives. These abilities are essential to their overall growth. Teams make differentiated instruction possible because they enable pupils with diverse skill levels to collaborate. A more inclusive learning environment can be created by peers helping and supporting one another. Pupils can explain topics to their teammates through the use of team-based tactics, which promote peer teaching. Pupils' comprehension of mathematical concepts is reinforced when they teach it to others, and it also enables them to better comprehend it themselves. Solving problems is a common task in Mathematics. Through cooperative learning and a variety of viewpoints, pupils can solve mathematical problems as a group in team-based activities, which improves their problem-solving abilities. When pupils collaborate in groups, they are frequently more involved in their studies. Mathematical enjoyment can be increased by the social component of cooperative learning, which also lowers anxiety and fosters a positive attitude toward the subject[19,21].

Pupils' confidence can be increased through team-based learning. Their sense of accomplishment and confidence is bolstered when they share their ideas, work well in a team, and get good feedback. Good communication is essential for teamwork. Pupils gain knowledge on how to listen to others, communicate their ideas clearly, and participate in productive debates. These are useful communication skills outside of the classroom as well. Solving problems that call for critical thought is a common part of team-based activities. Pupils can approach problems from numerous angles when they collaborate with classmates which improve their analytical skills. A lot of real-world scenarios need collaboration, which is similar to what collaborative learning in teams looks like. Pupils learn collaboration skills in the classroom, which are critical for success in their future academic and professional endeavors. When working as a team, pupils contribute a variety of viewpoints and methods to problem-solving. Their comprehension of mathematical ideas is improved and their thinking is expanded when they are exposed to diverse points of view[24].

Pupils are more likely to engage in active learning when they feel that they have a shared duty within the team. Being aware of how important their efforts are to the group's success can be a strong incentive. Teaching Mathematics in primary schools using a team-based approach not only improves the learning process but also helps pupils get ready for a collaborative and dynamic future where good communication and teamwork skills are critical[25].

The term "gender" refers to the expectations, actions, roles, and expressions that are socially constructed and considered proper for members of a particular community depending on their perceived sex[26]. Gender, as opposed to sex, is a more general term that encompasses individual, cultural, and societal conceptions of masculinity, femininity, and non-binary identities. Sex, on the other hand, usually refers to the biological distinctions between males and females[27]. In order to address problems with gender inequality, discrimination, and marginilisation in a variety of societal contexts—such as politics, education, the economy, and healthcare—it is imperative that one has a basic understanding of gender[28]. The creation of a society with greater equity and justice must begin with the promotion of gender equality and the development of inclusive environments that respect a range of gender identities and expressions[28, 29].

The success of teaching strategies, pupils' problem-solving abilities, and their comprehension of Mathematics can all have an impact on their academic performance when it comes to word problems in the subject of Mathematics. Academic success on Mathematics word problems is a complex result impacted by the interaction of teaching strategies, pupils' involvement, and the support networks at home and at school[30,31]. Teachers can help pupils improve their mathematical proficiency and problem-solving skills by having a solid understanding of the material covered in each topic. This entails having a thorough comprehension of ideas, rules, and theories[32]. Success in school greatly depends on one's capacity for critical thought, information analysis, and problem-solving. Evaluating the facts, forming well-reasoned conclusions, and approaching problems thoughtfully are all components of critical thinking. Creating efficient study habits, time management techniques, and organisational plans can have a big impact on academic success.

Research has shown that gender stereotypes and biases can affect primary school mathematics word problems as regard gender. Word problems may unfairly assess pupils' mathematics skills based on their familiarity with gender-specific contexts and over-emphasis on traditional gender roles restricts the diversity of scenarios, limiting pupils' ability to apply mathematics to real world situations. Also, gender biases in word problems can influence teachers' expectation and grading in learning mathematics word problems. Pupils who can organise their time for study, make goals, and rank their assignments are more likely to succeed academically[33].

1.2 Statement of the Problems

Despite efforts by the Federal and State governments to prioritise Mathematics in primary schools, pupils' performance in both internal and external examinations, such as the National Common Entrance and State Common Entrance Examinations and other entrance examinations into secondary schools, is still very low and below expectation[9,10]. Over the years, scholars and educators in Mathematics have conducted studies on factors that contribute to low performance in mathematics word problems in primary schools: inadequate facilities, lack of equipment and instructional resources for efficient teaching, huge class sizes, teacher shortages and Mathematics phobia or fear are only a few of these reasons. Teaching strategies could be a major cause of low Mathematics word problems performance in primary schools. Hence, this study sought to investigate "Effects of Case-Based and Team-Based Teaching Strategies on Word Problems in Primary School Mathematics in Ibadan, Nigeria."

1.3 Aim and Objectives of the Study

The aim of this study is to investigate "Effects of Case-based and Team-based Teaching Strategies on Word Problems in Primary School Mathematics in Ibadan, Nigeria."

The objectives are to:

i. determine the main effect of Case-based teaching strategy on academic achievement of primary school pupils in Mathematics word problems.
ii. determine the main effect of Team-based teaching strategies on academic achievement of primary school pupils in Mathematics word problems.
iii. examine the main effect of Gender on academic achievement of primary school pupils in Mathematics word problems.
iv. examine the interaction effect of Case-based, Team-based and Gender on academic achievement of primary school pupils in Mathematics word problems.

1.4 Hypotheses

The following Null Hypotheses were formulated at 0.05 significant level in the study.

$H_0$1: There will be no significant main effect of Case-based teaching strategy on academic achievement of primary school pupils in Mathematics word problems.

$H_0$2: There will be no significant main effect of Team-based teaching strategy on academic achievement of primary school pupils in Mathematics word problems.

$H_0$3: There will be no significant main effect of Gender on academic achievement of primary school pupils in Mathematics word problems.

$H_0$4: There will be no significant interaction effect of Case-based, Team-based and Gender on academic achievement of primary school pupils in Mathematics word problems.

1.5 Significance of the Study

The significance of this study lies in its potential to improve pupils' achievement in word problems using Case-based and Team-based teaching strategies, promote evidence-based instructional practices, foster personalised learning, support teacher professional development, and contribute to the overall advancement of educational practices and policies.

The study's findings can provide evidence-based insights into the most effective teaching strategies for enhancing word problem-solving skills. Educators and policymakers can use this information to make informed decisions about instructional practices and curricular choices, leading to more targeted and impactful teaching approaches.

The results from the primary schools could pave the way for more in-depth research on teaching strategies in higher education or other subjects. It can inspire further exploration of innovative teaching methods and their impact on different educational levels.

Policymakers can use the study's findings to support the adoption of effective teaching practices, potentially leading to system-wide improvements in Mathematics education.

By enhancing primary school pupils' problem-solving skills, the study can contribute to building a foundation for their future academic and professional success. The outcomes of this study could equip pupils to solve real-world challenges in various disciplines and in their everyday activities.

1.6 Scope of the Study

The scope of this study was limited contextually to effect of case-based and team-based teaching strategies on word problems in primary school Mathematics and was also delimited geographically to Ibadan North-west Local Government Area, Oyo state, Nigeria.

1.7 Limitations of the Study

The following were the constraints encountered during the course of this study:

i. Delay in quick response from pupils' parents on seeking their consent for their wards to participate in the study.

ii. Timidity of pupils among themselves proved implementation of the newly introduced teaching strategies difficult at early stage which affected their enthusiasms.

1.8 Operational Definition of Terms

The following terms were operationally defined as used in the study:

Academic Achievement: This is the score of the achievement test that the pupils took during this study in mathematics.

Teaching Strategies: These are set of instructions used in the study for the purpose of teaching and learning. They are Case-Based Teaching Strategy (CBTS) and Team-Based Teaching Strategy (TBTS).

Case-Based Teaching Strategy (CBTS): This is one of the teaching methods used in this study to teach pupils with real-life scenarios or cases that are relevant to the subject matter.

Team-Based Teaching Strategy (TBTS): This is a teaching method adopted by this study which involve group work as well as instant feedback.

Traditional Teaching Strategy (TTS): This is common way of teaching used by teachers through chalk and talk method adopted by this study for control group.

Primary School Mathematics: This is the subject matter focused in this study at elementary level of education.

Word Problems: These are the statement or expressional problems to be solved mathematically by the pupils.

Private Primary School: This is elementary level school owned by individual or group of individuals.

Primary School Pupils: They are the participants found in elementary level school used for this study.

Gender: They are the boys and girls in the primary school.

Endnotes

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Chapter Two

Literature Review

This chapter reviews relevant literature in the subject area. It was arranged under the subsequent subsections:

2.1 **Conceptual Review**

2.1.1 Academic Achievement

2.1.2 Gender

2.1.3 Teaching Strategies

2.1.3.1 Case Base Teaching Strategy

2.1.3.2 Team-based Teaching Strategy

2.1.4 Primary Mathematics

2.1.5 Word Problem

2.2 **Theoretical Review**

2.2.1 Constructivist Theory

2.2.2 Cognitive Load Theory

2.2.3 Social Learning Theory

2.3 **Review of Empirical Studies**

2.3.1 Primary Mathematics and Academic Achievement in Mathematics

2.3.2 Gender and Academic Achievement in Mathematics

2.3.3 Teaching Strategies and Academic Achievement in Mathematics

2.3.4 Word Problems and Academic Achievement in Mathematics

2.4 **Conceptual Model**

2.5 **Summary of Literature Reviewed**

2.1 Conceptual Review

2.1.1 **Academic Achievement**

Academic achievement refers to the degree of success a pupil has attained in their academic endeavors[1].A pupil's capacity to accomplish learning objectives and requirements in the early years of formal education is referred to as academic achievement in primary school. Depending on the educational system of a particular nation, primary school normally spans grades one through six.It is required for pupils to show mastery in language arts (reading and writing), science, social studies, and Mathematics. A pupil must comprehend and apply the concepts taught in these disciplines in order to attain academic success. Examinations, quizzes, projects, and assignments are just a few of the ways teachers use to gauge how well their pupils have understood the subject. To convey how well a pupil is doing, grades and feedback are given.

Academic achievement in primary school greatly depends on the development of excellent reading abilities[2]. It is expected of pupils to increase their vocabulary, comprehend texts, and improve their reading skills. During primary school, it is crucial to master basic Mathematics concepts such as addition, subtraction, multiplication, and division. Pupils may also be introduced to more complex arithmetic ideas as they mature. The improvement of writing abilities is a prerequisite for academic achievement[3]. Through writing, students acquire the skills necessary to communicate ideas clearly, utilize correct grammar and spelling, and express themselves logically. Academic attainment is enhanced by positive behaviour, active involvement in class, and engagement with the material. Successful educational outcomes are promoted by a supportive learning environment.

Education in primary schools is not limited to academics[2]. A child's total development includes social and emotional development, which includes teamwork, emotional resilience, and interpersonal skills. To succeed academically in primary school, parents' or guardians' engagement is essential. This covers assistance with homework, instructor communication, and motivation for lifelong learning. Even if they are not exclusively academic, involvement in extracurricular activities like clubs, athletics, and the arts can improve a student's overall academic experience and help them receive a well-rounded education. It is critical to understand that academic success in primary school involves more than just grades; it also entails building curiosity, a love of learning, and a solid foundation for success in further education. During these crucial years, parents and teachers are extremely important in helping and guiding their pupils[4, 5].

Subject mastery describes a pupil's in-depth knowledge, skill, and command in a specific academic subject. It entails a profound understanding of concepts, the capacity to apply knowledge, and a high degree of proficiency in the subject matter; it goes beyond merely memorizing facts or finishing assignments[6]. Subject mastery is a crucial sign of academic success since it frequently results in high test scores and practical application. When a pupil masters a subject, they have a deep comprehension of all of its underlying ideas, concepts, and principles[7]. They are able to clarify these ideas in their own terms and show how they relate to one another. Subject mastery involves applying information in real-world situations in addition to theoretical comprehension. Using what they have studied, pupils may solve issues, evaluate circumstances, and come to wise conclusions in the context of the subject.

Critical thinking abilities must be developed for pupils to be able to assess data, evaluate arguments, and reach well-founded conclusions[8]. This is a necessary part of mastery. They possess the ability to handle difficult issues rationally and analytically. The capacity to use information and abilities to solve issues is a necessary component of subject mastery[9]. A pupil who has subject mastery is able to overcome obstacles and come up with workable solutions in any field, including science and Mathematics. Subject-matter experts understand that learning is a continuous process. They are driven to study related subjects, broaden their knowledge, and keep up with industry advancements[8,9,10].

The capacity for effective and clear idea communication is a prerequisite for subject mastery[11]. This is the ability to communicate both orally and in writing, as well as the ability to explain complicated ideas in a way that other people can understand. Pupils who have mastered a subject frequently show a sincere enthusiasm and interest in it[12]. Their curiosity may prompt them to go more into the topic, conduct their own independent study, and engage in associated activities. Learning a subject is a continuous, dynamic process. It is fostered by good instruction, engaged students, and a positive learning environment[11, 13]. In order to help pupils master a subject, teachers must cultivate curiosity, allow opportunities for exploration, and provide helpful criticism on their work[14].

A pupil's academic achievement and progress are mostly determined by their grades and assessments, which are essential elements of the educational system[15].Multiple choice tests, quizzes, projects, presentations, assignments, in-class involvement, and more are examples of assessment methods. The purpose of the assessment is to determine how well a student comprehends the subject matter and how they can use it in various situations[15, 16].Grading scales use letters or numbers to represent a student's achievement level. The following are typical grading scales: A for excellent, B for good, C for satisfactory, D for bad, and F for failing. Numerical scales, such a 0-100 percentage scale, are also used in certain systems[17].

Teachers have the chance to provide pupils constructive criticism during assessments[18]. Pupils who receive feedback are better able to recognise their strengths and limitations, grow from their errors, and make progress. Giving constructive criticism is crucial for encouraging learning and development[19, 20].Formative assessments take place within the learning process and give educators and pupils' continuous feedback[21]. They support the decision-making process for education by pointing out areas that could require more focus[22].Summative tests are given at the conclusion of a class and are intended to gauge pupils' general comprehension and level of subject knowledge. Final examinations, standardized tests, and term projects are a few examples[23, 24].

The purpose of standardized examination is to provide a uniform scale for measuring pupils' knowledge and abilities[25]. These assessments, which are frequently given at the state or federal levels, have the power to affect choices about student progress, school rankings, and educational policies[26, 27].Instead of depending only on a single final examination, continuous assessment entails evaluating pupils on a frequent basis during the academic term. This method offers a more thorough picture of a pupil's progress over time. Fairness and objectivity are crucial for assessments[28, 29]. In order to minimise the influence of outside variables, educators work to develop evaluations that fairly represent pupils' knowledge and skills[27, 30].

Some teachers assess pupil achievement using alternative techniques like presentations, portfolios, and group projects[31]. A more comprehensive understanding of a pupil's skills and abilities is made possible by these methods[32].Good grading and assessment procedures help pupils set goals, promote their learning, and provide information for teachers to make judgments about how best to teach. Understanding the role of grades and assessments as instruments for learning and development is crucial for both teachers and pupils[31, 33]

2.1.2 Gender

The term "gender" refers to the expectations, actions, roles, and expressions that are socially constructed and considered proper for members of a particular community depending on their perceived sex[34]. Gender, as opposed to sex, is a more general term that encompasses individual, cultural, and societal conceptions of masculinity, femininity, and non-binary identities. Sex, on the other hand, usually refers to the biological distinctions between males and females[35]. In order to address problems with gender inequality, discrimination, and marginilisation in a variety of societal contexts—such as politics, education, the economy, and healthcare—it is imperative that one has a basic understanding of gender[36]. The creation of a society with greater equity and justice must begin with the promotion of gender equality and the development of inclusive environments that respect a range of gender identities and expressions[36, 37].

Social construction is the process by which people and societies use language, cultural practices, and social interactions to build and shape meanings, understandings, and realities[38]. Essentially, it emphasises how different facets of human existence—such as identities, roles, conventions, and institutions—are created within particular social contexts and historical circumstances rather than being intrinsically fixed or natural[39, 40]. Gender roles, racial and cultural divisions, class divides, beauty standards, and moral norms are a few instances of social construction. These ideas are socially produced through constant processes of negotiation, contestation, and change rather than being permanent or universal[41, 42]. To critically analyse how language, power, and culture affect individual and communal experiences, as well as to acknowledge the flexibility and contingency of social reality, one must have a solid understanding of social construction[43].

Societies can question and change current norms and inequalities to build more inclusive and equitable social structures by realizing that social phenomena are manufactured[44]. Assigning meanings to things, symbols, actions, and experiences through collective understandings and interpretations within a specific cultural and historical context is known as social construction. For instance, the definitions of gender roles, marriage, and money differ between countries and are subject to change[45]. Language offers a framework for communication and the presentation of ideas, beliefs, and values, it plays a critical role in forming social realities[46]. People negotiate and uphold identities, power relations, and social standards through language[47].

Within social organisations and institutions, individual interactions and connections play a crucial role in the process of social construction. People absorb society norms, values, and beliefs through these interactions, which helps to perpetuate and uphold social structures[48]. The prevailing narratives, ideologies, and social hierarchies that form social construction are shaped by power dynamics and hegemonic forces. Others may be excluded or marginalized, while other institutions or organisations may have greater influence in defining and enforcing specific meanings and realities[49]. Social construction is historically and culturally contingent, which means that certain historical occurrences, cultural norms, and sociopolitical settings influence meanings and realities. A society's definition of normalcy or acceptability may differ from another[48,50].

Gender identity pertains to an individual's subjective perception of their own gender, which may or may not correspond with the biological sex assigned to them. Gender identity can be shown in a person's behavior, appearance, and social interactions, and it is an essential part of their self-concept[51]. In contrast to biological sex, which is usually classified as either male or female based on physical characteristics, gender identity refers to a profoundly felt feeling of being either male or female, both, neither, or something completely different[52]. In order to create inclusive and supportive environments where people may be who they truly are without fear of discrimination or stigma, it is essential to understand and accept gender identity[53]. Society may encourage more acceptance, equality, and dignity for every person, regardless of gender identity or expression, by recongnising and valuing the range of gender identities. A person's subjective perception of their gender determines their gender identity; it is not always influenced by outside variables like biological sex, social expectations, or cultural conventions. An individual's gender identification can vary greatly and is a spectrum concept. Along with non-binary, gender fluid, and a gender identities, some persons only identify as male or female. Sexual orientation, which describes a person's romantic or sexual attraction to other people, is different from gender identity[54]. Sexual orientation is about who a person is attracted to, whereas gender identity is about how a person feels about themselves on the inside[52.55].

Gender identity is subject to change and development throughout time, depending on a range of factors such as social interactions, cultural norms, personal experiences, and societal views on gender. Promoting a person's wellbeing and mental health requires acknowledging and respecting their gender identity[56]. This entails giving them access to places and resources that are supportive of their gender identification as well as utilising names, pronouns, and terminology that correspond with their gender identity[57]. Global advocacy initiatives aim to guarantee the legal, social, and protective acknowledgement and safety of people with diverse gender identities[58]. This involves efforts to prevent discrimination and prejudice based on gender identity as well as updates to laws, regulations, and practices that are more inclusive of varied gender identities[59,60].

The term "gender expression" describes how a person's behavior, attire, looks, and other ways of presenting themselves to the outside world reflect their gender identity. Gender expression is how people show and tell others their gender externally, as opposed to gender identification, which is an interior feeling of one's gender[61]. It includes a broad spectrum of traits and actions that can vary substantially between people and cultures but are typically linked to either androgyny, femininity, or masculinity[62]. Promoting inclusion and valuing the identities of people throughout the gender spectrum require an understanding of and respect for the diversity of gender presentation. Societies may foster environments that celebrate variety and encourage people to express who they truly are without fear of discrimination or judgment by acknowledging that gender expression is complex and varies among individuals[62,63].

The way people move, speak, gesture, and engage with others are all examples of how gender expression manifests itself. While some actions could be seen as more stereotypically feminine or masculine, others might go against established gender roles[64]. People frequently use accessories, makeup, hairstyles, and clothes to publicly display their gender identity. Notwithstanding cultural expectations, people may choose to express themselves in ways that are true to their gender identity, even though in some societies specific dress codes are linked to specific genders[65]. Gender expression can be conveyed by body language and gestures, including posture, hand gestures, and facial emotions. Both individual preferences and societal standards may have an impact on these nonverbal signs[66,67].

Gender expression can also be expressed through speech patterns, vocal pitch, and tonality. While some people may alter their speech or voice to better fit their gender identification, others may choose to express themselves honestly without adhering to stereotypes[68]. Social interactions and circumstance have a significant influence on gender expression. Depending on who they are with, where they are, and cultural conventions concerning gender roles and presentation, people may change how they represent their gender[69]. Gender expression is dynamic and can shift with time or depend on the context. While some people exhibit their gender in a constant way, others may experiment and explore with various kinds of expression[70].

Gender roles are the customs, expectations, and actions that society associates with people according to their assigned or perceived gender[71]. Within a particular culture or civilization, these roles specify how people are supposed to act, interact, and carry out specific tasks[72]. Although they can also include a wider spectrum of gender identities, gender roles frequently represent preconceptions and presumptions about the traits, skills, and roles considered proper for men and women. Traditional gender roles present a number of difficulties, such as the reinforcement of discrimination and inequality, the limitation of human freedom and agency, the perpetuation of stereotypes, and the limitation of opportunities for both professional and personal growth[71,73]. Creating inclusive environments where people can express themselves authentically regardless of gender, challenging and altering traditional gender roles, and promoting various portrayals of gender are all part of the effort to promote gender equality[74]. Gender roles frequently dictate particular duties, obligations, and roles for people according to their gender. These roles have historically resulted in the division of labor, with women predominantly handling household and childcare responsibilities and men usually connected with paid work outside the home. Beginning in childhood and continuing throughout life, socialization processes teach and reinforce gender roles. The media, families, schools, and other social institutions all have a big impact on how people view gender and conform to gender norms[73,75].

Social standards and expectations about conduct, looks, interests, and goals are all part of gender roles[76]. For instance, girls may be socialized to be kind, sympathetic, and cooperative, but guys may be trained to be forceful, competitive, and autonomous. Numerous factors, including as peer pressure, rewards, punishments, and social acceptance, promote and enforce gender roles[77]. People that don't fit into the stereotypical gender norms could be shunned, discriminated against, or shunned by society. Gender roles are culturally and historically diverse, reflecting a range of gender-related ideas, values, and practices[78]. The standards of behavior that are deemed suitable or acceptable for men and women might vary greatly throughout societies. People's experiences of power, oppression, and marginilisation are shaped by the intersections between gender roles and other social categories, including race, ethnicity, class, sexual orientation, and disability[79]. The intricacy of identity and the interdependence of systems of power and injustice are acknowledged by intersectional perspectives[77,80].

Gender stereotypes are commonly held views or presumptions about the traits, roles, actions, and qualities that are seen normal or suitable for someone depending on their gender[81]. These preconceptions are frequently oversimplified, exaggerated, and grounded in cultural norms and societal expectations rather than unique characteristics or abilities. Bias, discrimination, and inequity can result from gender stereotypes' influence on attitudes, behaviors, and perceptions toward men, women, and individuals with different gender identities[82]. Gender stereotypes must be challenged and dismantled in order to advance gender equality and create an inclusive and equitable society. This means debunking myths regarding the harmful Effect of stereotypes, challenging traditional gender norms, endorsing a variety of gender representations, and establishing areas where individuals of different gender identities can express themselves without restriction[83]. It is possible to debunk stereotypes and promote cultural variety so that everyone has the opportunity to realize their full potential and lead happy lives[81].

Gender stereotypes frequently attribute particular characteristics, attributes, and proficiencies to people according to their gender[84]. For instance, stereotypes may suggest that women are emotional, emotional, and subservient, and that males are strong, logical, and forceful. Social norms and expectations about the roles, responsibilities, and behaviors that are considered suitable for men and women are determined by gender stereotypes. Expectations about parenting responsibilities, household chores, professional options, and social interactions might all fall under this category[84,85].

Through socialization processes, gender stereotypes are picked up and absorbed, starting in childhood and lasting a lifetime[86]. Gender stereotypes are reinforced and perpetuated by families, schools, the media, and peer groups through language, cultural representations, and social standards[87]. When gender norms are severe and unyielding, people are less able to express who they truly are and follow their passions and goals without worrying about criticism or retaliation. In addition to causing exclusion, prejudice, and injustice, stereotypes can also erect obstacles in the way of gender equality[86,88]. Gender stereotypes influence people's experiences of power, oppression, and marginilisation by interacting with other social categories like race, ethnicity, class, sexual orientation, and disability[87,89]. Intersectional perspectives acknowledge how intricately linked and multifaceted inequality and identity are. By establishing irrational expectations, encouraging feelings of inadequacy or pressure to fit in, and sustaining unfavorable self-perceptions and body image problems, gender stereotypes can have a severe impact on people's mental health, self-esteem, and general well-being[86,88,90].

The term "gender equity" describes the idea of justice and fairness in giving people of all genders the same chances, resources, and treatment[91]. It entails pursuing parity and doing away with bias and discrimination based on gender in order to guarantee that everyone, regardless of gender identity, has the opportunity to realize their full potential[92]. The concept of gender equality pertains to the equitable and just treatment of people of all genders, with equal access to resources, opportunities, and treatment[93]. In order to guarantee that everyone has the opportunity to realize their full potential, regardless of gender identity, it entails pursuing parity and doing away with bias and discrimination based on gender. Ensuring that people of all genders have equal access to opportunities in healthcare, politics, work, education, and other spheres of life is essential to achieving gender equity. This entails tackling ingrained prejudices and restrictions that can disproportionately impact particular genders[94].

Encouraging equitable representation and involvement of men, women, and individuals with other gender identities in leadership positions, decision-making processes, and other domains of influence is the essence of gender equity[95]. This makes it easier to guarantee that different viewpoints are taken into account and that power is distributed more fairly[96,97]. Gender equity is that people should be treated equally and without distinction on the basis of their gender. This entails combating prejudices, preconceptions, and discriminatory behaviors that could harm particular genders and maintain inequality[98]. Equitable resource distribution is necessary for gender equity, including financing, support services, and chances for career growth and skill development[99].

Gender equity acknowledges that people can be subjected to various forms of discrimination and disadvantage due to intersecting identities, including but not limited to race, ethnicity, class, sexual orientation, and disability[97,100]. In order to address these overlapping disparities and advance inclusive solutions, intersectional methods to gender equality are used. It takes social norms, attitudes, and practices that support discrimination and inequality based on gender to be challenged and changed in order to achieve gender equity. Advocacy, instruction, and cultural transformation programs might be needed to encourage more inclusive and fair social standards[95,101].

2.1.3 Teaching Strategies

Teaching strategy is a teacher's technique to facilitating learning and assisting pupils in gaining information and skills. The subject matter, grade level, and unique needs of each pupil all influence the effective teaching techniques[102].Primary school teaching strategies ought to be created with young pupils in mind, with an emphasis on creating a good learning environment and accommodating a range of learning preferences. To provide pupils with a comprehensive and interesting learning experience, effective primary school teaching frequently combines several approaches. Being adaptable is crucial, and you should modify your strategy according to the demands and dynamics of the particular classroom and the pupils you are dealing with. Combining these techniques in a way that is appropriate to the requirements of the pupils and the situation in which they are being taught can result in effective teaching. Key elements of an effective teaching strategy include adaptability and the capacity to modify strategies in response to pupils input and advancement[103].

A teaching strategy known as "discussion-based learning" places a strong emphasis on the involvement and active participation of pupils in group discussions. Rather than following a conventional lecture structure where the instructor teaches material to passive pupils, discussion-based learning fosters teamwork, idea sharing, and critical information analysis. This approach seeks to develop critical thinking abilities, a greater comprehension of the material, and effective communication. Pupils respond to their classmates, ask questions, and share their opinions in order to actively engage with the material. As a result, the learning environment is made more lively and participatory[104].

Pupils build their own beliefs, assess opposing viewpoints, and learn how to critically analyse information through debates. A more profound comprehension of the subject matter is encouraged by this method. Pupils who participate in discussion-based learning are better able to express themselves verbally, listen to others, and give insightful answers. It also facilitates the growth of civil and efficient group communication. To solve issues, exchange ideas, and gain knowledge from one another, pupils collaborate. Through collaboration, pupils can benefit from a variety of viewpoints and a sense of community in the classroom. Applying theoretical knowledge to real-world problems is a common practice in discussions. This makes learning more relevant and applicable by assisting pupils in drawing the connection between abstract ideas and real-world scenarios. Even though conversations are led by pupils, the instructors are very important in helping to guide the discussion. They lead the conversation, pose insightful queries, dispel misunderstandings, and offer further details when needed[105].

The integration of varied viewpoints and experiences is encouraged by discussion-based learning. Because it exposes pupils to a variety of concepts and points of view, diversity can enhance the educational process[106]. Engaging in active involvement in conversations can boost pupils' motivation and engagement. Pupils are more likely to be motivated to learn when they believe their ideas are recognised and that their efforts count. This method can be used for a variety of subjects and learning levels. Topics and academic levels can be accommodated by customising discussion-based learning, whether in the humanities, sciences, or professional training. Pupils frequently have to study given texts or do research in order to get ready for class discussions. Furthermore, pupils can strengthen their comprehension and reinforce what they have learned by thinking back on the debate afterwards. To sum up, discussion-based learning encourages participation, critical thinking, teamwork, and proficient communication. In addition to encouraging rote memory, it offers an approach focused on learners that promote a deeper and more meaningful grasp of the subject matter[107].

As part of an instructional technique called cooperative learning, pupils collaborate in small groups to accomplish a shared objective. Cooperative learning stresses teamwork, mutual support, and shared accountability for the learning process, in contrast to competitive or individualistic approaches[108]. The underlying theory of this teaching approach is social constructivism, which holds that knowledge is created by people via interactions with others and that learning is an active, social process. Because of their interdependence, pupils' achievement is correlated with the success of the group. Pupils are encouraged to support one another's success and to feel a feeling of shared responsibility as a result. Although they collaborate in groups, each pupil is still responsible for their own education and receives individualised feedback. This guarantees that everyone in the group comprehends the content and participates actively[109].

Group members' direct connection and communication are essential to cooperative learning. This encourages the growth of interpersonal relationships, effective communication, and social skills. Groups evaluate their cooperation, communication, and efficacy on a regular basis[110]. Pupils can evaluate their group dynamics and make necessary adjustments to enhance their teamwork by using this mental process. Pupils can practice and develop social skills including active listening, conflict resolution, and teamwork through cooperative learning. These abilities are beneficial in both educational and practical contexts. A welcoming environment where pupils from all backgrounds and skill levels can collaborate is fostered by cooperative learning. This encourages equity, diversity, and a feeling of community[111].

The teacher facilitates group work, while the pupils are actively participating. The instructor gives direction, keeps an eye on group dynamics, and extends assistance when required. This strategy differs from the conventional lecture-based method. Peer tutoring, cooperative projects, jigsaw puzzles, small group conversations, and more are examples of cooperative learning activities. Various frameworks can be applied based on the type of material and the learning objectives. Pupil motivation and engagement might rise when teamwork is practiced. When they can collaborate with others to solve issues, discuss ideas, and pick up knowledge from one another, pupils frequently find that learning is more meaningful and pleasurable[112].

Cooperative learning encourages pupils to use their knowledge and skills in novel circumstances, which helps to facilitate the transfer of learning. This aids pupils in seeing how what they are learning applies to actual circumstances. It has been demonstrated that cooperative learning improves attitudes towards learning, social skill development, and academic accomplishment. But for implementation to be successful, teachers must continue to promote the strategy, provide clear objectives, and provide thoughtful planning. The effectiveness of team-based learning activities depends on the establishment of a friendly and upbeat group culture[113].

A teaching strategy known as "problem-based learning" (PBL) relies on giving pupils challenging, real-world issues to solve. The PBL involves pupils investigating and analysing problems in small groups, identifying pertinent concepts and principles, and coming up with solutions together. With this approach, the focus is shifted from traditional teacher-centered instruction to a more inquiry-based, learner-centered environment. Problem-Based Learning (PBL) begins with the presentation of a real-world problem, which is frequently intricate, poorly organised, and might not have a single right answer. Learners are encouraged to think critically and solve problems as a result. Pupils actively participate in their learning by investigating the issue, posing queries, and gathering information rather than only being given instructions. This encourages a more thorough comprehension of the subject[114].

Problem-Based Learning (PBL) involves teamwork by nature. In small groups, pupils collaborate while exchanging their varied viewpoints, expertise, and abilities. This encourages interpersonal, teamwork, and communication skills[115].The instructor facilitates the pupils' problem-solving process by offering direction, assistance, and resources as required. Without giving away the answer, the teacher guides the learning process of the pupils. Problem-Based Learning (PBL) promotes pupils to be in charge of their own education. They determine what information is required, carry out investigation, and develop the abilities required to address the issue. This encourages self-directed learning and a sense of autonomy.

Integrated knowledge from other areas is frequently needed to solve problems in Problem-Based Learning (PBL). Real-world problems are inter-related, which is reflected in this interdisciplinary approach. Through information analysis, solution evaluation, and decision-making, Problem-Based Learning (PBL) fosters critical thinking abilities in pupils. Another essential element that helps pupils improve their learning and thinking skills is reflection on the problem-solving process. Evaluation of the problem-solving process and the finished product or solution is a common component of authentic assessment in Problem-Based Learning (PBL). Presentations, reports, and other understanding-related performances may be used to illustrate this[116].

The goal of Problem-Based Learning (PBL) is to encourage knowledge and skill retention over the long term. Pupils who actively solve problems are more likely to retain and apply the lessons they have learnt. Problem-Based Learning (PBL) helps pupils acquire abilities like critical thinking, problem-solving, cooperation, and effective communication in addition to specialised subject knowledge. These abilities are important for success in a variety of contexts and lifetime learning. Careful preparation, well-crafted problems, and continuous support for learners are necessary for implementing Problem-Based Learning (PBL) successfully. It is a method that may be applied across a wide range of disciplines and in a variety of educational contexts[117].

2.1.3.1 Case-based Teaching Strategy

A teaching strategy known as "case-based teaching" uses actual or imagined situations to provide a framework for learning. This method is frequently used in a number of fields, including business, law, medical, and education. Usually, the approach entails giving pupils a thorough situation or case before assisting them in analysing, debating, and applying pertinent ideas and abilities. Start by giving the pupils a thorough and pertinent case. This could be any setting that is acceptable for the subject matter, such as a historical event, corporate challenge, medical case, or real-world scenario. Urge pupils to examine the case's specifics in order to pinpoint the main concerns, difficulties, or obstacles. Encourage pupils to participate in class discussions by allowing them to contribute their insights, opinions, and possible solutions.

Assist pupils in applying problem-solving techniques to the given situation. Motivate pupils to put their theoretical understanding to use in practical settings. Encourage pupils to think critically by giving them tasks that require them to weigh several viewpoints and assess the effect of various answers. Pupils can study and discuss the case in small groups to foster collaborative learning. Motivate pupils to collaborate, communicate, and share ideas. Link the case to pertinent theories and concepts from the course. Assist pupils in putting their academic knowledge into real-world contexts. Reiterate the idea that the knowledge and abilities acquired from the case analysis are applicable in different settings[118].Include reflection times where pupils discuss the case and how it relates to their overall understanding of the subject. Invite pupils to consider how they solve problems; make decisions, and how their viewpoints have changed.

Comment on the analysis and solutions that pupils have provided. Help pupils as required, making sure they comprehend the fundamental ideas and are able to use them successfully. To introduce pupils to a range of situations, difficulties, and industries, use a variety of cases. For a well-rounded educational experience, include both hypothetical and real-world examples. Assess pupils according to how well they comprehend the case, how well they analyse it, and how well they solve problems[119].Think about combining group and individual evaluations. Be adaptable when modifying the case-based approach to fit the particular requirements of the subject and the classroom. Permit free-flowing dialogue and experimentation with different approaches. Active learning, critical thinking, and the application of information to real-world contexts are all encouraged by case-based learning. It supports the growth of pupils' analytical thinking, problem-solving abilities, and deeper comprehension of the material in a real-world setting[120].

2.1.3.2 Team-based Teaching Strategy

The term "team-based learning" (TBL) refers to a method of instruction in which pupils are divided into smaller groups and given tasks, projects, or activities to solve together[121]. The development of collaboration and communication skills, as well as active engagement and peer interaction, are all encouraged by team-based learning. Pupils are divided into a variety of teams, each with five to seven members. Teams are frequently created to be diverse in order to unite pupils with various experiences, viewpoints, and skill sets. Team-Based Learning (TBL) starts with a readiness assurance procedure in which each student gets ready for the class by working through pre-selected readings or resources. An understanding assessment quiz is given to each person after this[122].

Following the individual evaluations, groups work together on application exercises, which might involve discussions, case studies, or problem-solving exercises. Peer teaching, group dynamics, and applying knowledge to practical situations are all encouraged during this phase. When participating in the team application exercises, immediate feedback is given. This may entail the teacher clearing up frequent misunderstandings, explaining ideas, or encouraging team discussion. Teams are encouraged to share their ideas, solutions, and perspectives during the class's facilitated discussions. This stage facilitates a more thorough investigation of the subject and promotes critical thinking.

Pupils are evaluated in groups as well as individually. Quizzes on readiness assurance are frequently included in individual assessments, whereas team assessments evaluate the caliber of contributions and collaborative work. Pupils who participate in problem-solving activities, information analysis, and effective team communication are encouraged to think critically. Members of a team hold one another responsible for their contributions and learning. One of the main components is peer learning, where team members take turns grasping and mastering the material. Team-Based Learning (TBL) can be used in a variety of academic contexts, including STEM fields, the humanities, and the social sciences. It can also be adapted to different disciplines[123].

Class time is maximised by Team-Based Learning (TBL) when pre-class assignments take on the role of content delivery outside of the classroom, freeing up time for interactive, application-focused learning. It is well known that team-based learning works well to encourage pupil involvement, cooperation, and critical thinking. It can improve the overall education of pupils' experience by offering an organised framework for active learning. It is crucial to remember that careful planning, clear communication, and instructor support are necessary for the successful implementation of team-based learning[123,124].

2.1.4 Primary Mathematics

Mathematics is a broad field that includes the study of numbers, quantities, forms, patterns, structures, and relationships. In order to solve problems and comprehend the world around us, it offers a framework for logical reasoning. For pupils in the early years of their education, usually spanning from kindergarten to primary school, primary Mathematics education focuses on developing a strong foundation in mathematical concepts and skills[125]. The primary Mathematics curriculum strives to enhance pupil's understanding of mathematical concepts, aptitude for addressing problems, and mathematical reasoning. The curriculum for primary Mathematics is meant to be developmental, with each concept building on the one before it. The objective is to build problem-solving abilities, cultivate a positive attitude towards Mathematics, and lay a strong foundation for more complex mathematical ideas in later education. To help young pupils find Mathematics interesting and meaningful, teachers frequently employ a range of practical exercises, manipulative and captivating teaching techniques[126].

The fundamental arithmetic skills of basic Mathematics serve as the cornerstone for more complex mathematical ideas[127]. These abilities are necessary for daily living, overcoming problems, and pursuing higher education and careers. Number recognition and identification are essential skills. Understanding the symbols for the numbers 0 to 9 as well as their written forms is part of this. Reciting numbers in order and comprehending the idea of one-to-one correlation are prerequisites for basic counting. This ability is essential to comprehending quantity. Basic operations include adding (combining two or more numbers) and subtracting (moving one number away from another). These abilities are put to use in a variety of real-world scenarios, including pricing calculations, currency exchange, and basic problem solving. Division is the sharing or distributing of a quantity into equal parts, whereas multiplication is the process of repeated addition. These operations are the foundation for more complex mathematical ideas and build upon addition and subtraction. It is essential to know the value of each digit in a number according to its position (ones, tens, hundreds, ...) while working with larger numbers and carrying out operations quickly.

Mathematics problems can be solved more quickly and precisely when basic number concepts, such addition and multiplication tables, are committed to memory. It is crucial to have a fundamental understanding of fractions, including the ability to identify common fractions (such $^{1}/_{2}$ and $^{1}/_{4}$) and comprehend how they relate to whole numbers. Understanding length, weight, volume, and time units are among the fundamental measurement abilities. This calls for the use of instruments like clocks, scales, and rulers. Understanding and identifying shapes, sizes, and spatial relationships are fundamental geometry skills. This entails recongnising typical forms (such as squares, triangles, and circles) and comprehending ideas like area and perimeter.

Utilising mathematical ideas in practical settings is essential to developing problem-solving abilities[128]. This entails determining the issue, deciding on the proper mathematical operation, and analysing the outcome. For handling money, basic mathematics abilities are essential. These include knowing how much coin and bills are worth, how to make change, and how much anything will cost. Understanding data representations and graph interpretation are fundamental abilities needed to make sense of information that is graphically presented. When more complex mathematical topics are introduced in subsequent educational stages, these foundational Mathematics skills serve as a strong basis. The ability to solve a variety of mathematical problems in daily life and to think critically and logically are all supported by the mastery of these skills. The development and reinforcement of these foundational abilities are mostly the responsibility of teachers.

2.1.5 Word Problems

Word problems are mathematical scenarios or situations that are described in words and call pupils to use mathematical ideas to solve specific challenges or questions. These exercises are meant to evaluate a pupil's understanding of the subject, recognition of pertinent mathematical operations, and solution-finding skills. They frequently mirror real-world scenarios. Word problems are frequently used at different educational levels and encompass a broad range of mathematical concepts and abilities. Mathematical difficulties are presented in word problems within a relevant, practical setting. This aids pupils in understanding how mathematical ideas are used in real-world situations[129].Pupils must acquire and use problem-solving techniques in order to solve word problems. They have to evaluate the available data, pinpoint the issue, and choose an appropriate course of action.

Basic mathematical operations like addition, subtraction, multiplication, and division are frequently used in word problems. Based on the problem's context, pupils must select the appropriate operation. In order to solve problems, pupils are urged to exercise critical thought and make decisions about the mathematical operations and strategies to employ. Comprehension of language is also evaluated through word problems. The problem must be understood by the pupils in order for them to gather pertinent data and convert it into a mathematical expression. A lot of word problems have several steps. To show that they can deconstruct difficult situations into manageable steps, pupils must solve one portion of the problem before going on to the next. Interpreting data displayed in tables, graphs, and charts is a requirement for some word problems. To solve the problem, pupils must extract information from these visual aids.

Pupils must apply the mathematical ideas they have learned in class to new scenarios in order to solve word problems. This supports comprehension and proficiency with these ideas. Units of measurement are often used in problems, so pupils must be able to recognise and use various units correctly. Pupils are frequently asked to defend their decisions or provide an explanation for their logic. This facilitates their ability to express their ideas and comprehension of the issue. Taking the problem's context into consideration is essential to successful problem solving. Pupils need to make the connection between the problem's real-world scenario and the Mathematics. It is possible to create word problems with varying degrees of complexity to test pupils' knowledge at different proficiency levels. This makes it possible for classroom differentiation.

Word problem teaching techniques frequently involve guiding pupils through a methodical approach to problem-solving, highlighting comprehension of the question, identifying important details, selecting the proper operation, and ensuring that the solution is reasonable. Pupils gain confidence and proficiency in applying mathematical concepts to real-world situations by practicing with a variety of word problems. Since word problems allow pupils to apply mathematical concepts to real-world scenarios, they are an essential component of primary Mathematics education. Word problem solving improves analytical reasoning, problem-solving techniques, and the capacity to apply mathematical reasoning in real-world contexts[129],[130].

It is crucial that pupils use a methodical approach when working on word problems: Recognise the situation that the word problem presents. Assess the information provided and the problems that need to be resolved. Determine if you need to perform addition, subtraction, multiplication, or division. Convert the data into an expression or equation in Mathematics. Make sure the solution makes sense in the context of the problem by completing the calculations. Pupils' problem-solving abilities can be improved by teaching them a methodical approach to word problems and encouraging them to use models, diagrams, or drawings. Word problems are crucial for gaining a deeper understanding of Mathematics because they offer a real-world setting in which to apply mathematical concepts[131].

The following are some common types of word problems in primary Mathematics with respective examples: Addition and Subtraction: example; Tope has five apples. He gives two apples to his friend. How many apples does Tope have now? Multiplication and Division: example; Eniola has three boxes, and each box has four candies. How many candies does she have in total? Comparison Problems: example; Seun has eight toys, and Jimoh has five toys. How many more toys does Seun have than Jimoh? Time and Calendar Problems: example; if a play starts at 3:45 PM and lasts for 1 hour and 30 minutes, what time will it end? Money Problems: example; Maria has ₦12. She buys a book for ₦5 and a toy for ₦3. How much money does she have left? Measurement Problems: example; A rectangle is 7 meters long and 4 meters wide. What is the perimeter of the rectangle? Fraction Problems: example; Jide ate $^{2}/_{3}$ of a loaf of bread. If the loaf was divided into six equal slice, how many slice did Jide eat? Problem-Solving with Multiple Steps: example; Jadesola saved ₦5 each week for 4 weeks. Then she spent ₦8 on a gift. How much money does she have now? Rate and Speed Problems: example; if a car travels at a speed of 60 km per hour, how far will it travel in 4 hours? Geometry Problems; example, the perimeter of a square garden is 20 meters. What is the length of one side of the square?

2.2 Theoretical Review

2.2.1 Constructivist Theory

Constructivism is an educational model that argues that learning is a social and active process in which learners actively create their own worldview by incorporating new knowledge into preexisting cognitive structures and modifying those structures in response to novel experiences[132]. Traditionally held behaviorist perspectives that represent learners as passive information consumers contrast with this theory. Constructivism places a strong emphasis on the value of learners actively interacting with the course material. Learners build knowledge through problem-solving, exploration, and practical experiences. In constructivism, social interaction is essential. Knowledge is constructed through discussions, peer and teacher interactions, and collaborative learning. Constructivism's Zone of Proximal Development (ZPD), developed by Lev Vygotsky, is frequently linked to this idea.

Cognitive development happens when learners rearrange and adjust their preexisting mental models to make room for new knowledge. The phases of cognitive development proposed by Jean Piaget offer a framework for comprehending how people advance through various cognitive ability levels. Vygotsky introduced the idea of scaffolding, which is helping learners within their Zone of Proximal Development. When learners gain greater proficiency, this support can be progressively decreased. When education is applied in real-world situations, it is most successful. Realistic, meaningful tasks that are connected to the experiences and surroundings of learners should be the main focus of education, in line with constructivism. Constructivism promotes reflection on one's own methods of thinking and learning. The ability to reflect on one's own thinking, or metacognition, is regarded as essential to developing into a self-regulated learner[133].

The teacher's job description changes from information provider to guide or facilitator. Instructors design classrooms that promote inquiry, critical thinking, and discovery. Constructivism recognises that learners actively modify their mental models by assimilation (fitting new information into preexisting structures) and accommodation (changing preexisting structures to make room for new information).Constructivism acknowledges that every person contributes unique viewpoints and interpretations to the process of learning. The same information can have different meanings constructed by different learners.

Constructivism and Problem-Based Learning (PBL) are complementary educational approaches. Students collaborate, exercise critical thinking, and apply their knowledge as they work on real-world issues. Learners are encouraged to research topics, pose questions, and develop their own understanding through inquiry-based learning. Curiosity and a sense of control over the learning process are encouraged. Learners that participate in project-based learning work on tasks that demand them to apply their knowledge and abilities in meaningful ways, much like those in problem-based learning. Technologies that support learner-centered, interactive learning are in line with constructivist principles. Multimedia resources, team-based online learning environments, and virtual simulations can all improve education.

Conventional assessment techniques that emphasise rote memorization may pose difficulties for constructivist approaches. In constructivism, evaluation of understanding through application and performance-based tasks are common forms of assessment. Constructivist approach implementation can take a lot of time because it needs careful planning, ongoing support, and facilitation. In situations where there are a lot of time constraints, it could be difficult. Diverse interpretations and applications of constructivism result in a variety of teaching approaches. Although diversity can be advantageous because it fosters adaptability, it can also result in inconsistent application. Education as a field has been greatly influenced by constructivism. Constructivism has affected curriculum design, instructional strategies, and the integration of technology in the classroom by acknowledging students as active participants in their own education[134]. It encourages an all-encompassing perspective on learning that takes into account the emotional, social, and cognitive facets of the learner's experience. However, careful planning and consideration of the various needs of learners are necessary for effective implementation.

2.2.2 Cognitive Load Theory

A theoretical framework called Cognitive Load Theory (CLT) investigates the working memory constraints and how they affect learning, instructional design, and problem-solving. The theory suggests that the human cognitive system has a finite capacity to process information. It was first presented by John Sweller in the late 1980s. The mental strain necessary to finish a learning task is referred to as cognitive load. The working memory system, which is in charge of momentarily storing and processing information during cognitive tasks, is the focus of Cognitive Load Theory (CLT). Information can only be stored in working memory for a limited amount of time and can only hold a limited number of elements (chunking).

Intrinsic cognitive load, as used in the context of Cognitive Load Theory (CLT), is the term used to describe the difficulty that a particular learning task or material has by nature. It stands for the mental work learners must do in order to process and comprehend knowledge that is crucial to the course material. The degree of complexity in the content itself as well as the learner's prior knowledge and proficiency in the subject matter have an impact on intrinsic cognitive load. The intrinsic complexity of the learning task is the main factor that determines intrinsic cognitive load. Higher intrinsic cognitive load is often associated with conceptually challenging tasks, tasks involving multiple interacting elements, or tasks requiring the integration of disparate pieces of information. Intrinsic cognitive load can be influenced by the degree of experience or background knowledge learners bring to a task. For beginners, tasks might be more difficult, but for experts in a given field, they might be less so[135].

There is a correlation between the level of element interactivity in a task and intrinsic cognitive load. The amount that various informational elements must be processed concurrently is referred to as element interactivity. The cognitive load is increased by high element interactivity. Cognitive Load Theory assumes that the intrinsic cognitive load associated with tasks in a given domain may decrease as learners gain expertise and form mental schemas (organised mental structures) related to that domain. Information can be chunked and the cognitive load is decreased with the use of schemas. Complex problem-solving, abstract reasoning and critical thinking tasks typically have higher intrinsic cognitive loads. These are difficult tasks that call for deep cognitive processing on the part of the learners.

Understanding intrinsic cognitive load is essential to instructional design. In order to properly support learners based on their current level of expertise, instructional designers must take into account the inherent difficulty of the content. Although some intrinsic cognitive load is required for learning, it must be optimised. Learners can concentrate on mastering the key material by lowering extraneous cognitive load (unnecessary mental processing) and increasing cognitive load (cognitive effort dedicated to learning).Present challenging assignments gradually so that students can develop their understanding bit by bit. This strategy is consistent with the Zone of Proximal Development (ZPD) concept. Assist learners in managing the intrinsic cognitive load by providing suitable scaffolding and support. Supporting materials that aid in comprehension may include instructions, illustrations, and interactive features.

Create educational resources and activities with coherence and clarity. Having content that is well-organised can help learners focus on mastering the key concepts by reducing needless cognitive load. Link newly learned material to the prior knowledge and experiences of learners. This link can improve comprehension and lessen the sense that a task is difficult. Acknowledge that learners vary widely in their backgrounds and experiences. Make sure that the tasks are suitably difficult for each student by customising the instruction to suit their varying levels of skill. Effective instructional design requires an understanding of and ability to manage intrinsic cognitive load. Teachers can maximize the learning process and encourage profound comprehension by taking into account the inherent difficulty of the learning tasks and utilising strategies to support learners[136].

In the context of Cognitive Load Theory (CLT), mental strain placed on students that is unrelated to the learning task is referred to as extraneous cognitive load. It stands for the extra mental strain brought on by inadequate instructional materials, unrelated data, or distracting features. In order to maximize the learning process and free up learners' attention to concentrate on mastering the core material, it is imperative to reduce unnecessary cognitive load. Instructional materials that contain non-essential or irrelevant information may cause extraneous cognitive load. This unnecessary material can distract learners and make it more difficult for them to understand the main ideas. Unnecessary complexity in presentation, unclear instructions, and confusing formatting are examples of elements that lead to cognitive interference and extraneous cognitive load. Instead of learning, students might focus their mental energy on decoding information.

Extraneous cognitive load rises when learners need to divide their focus between several information sources. For instance, instructional materials may place undue cognitive demands on learners if they ask them to process information from several locations on a screen at the same time. A material's poor presentation or organisation can cause unnecessary cognitive load. Learners may find it difficult to extract meaning if material is not presented in a logical manner or if important information is hidden within a cluttered presentation. Extraneous cognitive load in technology-enhanced learning environments can be caused by interface distractions or superfluous features. Instead of focusing on the learning task, learners might divert their cognitive energies to navigate the technology[137].When multimedia elements (such as images and videos) are not properly integrated with the learning content; extraneous cognitive load may be introduced. Visual aids may become distractions if they do not directly support the learning objectives.

When information is simultaneously presented in several formats without adding value, this is known as cognitive redundancy. This repetition can strain students' minds and cause overload without leading to a more in-depth comprehension. Provide coherent and clear instructional materials. To reduce confusion, clearly define the learning objectives, give clear instructions, and arrange the content logically. Only content that is directly related to the learning objectives should be included. Remove any extraneous information or components that don't add to the main ideas. Ensure that instructional materials follow a clear and consistent format. Learners can navigate content more quickly and with less cognitive strain when formatting is consistent. Steer clear of components that cause cognitive interference, such as disorienting images, unclear instructions, or cluttered layouts. Simplify the classroom setting to enable concentrated mental processing.

Make sure that any multimedia components you use directly contribute to the learning objectives. When incorporating videos, interactive elements, or visual aids, make sure they improve comprehension rather than adding to the cognitive load. Select platforms and interfaces for technology-enhanced learning that are easy to use and intuitive. Requirements that could divert learners from the learning objectives should be minimised. Provide direction and assistance to learners in navigating the course materials. To assist learners in efficiently managing their cognitive load, clearly communicate expectations and offer scaffolding. Teachers can design learning environments that support understanding and free learners to concentrate on mastering the fundamentals by reducing unnecessary cognitive load[138]. The objective of maximizing cognitive resources for worthwhile learning experiences is in line with this strategy.

Cognitive load is the mental effort put forth to process and arranges information in a way that facilitates learning and the creation of long-term memory, as per the definition given by the Cognitive Load Theory (CLT)[139]. In contrast to intrinsic cognitive load, which is linked to a task's inherent difficulty and extraneous cognitive load, which denotes needless mental effort, cognitive load is thought to be advantageous for learning. It entails cognitive processing that aids in automating tasks, building schema, and gaining a deeper comprehension of the subject matter. Cognitive load is the mental strain associated with the cognitive functions required to acquire, comprehend, and incorporate new information into preexisting knowledge structures.

Mental structures called schemas serve to arrange information and offer a foundation for comprehension. The creation and improvement of these schemas are linked to a cognitive load, which makes it easier to organise information for better application and retention. It is possible for some cognitive functions to become automatic with repetition and practice. Cognitive load facilitates the automation of cognitive tasks that are repetitive in nature, thereby freeing up cognitive resources for more complex learning tasks. Cognitive load is associated with meaningful learning, in which learners actively interact with the material, draw connections to prior knowledge, and develop a thorough comprehension of the subject. Relevant cognitive load is activated when students come across new material and attempt to incorporate it into their prior knowledge. An increasingly connected and cohesive knowledge structure is a result of this integration[140].

Cognitive load aids in the transfer of learning by enabling learners to relate newly acquired information to practical uses[141]. It helps learners to apply what they have learned in one situation to tackle issues or find solutions in other situations. Cognitive work is required for higher-order thinking abilities like analysis, synthesis, and evaluation. Cognitive load facilitates learners' engagement with challenging cognitive tasks that extend beyond simple comprehension and recall. Create educational exercises that promote in-depth comprehension of the material. This can involve discussions, reflective assignments, and exercises that force students to draw conclusions and put their knowledge to use. Provide opportunities for learners to put their knowledge into practice. Over time, practice and repetition help to automate some cognitive functions, which lowers cognitive load.

Think critically about the things you are learning. When learners reflect on their own thinking, examine the organisation of their knowledge, and pinpoint areas that require more investigation, they are encouraged to engage in cognitive load. Through the provision of opportunities for discussion, peer teaching, and the exchange of varied perspectives, collaborative learning activities can help to increase cognitive load. Meaningful learning is supported by peer interaction. Create tests that demand higher-order cognitive functions and are in line with the learning objectives. Beyond-recall assessments have the potential to increase cognitive load.

Use a range of teaching techniques to engage students in various ways. This can involve activities that encourage active participation and cognitive processing, such as case studies, simulations, and problem-solving. Clearly state the aims and goals of the learning process. Learners are better able to direct their cognitive resources towards accomplishing learning objectives when they are aware of the purpose of the activities they are engaged in. Teachers can design learning environments that facilitate the construction of meaningful knowledge and the development of higher-order cognitive skills by recongnising and purposefully promoting cognitive load. This helps with both long-term memory retention and applying what is learned to actual situations.

When the intrinsic cognitive load of a learner is equal to their current cognitive capacity, defined by Cognitive Load Theory (CLT), optimal learning takes place. Learning can be hampered by cognitive overload caused by an excessive intrinsic load. The goal of effective instructional design is to reduce unnecessary cognitive load. Clear presentations, organised materials, and the removal of superfluous distractions can all help achieve this. In order to organise information, Cognitive Load Theory (CLT) emphasises the significance of creating mental schemas or cognitive structures. Cognitive load can be decreased by automating some processes through repetition and practice. By making the task less complex, offering guidance and worked examples to learners can aid in managing cognitive load. The level of guidance can be progressively reduced as students gain proficiency.

For experts, what works well for new learners might not be as useful. For those with more advanced knowledge, learning may be hampered by strategies that lessen cognitive load for beginners. The application of Cognitive Load Theory (CLT) to the creation of educational activities and materials is practical. It recommends that task complexity be taken into account, that learners receive the right kind of guidance, and that learning experiences be organised in a way that best suits their cognitive abilities. Cognitive Load Theory has been widely used in educational settings to enhance learning materials development, e-learning environments, and instructional design. Teachers can design more efficient learning experiences that help students comprehend and retain material by having a better understanding of the cognitive load that is placed on them[142].

2.2.3 Social Learning Theory

Albert Bandura's Social Learning Theory is a psychological theory that highlights the value of seeing, copying, and emulating the actions, attitudes, and feelings of others[143]. Though it introduces the idea that cognitive processes are vital to learning and behavior, Bandura's theory is based on behaviorist principles. Based on the Social Learning Theory, individuals can acquire knowledge by seeing the actions of others and the results of those actions. Vicarious learning or modeling is other name for this kind of observational learning. People pick up skills through watching the behaviors of models, which can be actual people in their community or media symbols (like influencers on social media or

TV characters). Models act as role models for the acquisition of new behaviors. If observers believe that the model is acting in an effective or rewarding manner, they may choose to emulate the observed behaviors. The qualities of the model, the outcomes of the behavior, and the observer's own abilities all have an impact on the decision to imitate.

Albert Bandura, a psychologist best recognised for his contributions to social learning theory and social cognitive theory, introduced the idea of reciprocal determinism. Under the theory of reciprocal determinism, a person's conduct is shaped by a combination of environmental, personal, and behavioral factors. Put differently, there exists a dynamic and reciprocal relationship between individuals and their environments, resulting in mutual influences. Individual characteristics like thought processes, beliefs, values, and personality traits are referred to as personal factors. These elements affect how people view and understand their surroundings. The social, cultural, and physical surroundings are all included in the external factors that make up the environment. It encompasses the people, organisations, and circumstances that people come into contact with throughout their lives.

The dynamic and interactive nature of the relationship between an individual's behavior, the environment, and personal factors is highlighted by reciprocal determinism. Modifications to one element may cause modifications to the others. The existence of feedback loops is implied by the idea of reciprocal determinism. For instance, a person's actions may cause the environment to respond in a particular way, which may then have an impact on the person's conduct going forward. The importance of observational learning is emphasised by Bandura's social learning theory, which embraces reciprocal determinism. People can pick up knowledge by seeing how other people behave and the results of that behavior. A foundational idea in Bandura's social cognitive theory, reciprocal determinism offers a framework for comprehending the intricate and dynamic relationships that influence behavior in people. It highlights how crucial it is to take into account how behavior, environment, and individual characteristics interact in order to understand and forecast human behavior[144].

Self-efficacy is a term coined by psychologist Albert Bandura to describe a person's confidence in their ability to carry out particular tasks and achieve desired results. It is a fundamental element of Bandura's social cognitive theory, which highlights how social influences, cognitive processes, and observational learning shape behavior. Learners who believe they can succeed in their studies (self-efficacy) may be more driven to work hard (behavior) and set up a comfortable space to study (environment). However, a difficult learning environment or low self-efficacy may have an impact on a learner's behavior, which may then have an impact on their experiences and beliefs. Fundamentally, self-efficacy is the conviction that one can carry out actions, handle difficulties, and accomplish objectives. It is an arbitrary evaluation of one's skill level. Self-efficacy frequently varies by task or domain. One might feel very effective at one thing (like academic work) but not so much at another (like sports). Self-efficacy levels can differ depending on the task.

In Bandura's theory, behavior is strongly influenced by beliefs about one's own efficacy. People who have a strong sense of their own abilities are more likely to take on obstacles head-on, showing perseverance and initiative. Conversely, low self-efficacy can cause avoidance or give up when faced with challenges. Self-efficacy is a potent source of motivation. People who have confidence in their ability to succeed are more likely to set difficult objectives, put effort into their work, and keep going when things get tough. The development of self-efficacy is greatly aided by mastery experiences, or the accomplishment of tasks. While setbacks or failures can reduce self-efficacy, successes can increase it. Bandura stresses the significance of viewing events as chances for growth and learning. The ability to perform a task successfully by others, or models, can have an impact on self-efficacy. Seeing someone who is similar to oneself succeed can give one more self-assurance and serve as a benchmark for their own abilities.

Self-efficacy can be impacted by verbal persuasion, constructive criticism, and positive reinforcement from others. Getting constructive criticism that point out one's strengths and areas for growth can boost self-confidence. Emotional and physical conditions, like peace or anxiety, can affect one's sense of self-worth. Overwhelming anxiety, for instance, has been shown to reduce self-efficacy, whereas focused and tranquilly elevate it. Cognitive appraisals examine how people understand and assess their own capabilities. While negative evaluations can erode confidence, positive evaluations help people feel more capable of handling situations.

Self-efficacy affects students' academic performance, goal-setting, and perseverance in the face of difficulties in the educational setting. Teachers can contribute to the development of positive self-efficacy by establishing a mastery-oriented learning environment and providing constructive feedback. Self-efficacy has been related to career advancement, job performance, and job satisfaction in the workplace. High self-efficacy workers are more inclined to take on difficult assignments and keep going when things get tough. A crucial element in changing health-related behavior is self-efficacy. People who have high self-efficacy for particular health behavior (like exercising or quitting smoking) are more likely to start and stick with healthy habits. The resilience and performance of athletes are influenced by their self-efficacy beliefs. Through skill development, encouraging team environments, and providing positive feedback, coaches frequently aim to increase athletes' self-efficacy.

Interventions that focus on self-efficacy in therapeutic settings have the potential to effectively treat a range of psychological conditions. For instance, techniques to increase clients' self-efficacy are frequently included in cognitive-behavioral therapy. Self-report measures, in which respondents rate their confidence in carrying out particular tasks or overcoming obstacles, can be used to measure self-efficacy. Likert scales and other rating systems are frequently used in these assessments. In conclusion, self-efficacy is a dynamic and powerful idea that is essential to behavior, motivation, and personal growth. It is essential to comprehending how people approach and manage different facets of their lives.

In contrast to conventional behaviorism, Social Learning Theory takes cognition including motivation, attention, and memory into account. The influence of observational learning on behavior is mediated by these mechanisms. If people observe the behavior of a model closely, they have a higher chance of picking up knowledge from them. The features of the model, the intricacy of the behavior, and the degree of interest of the observer are all factors that affect attention. Individuals need to be able to remember the information in order to mimic observed behaviors. To do this, the observed behavior must be stored in memory and be retrievable when required. To replicate the behavior they saw, learners must possess the necessary cognitive and motor skills. This covers motor abilities as well as self-efficacy, or the conviction that one can carry out the action.

Motivation affects the decision to mimic a behavior. An observer is more likely to be motivated to copy a behavior if they believe it will result in benefits or rewards. Social and aggressive behaviors have been understood through the lens of social learning theory.

While exposure to social models can encourage social behavior, watching aggressive models may encourage imitation of aggressive behavior. The Social Learning Theory has greatly influenced disciplines like psychology, communication, and education. It sheds light on how people pick up knowledge from their social surroundings, how media shapes our behaviors, and how crucial cognitive processes are to the learning process[145].

2.3 Review of Empirical Studies

2.3.1 Primary Mathematics and Academic Achievement in Mathematics

The research investigated the association between primary school pupils' academic achievement in Mathematics and the teacher's self-efficacy, interest, attitude, qualification, and experience. 120 primary school pupils and 254 primary school teachers make up the study's participants. A stepwise multiple regression analysis was used to analyse the study's data collection process. The findings show a significant relationship between teachers' interest and self-efficacy and pupils' achievement scores. Teacher interest was found to be the second most reliable indicator of pupils' academic achievement in Mathematics, after the teacher's self-efficacy. There was no significant correlation found between the pupil's achievement in Mathematics and their attitude, qualification, or experience. The study concluded that in order to ensure that universal basic education is achieved, it is imperative that primary school Mathematics teachers adopt a new perspective on the subject. It was also demanded of primary school educational authorities to guarantee that only instructors who possess the necessary qualifications are hired. Not just this, but they were also reminded that in order to improve the predictability of pupils' Mathematics achievement, educators should create curricula that bolster teacher confidence[146].

In the Nkanu West Local Government Area of Enugu State, the study's goal was to ascertain the impact of teachers' qualities and school quality on the Mathematics learning outcomes of primary school pupils. The investigation was directed by two research questions and two null hypotheses. The research design used was correlational. The 665 teachers who worked in the 54 local public primary schools made up the study's population. Simple random sampling was used to choose a sample of 100 teachers for the study. Data was gathered using two research instruments: the Class Size Questionnaire (CSQ), the Teacher's Attitude towards Teaching Questionnaire (TATTQ), and the overall academic achievement in Mathematics of the primary five pupils in internal examinations from the academic year 2014/15 to the academic year 2017/18.Three experts from the Department of Educational Foundation at the University of Nigeria, Nsukka—two from Childhood Education and one from Measurement and Evaluation—validated the instrument[147].

Internal consistency was measured using Cronbach Alpha, yielding co-efficients of 0.92 and 0.79 with an overall co-efficient of 0.85.In order to address the research questions and hypotheses, the collected data were analysed using the Pearson Product Moment Correlation Coefficient and SPSS version 23.0 to test at the 0.05 level of significance. The study found that, in the Nkanu West Local Government Area of Enugu State, there is a positive, high, and significant relationship between class size, teachers' attitudes towards teaching, and pupils' academic achievement in Mathematics. In light of the results, the researchers suggested, among other things, that the State Government hire more Mathematics teachers in order to address the issue of large class sizes that hinder efficient instruction[147].

The purpose of this study was to determine how pupils' use of technology affected their academic performance in primary Mathematics instruction. To this end, the current study aims to calculate the overall effect size by combining the results of experimental research done between 2013 and 2019 on the impact of technology use in primary school Mathematics instruction on pupils' academic achievement. Since the goal of the meta-analysis method was to determine the effect sizes of studies looking at the impact of technology-based applications on academic achievement in Mathematics education, it was employed. It was discovered that the examined studies' effect sizes were 0.483. The effect sizes were also found to differ significantly depending on the grade level, technology-based applications, length of study, study type, and whether or not the study was conducted nationally or internationally. The use of technology in primary school Mathematics instruction was found to have a marginally beneficial impact on pupils' Mathematics achievement[148].

An analysis was conducted on the correlation between academic achievement and cognitive abilities from grades one to eleven. Grades in Mathematics, language, and biology were used to determine general academic achievement, which was predicted by factors including information processing speed, fluid intelligence, number sense, and visualization working memory. In general education schools; 1560 pupils in grades 1–11, ages 6.8–19.1 (50.4% male), participated in this cross-sectional study. We measured information processing speed, visualization working memory, and number sense using computerized tests: Choice Reaction Time, Corsi Block-Tapping, and Number Sense. The Standard Progressive Matrices test, administered with paper and pencil, was used to gauge fluid intelligence. We performed structural equation modeling and correlation analysis. Research has demonstrated that a unified model can effectively characterize the structure of the relationship between cognitive abilities and academic achievement across all educational levels. Within this framework, the primary determinant of fluid intelligence, working memory, and number sense—all of which are linked to individual variations in academic achievement—is information processing speed. Furthermore, it was shown how precisely each level of education's academic achievement and individual measures of cognitive ability relate to one another[149].

Achievement emotions are those that are associated with successful or unsuccessful academic, professional, or athletic endeavors (activity emotions) and their corresponding outcomes (outcome emotions). Based on recent research, motivational, self-regulatory, and cognitive processes that are essential for academic success are linked to achievement emotions. There are few syntheses of empirical research examining the relationship between these emotions and student achievement, despite the significance of these feelings. Objectives are to compile all of the research and ascertain the degree to which emotions such as enjoyment, anger, frustration, and boredom are associated with academic performance, as well as to look into the factors that may moderate these Effect. We conduct a comprehensive review of the literature on achievement emotions with an emphasis on activity-related emotions. 68 studies from a systematic database were used to perform a meta-analytical review.57 independent samples ($N = 31,868$) for enjoyment, 25 for anger ($N = 11,153$), 9 for frustration ($N = 1,418$), and 66 for boredom ($N = 28,410$) were included in the 68 studies. The findings showed that academic achievement and enjoyment of learning had a positive relationship (ρ =.27), but the relationships for boredom and anger (ρ = -.25 and -.35, respectively) were negative. The relationship between frustration and performance was almost nonexistent (ρ = -.02). Moderator tests showed that when students are in secondary school as opposed to both primary and college, the relationship between activity emotions and academic performance is stronger. Additionally, the Achievement Emotions Questionnaires – Mathematics (AEQ-M) is used to measure the emotions[150].

Research in this field has been rekindled by the potential advantages of using programming environments like Scratch to learn Mathematics. However, there aren't many studies that look at their impact during the primary education stage. We present the findings of a quasi-experimental study on the impact of Scratch on the development of computational thinking as well as the acquisition of mathematical concepts in sixth-grade pupils. The experiment was divided into two parts: a programming phase that was connected to the Scratch instruction and concentrated on teaching students the fundamentals of computational thinking (sequences, iterations, conditionals, and event handling), and a mathematical phase that was entirely focused on solving mathematical problems. The mathematical portion of the exercise concentrated on word problems that required the use of the greatest common divisor and the least common multiple. Test results for computational thinking and the mathematical standards were compared before and after instruction in order to assess the study's objectives. The findings seem to suggest that Scratch can help students improve their computational thinking and mathematical concepts[151].

The research investigated how various forms of physical activity breaks in the classroom affected children's academic performance, cognitive function, and on-task behavior.87 Australian primary school pupils, with a mean age of 9.11 ± 0.62 years, were enlisted from a single school as participants. Random assignment was used to place three classes into three groups: activity breaks only (n = 29), activity breaks plus Mathematics (n = 29), or control conditions with only mathematical material (n = 29). For four weeks, students participated in three times a week, five-minute classroom physical activity breaks (split into two minutes at the start of the regular Mathematics curriculum lesson and three minutes in the middle of the lesson). There were pre- and post-test assessments done. On-task behavior (active engagement: activity breaks and Mathematics combined versus control, $p \leq 0.001$; activity breaks versus control, $p \leq 0.001$; activity breaks and Mathematics combined versus activity breaks, $p = 0.037$; passive engagement: activity breaks and Mathematics combined versus control, $p \leq 0.001$) and Mathematics scores (activity breaks versus control, $p = 0.045$) were found to have significant group-by-time Effect. Both with and without integrated Mathematics content, physical activity breaks helped children's learning scores and on-task behavior[152].

Examining academic achievement and motivation in primary school pupils in relation to parental attitudes, teacher motivation, teacher self-efficacy, and leadership perception is the goal of this study. The study's descriptive research model was created, and data were gathered from 1476 fourth-grade primary school pupils as well as 60 primary school teachers who were instructing fourth-graders in the 2017–2018 school year. The study's conclusions demonstrate that a democratic family environment, highly motivated teachers, and well-educated fathers are among the variables that favorably impact students' academic success. The results also show that high levels of teacher motivation and democratic parenting styles boost enthusiasm among pupils. Additionally, it has been determined that students' motivation and achievement are severely impacted by neglectful parental attitudes. Teacher motivation is influenced by the leadership style that is accepted or distributed in the school. The results demonstrate that highly motivated teachers also have high levels of self-efficacy. Additionally, it is determined that early in their careers, teachers are less motivated. The study is thought to serve as a model for future research on related subjects[153].

Study sought to investigate the connections between pupils' academic achievement in Mathematics and their motivation to learn and self-regulated learning strategies. An exploratory research design was used in the study. 238 ninth-graders from the Sultanate of Oman took part in the activity. To gauge the participants' motivation and usage of self-regulated learning strategies, the Motivated Strategies for Learning Questionnaire was employed. The overall Mathematics score demonstrated academic achievement. The findings showed that self-regulated learning has statistically significant positive relationships with task value, extrinsic and intrinsic motivation, control over learning beliefs, self-efficacy, and academic achievement. There is a negative correlation between test anxiety and self-regulated learning. The study provides guidance on how to create instructional strategies that effectively improve students' capacity for self-regulated learning[154].

The purpose of this research is to examine the relationship between pre-service teachers' beliefs about the efficacy of their teaching of Mathematics, their attitude towards the subject, and their academic achievement in Mathematics, given the significance of these attitudes and beliefs. To be more precise, this research examines the relationship between the two variables and academic achievement in Mathematics. The method used to gauge pre-service teachers' efficacious beliefs is the Mathematics Teaching Efficacy Belief Instrument (MTEBI). Also, students' attitudes towards Mathematics are rated using the Attitude Towards Mathematics Scale (AMS). 57 pre-service teachers pursuing a third-year primary education degree are involved. Third-year bachelor's degree students were invited to respond to the MTEBI and AMS. The findings confirm that pre-service teachers' academic achievement in Mathematics is largely dependent on their efficacy beliefs and attitude towards the subject. Additionally, there is a moderate correlation between the two factors. Additionally, the results show that the most important subscale for predicting academic achievement is Personal Mathematics Teaching Efficacy (PMTE). It has been demonstrated how crucial it is to support pre-service teachers' attitudes towards Mathematics and their efficacy beliefs[155].

In order to improve student academic achievement using two methods—face-to-face instruction and game-based e-learning—the main goal of the current study was to develop a multi-methodological teacher training programme based on emotional intelligence (EI) as a key competency. Three groups were randomly selected to consist of twenty-six primary education teachers and their student body of seventy-four. The first set of teachers (n = 23) received face-to-face instruction. The goal of the training was to enable the teachers to use emotional intelligence (EI) in their face-to-face instruction to raise the academic achievement of their students (n = 645). The teachers in the second group (n = 28) received training on how to apply gamification to e-learning. As with the first group, the goal of the training was to enable the teachers to use gamification in e-learning to incorporate emotional intelligence (EI) into their lessons and raise academic achievement in their students (n = 758). As the controls, the third group of teachers (n = 23) did not receive any additional training and did not incorporate emotional intelligence (EI) into their lessons, unlike the other group (n = 666).Using both approaches, integrating EI into the classroom successfully raised pupils' academic achievement in primary school. On the other hand, the group that used game-based e-learning saw a bigger rise in both teacher satisfaction and academic achievement. There were no discernible variations in the academic performance of the control group's pupils. Having emotional intelligence is essential for academic achievement[156].

This study's main objective was to investigate the relationships between the elements of EF—working memory [WM], inhibitory control, and shifting—and academic outcomes—reading, Mathematics, and language—in children who were in primary school. These relationships were investigated using an extension of the theories of unity and diversity, intrinsic cognitive load, and dual processes within the framework of the development of EF and academic skills. We compiled data from 305 studies with 292 independent samples, or 64,167 primary school-age children (42–191 months old [M=101 months, SD=24.49 months]), using meta-analytic techniques. The results showed that there were weaker relationships between EF and academic skills when general EF was taken into account, as opposed to the bivariate relationships that have been previously reported in meta-analytic reviews. This was achieved by taking into account the correlations among EF tasks in meta-analytic path models and accounting for Effect between all three EF components and academic outcomes simultaneously. All of the relationships between EF and academic outcomes, despite being smaller, remained significant throughout primary school[157].

The findings showed that although WM was consistently moderately associated with reading, Mathematics, and oral language throughout development, the relationships between inhibitory control and shifting and academic outcomes varied depending on the academic skill that was under investigation. Academically, there were minimal developmental shifts in the relationships between EF components and math skills throughout primary school, but there were variations in the relationships between reading and language skills with EF components. Within the framework of pertinent theoretical models, future directions and implications of the findings for the conceptualization of the impact of EF on academics are discussed[157].

2.3.2 Gender and Academic Achievement in Mathematics

The study aims to investigate the explanatory potential of boys' and girls' attitudes towards Mathematics on their performance, in addition to verifying gender differences. 897 primary school pupils in their fifth and sixth years made up the sample (450 boys and 447 girls).The findings support earlier research's findings that girls have generally had less positive attitudes towards Mathematics than their male classmates. This is especially true for lower motivation, a worse sense of competence, and higher rates of anxiety, all of which had small effect sizes. As anticipated, there were no appreciable gender differences in academic performance; however, attitudes towards Mathematics had a significantly greater explanatory power in boys than in girls ($R2 = 0.194$ and $R2 = 0.103$, respectively)[157].

The Effect of achievement emotions on academic performance are introduced, and the results of the regression analysis for each sample support the well-established beneficial effect of perceived self-efficacy on Mathematics performance. Since test anxiety is not included in the regression equation explaining girls' performance, it appears that test anxiety in Mathematics only affects boys' grades. We address the subject of perceived competence and its relationship to anxiety and academic performance in the context of control-value theory. Because boys are more likely to be self-assured, driven to stand out, and interested in Mathematics, their anxiety levels may have an impact on their test scores. While girls report high rates of anxiety, their low perception of control may have a negative effect on their performance, which could be attributed to a higher value placed on Mathematics[157].

Numerous studies have examined the connections between academic achievement and various psychological constructs, including self-concept, personality, and emotional intelligence, in line with a review of the scientific literature. There are two primary goals for the current work. Initially, a gender and cultural origin analysis of the participants' academic achievement, self-concept, personality, and emotional intelligence will be conducted (European vs. Amazigh). The second goal is to determine which aspects of personality, self-concept, and emotional intelligence are associated with academic success. Final samples of 407 pupils enrolled in the final two years of primary education were used for the study in order to achieve this. With an average age of 10.74 years, there were 192 boys (47.2%) and 215 girls (52.8%) according to gender. In terms of cultural grouping, 265 people were Amazigh (65.1%) and 142 people were European (34.9%). The academic achievements were assessed based on grades received in three subjects: Mathematics, natural sciences, and Spanish language and literature. The Self-Concept Test—Form 5, the Big Five Questionnaire for Children—Short Form, and the Bar on Emotional Quotient Inventory: Youth Version—Short were the instruments used to collect data for the psychological constructs that were analysed. First, in accordance with the goals established, the gender of the students affected their Spanish Language and Literature grades[158].

Gender differences were also observed in self-concept, personality, and emotional intelligence. The physical self-concept differed depending on the cultural group as well. In reference to the second goal, the academic self-concept demonstrated a higher predictive value in the predictive analysis for every subject in the Primary Education curriculum. Other aspects of personality, emotional intelligence, and self-concept, however, also did. There is talk about the necessity of implementing a comprehensive education programme in schools that promotes social and personal as well as academic competencies. Furthermore, a deeper investigation of the factors influencing gender differences is required[158].

2.3.3 Teaching Strategies and Academic Achievement in Mathematics

The study to investigate the impact of computer-supported collaborative learning (CSCL) on academic achievement. The meta-analysis method was used to carry out the investigation. A meta-analysis was performed on 40 studies that met the inclusion criteria and were conducted between 2010 and 2020 for this study. The Comprehensive Meta-Analysis (CMA) software was utilised in the current study to calculate the effect size and combined effect size of all the studies that were included in the meta-analysis. The study's sample size is 3474 individuals. The study's findings showed that most research was carried out with a medium sample size at the university level and published as articles. It was also discovered that the majority of the research was done in the social and scientific sciences. When taking into account the lengths of the interventions, it was found that the majority of the studies (37.8%) were conducted in the time frame of one to four weeks. Based on the analysis's findings, an average effect size of 0.523 was determined. Based on the findings, it can be concluded that CSCL has a moderately good impact on academic achievement. Additionally, the moderator analysis's findings showed that the length of the intervention was the determining factor in how much the impact of CSCL on academic achievement varied, rather than the learning stage, domain subject, or sample size[159].

From preschool to higher education, peer tutoring in Mathematics has been shown to have positive Effect on academic achievement among students. Recent reviews of the literature and meta-analyses, however, indicate that pupils make greater progress in primary or elementary education (ages 7–12) than in secondary education, which includes middle school and high school (ages 13–18). In comparable classroom environments, this study looked at how peer tutoring affected students' Mathematics proficiency in primary and secondary school. The study included 89 pupils from the first, fourth, seventh, and ninth grades. This study used a pretest–posttest design without a control group, making it quasi-experimental in nature. Both primary and secondary educations have significantly improved, according to the statistical analysis. There were no appreciable variations in the increases of the students' grades when these educational levels were compared. Cohen's d = 0.78 was the reported global effect size for the experience. The primary finding is that peer tutoring in Mathematics has comparable positive Effect on students' academic achievement in both primary and secondary education. Further studies are necessary because it is still unclear whether peer tutoring in primary school is better than secondary education when it comes to Mathematics[159].

The literature has not done enough research on STEM (science, technology, engineering, and Mathematics) programmes that serve students from low socioeconomic backgrounds. To make educated decisions about instruction for students who might be less advantaged than their peers from wealthier socioeconomic backgrounds, more research has to be done. The aim of this research study was to ascertain how STEM achievement of pupils in primary schools from low socioeconomic areas was affected by traditional science instruction and blended learning. Pupils from a low-socioeconomic school (N = 129) in the third, fourth, and fifth grades were randomized to receive traditional science instruction or a blended learning science curriculum approach. Using the R statistical computing platform, a one-way two-group Multiple Analysis of Variance (MANOVA) was performed to analyse the STEM achievement scores (science, technology, engineering, and Mathematics). The teaching strategy was found to have a statistically significant positive impact on the blended learning approach's linear combination of science, technology, Mathematics, and engineering scores ($F(4,124) = 80.27$; $p < .0001$; Pillai's Trace =.721; partial $\eta 2 = .721$)[160].

Children's daily lives now involve smart mobile devices like tablets and their corresponding applications (apps). Digital educational activities that are well-designed can be a powerful tool for efficient and effective learning in kindergarten education. With the use of these tools, kids can make the most of new learning environments and efficiently acquire new information through engaging in activities that connect to their current interests and real-world situations in subjects like Mathematics. The use of tablet-like devices in preschool education to implement teaching reform proposals to implement Realistic Mathematical Education in kindergarten classrooms has been the subject of systematic research at the University of Crete's Department of Preschool Education in recent years. The results suggest integrating mobile devices with developmentally appropriate apps in kindergarten classrooms. These applications, which focus on foundational mathematical ideas for kindergarten pupils, were developed using the three Realistic Mathematics Education (RME) levels as their foundation[161].

Study uses the Team Assisted Individualization learning model with modules to enhance social interaction and learning achievement in Computer and Network learning materials for Grade X-9 Vocational High School 1 Padang students. This study is a two-cycle class action research project. Action planning, action carrying out, observation, and reflection comprise each cycle. 38 students from Grade X-9 Vocational High School 1 Padang Year 2019/2020 were the subject of this study. Students and teachers are the data sources. This study employed a triangulation technique for data validity, which verifies the accuracy of data by using external sources of data to validate or standardize data collection procedures. The three steps of the Miles and Huberman analysis models—data reduction, data presentation, conclusion drawing, and verification—are also referred to as the analysis technique. Tools for gathering data include surveys, examinations, interviews, and observations. Both qualitative and quantitative descriptive analyses are the methods of data analysis that are employed. Based on the findings, there is room for improvement in the Team Assisted Individualization learning model with modules. Specifically, social interaction rose from 47.37% to 71.05%, and cognitive aspect learning achievement increased from 34.21% to 65.79%. As for the affective component, learning in Cycle I achieved the desired 81.58%[162].

Students' satisfaction with Mathematics lessons and their understanding of learning through distance learning are contingent upon their appreciation of the individual's effort, as outlined in the axis of fundamental skills and values. This need is greatly rewarded and successful when team-based learning is used. A person's self-confidence grows and they become more capable and optimistic about learning Mathematics when they succeed. Mathematical obstacles that could negatively impact a person's success in social interactions with friends could be eliminated by cultivating a positive attitude. Additionally, a person can support and uphold his or her own beliefs and self-worth by teaching their friends[163].

The purpose of this study is to ascertain how the team-based learning approach affects fourth grade math students' academic performance and attitudes towards the subject. "Pre-test -post-test control group experimental design" was used to conduct the study. This pattern makes it possible to compare how well the team-based learning approach in the Mathematics course has worked to raise student achievement and foster a love of the subject. Applying the "Team Play Tournament Supported Student Teams and Achievement Divisions" (TPT supported STAD) technique to the test group involved combining the use of the team-based learning applications' "Team Play Tournament" (TPT) and Student Teams Achievement Divisions (STAD) applications. The fourth grade Mathematics Teacher's Guide Book from the Ministry of National Education (MNE) was used to instruct the lessons for the control group. Participants in the study were fourth-grade primary school students in Malatya Battalgazi during the academic year 2015–2016. There were forty students total—20 in the control group and 20 in the test group. The researcher's "Mathematics Achievement Test" and Baykul's "Mathematics Attitude Scale" were administered as pre-test and post-test to the test and control groups. TPT supported STAD technique is more effective than teacher-centered teaching in raising students' academic achievement in Mathematics courses; however, it is less effective than teacher-centered teaching in their attitudes towards Mathematics[163].

The way Mathematics is taught nowadays is fraught with issues. The only skill taught to students receiving traditional instruction was listening. The teacher is in charge of the learning process without the participation and feedback of the students. Both learning freedom and the ability to communicate were lacking in the students. The purpose of this study was to determine how case-based learning impacted students' communication abilities in Mathematics. The study was a quasi-experimental inquiry with a posttest-only design. While the experiment class received case-based learning training, the control class was given normal teaching. In this study, the dependent variable was students' mathematical communication skills. Case-based learning and independent factors served as the study's independent variables. The research participants in their fifth semester were forty-six pre-service Mathematics teachers from two full courses. Study aids included the prior knowledge and mathematical communication skills examinations. The results of the study show that students who get case-based learning instruction and those who receive standard education differ in their ability to communicate mathematical ideas. Students in the experiment class were more adept at communicating than those in the control group (p-value = 0.047). Thus, one choice for improving students' communication skills is case-based learning[164].

The impact of using the visualized case-based learning (VCBL) technique on the academic performance of chemistry students was examined in this study. Thorndike's theory of the transfer of learning serves as the foundation for the study's theoretical framework. For the study, a sample of 145 senior high school II chemistry students was selected from four complete classes in two local government districts of the city of Ibadan. Three reliable instruments were employed in the data collection process. Using the Smith and Ragan Instructional System Design (ISD) Model (1999), the VCBL package was created. The four steps of this model are Analysis, Design, Development, and Implementation/Evaluation. Inferential statistics (ANCOVA, EMM, and Tukey's post-hoc) were used to analyse the data. The findings indicated a significant main effect of treatment on students' accomplishment in Chemistry ($F (2, 248) = 17.539$; $p<0.05$; $\eta 2=0.124$); this suggests that there is a substantial difference in posttest scores between the treatment and conventional groups in terms of students' achievement. It was determined that by encouraging learning transfer, the VCBL approach has the potential to help students comprehend chemistry more fully. This led to a discussion of the ramifications and the making of pertinent recommendations[165].

The perspectives of high school students regarding team-based problem-solving in Mathematics classes are the main subject of this study. In this study, a case study research design was used. Students in grade 11 at Dangila Preparatory High School in Awi-zone, Ethiopia, participated in this study. There were 105 participants in all. An unstructured interview and a structured Likert scale questionnaire with 15 items focused on team-based problem-solving and learning were used to gather the data. While the qualitative data were evaluated using narrative based on themes developed in accordance with the central research objectives, the quantitative data were examined using a single sample t-test. The study's findings demonstrated that students' reactions to the use of team-based problem-solving learning were favorable. The quantitative results showed that team-based problem-solving instruction has a significant impact on students' learning and, in turn, their performance in Mathematics. The qualitative information revealed the students' general skills and assisted teachers in comprehending how the students saw the knowledge they had acquired from the learning exercises. Additionally, it was shown that students were accustomed to collaborative projects in Mathematics classes. In conclusion, team-based problem-solving learning is an effective strategy for helping students learn Mathematics more quickly and more effectively than they have in the past. The researchers have sent pertinent suggestions based on their findings[166].

Students can be encouraged to develop their mathematical connection skills through the use of two learning methodologies that feature problem-solving activities: Case-Based Learning (CBL) and Problem-Based Learning (PBL). The purpose of this study was to characterize the variations in mathematical connection ability between PBL and CBL study groups. For that reason, a quasi-experiment using a pretest-posttest non-equivalent group design was carried out. Non-routine issues involving mathematical connections served as the study's technique of data collecting. Inferential statistics were used in the analysis of the data. Independent sample t-tests are used to confirm that the two learning strategies differ in terms of efficacy, and paired sample t-tests are used to compare the differences between pretest and posttest data in each experimental class. The outcomes demonstrated that improving mathematical connection ability was a successful goal of both the PBL and CBL techniques. But there was no discernible difference in the students' capacity to make mathematical connections between the PBL and CBL study methods. The findings of this study may lead educators to design suitable lessons that will develop students' capacity for mathematical connection[167].

2.3.4 Word Problem and Academic Achievement in Mathematics

One of the hardest types of problems that Mathematics students face is word problems. They have been the subject of an enormous amount of research over the past 50 years, possibly as a result. This introductory article provides a summary of the research literature on word problem solving by highlighting several key issues, disputes, and topics that have dominated the area. Following a brief introduction, we start with research that views word problems primarily as comprehension issues. We go on to discuss the different theoretical conceptions of this intricate comprehension process as well as the empirical data that supports them[168].

Next, we examine studies that have concentrated on methods for genuinely resolving the word problem. Discussion is held regarding the benefits and drawbacks of both informal and formal solution strategies at different stages of learners' mathematical development (algebra, arithmetic). Fourth, we discuss research that views word problems as challenging exercises in complex problem solving that call for the application of both meta-cognitive (also known as self-regulatory) and cognitive strategies (also known as heuristics). The use of graphical representations in word problem solving is covered in the fifth section[168].

The intricate and occasionally unexpected findings of studies on representations—both those created internally and those obtained externally—are outlined and talked about. Word problem solving ability has been demonstrated to be strongly correlated with several general cognitive resources, including working memory capacity and inhibitory skills, as in many other areas of Mathematics learning. A review of studies examining the function of these general cognitive resources follows. Research examining the intricate connection between (traditional) word problems and (real) mathematical modelling tasks is covered in the seventh section. In general, this research highlights the disparity that exists between the synthetic word problems that students encounter in their math classes and the real-world authentic mathematical modeling scenarios that they encounter[168].

Lastly, we examine research on how teachers, software, and textbooks—three crucial components of the teaching and learning environment—affect students' ability to develop word problem solving skills. It is demonstrated how each of these three environmental factors may help or impede students' ability to become proficient word problem solvers. We set the stage for the empirical contributions on word problems that appear in this special issue with this broad review of global research on the various viewpoints on this intricate and fascinating kind of mathematical problem[168].

2.4 **Conceptual Model**

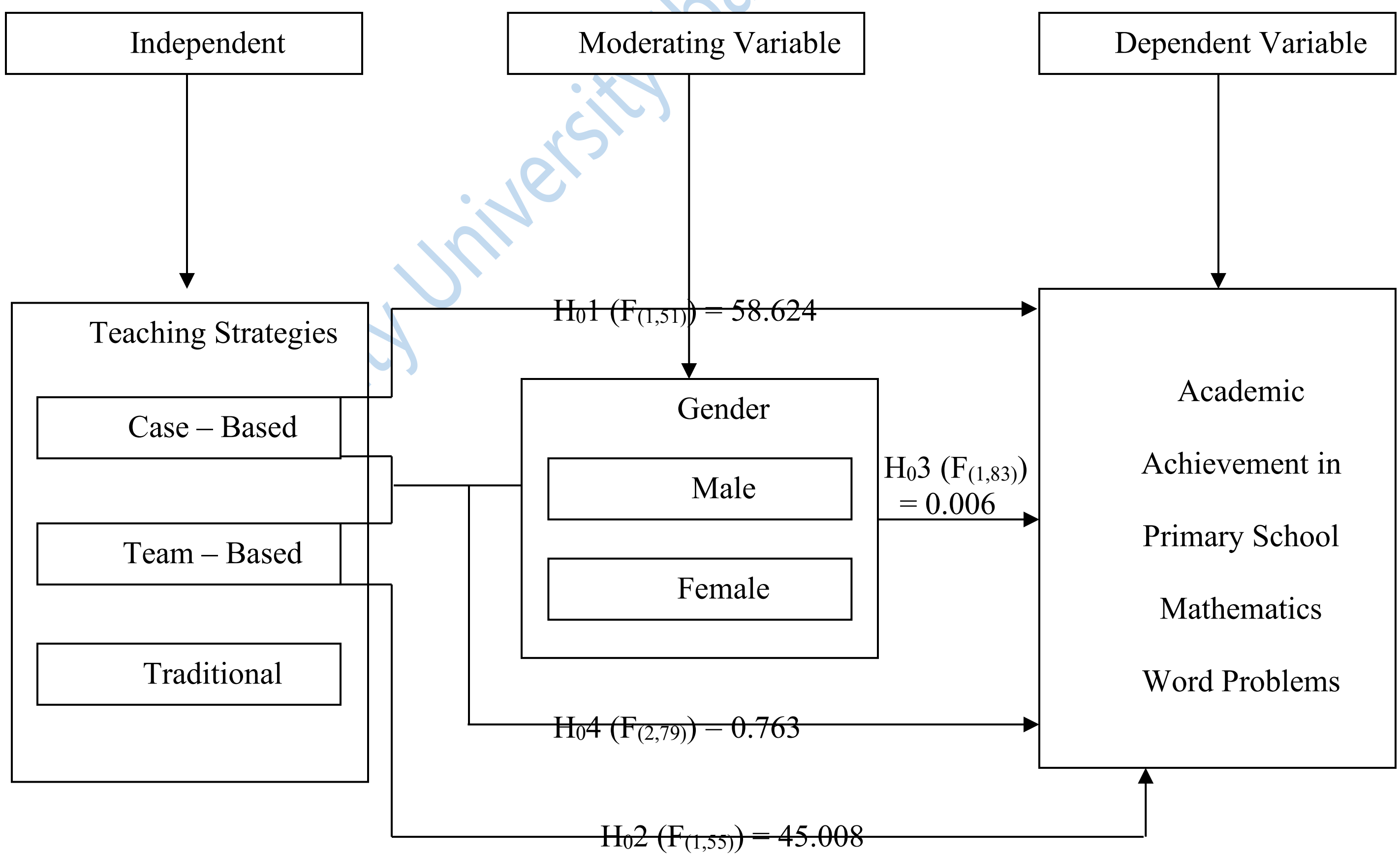

Figure 2.1: Conceptual Model of Case-based and Team-based Teaching Strategies on Academic Achievement in Primary school Mathematics Word Problems.
Source*: Fieldwork 2024.*

2.5 Summary of Literature Reviewed

The literature review for "Effects of Case-based and Team-based Teaching Strategies on Word Problems in Primary School Mathematics in Ibadan, Nigeria" covers various aspects related to academic achievement, teaching strategies, primary Mathematics, and theories that underpin educational practices.

The conceptual review discussed the importance of academic achievement as an outcome measure in education, particularly in the context of primary school Mathematics and examined how gender may influence academic achievement in Mathematics word problems. The methodology of using case-based teaching in the classroom, where students analyse real-life situations to develop problem-solving skills was explored and the team-based learning approach where students work together in teams to solve problems or complete tasks, fostering communication and cooperation skills was focused. The unique challenges and considerations in teaching Mathematics at the primary school level, including curriculum design, instructional methods, and learning outcomes were discussed. Then, the significance of word problems in Mathematics education, emphasising their role in applying mathematical concepts to real-world situations and enhancing critical thinking skills were also investigated.

Theoretical review explores how learners construct knowledge through active engagement with their environment, highlighting the importance of hands-on experiences and problem-solving activities. It examines the cognitive demands placed on learners during the learning process and how instructional design can manage these loads to optimise learning outcomes and also considers the role of social interaction and observation in the learning process, suggesting that students learn from observing others and participating in collaborative activities.

Empirical review examines the relationship between primary school Mathematics education and students' academic performance. It investigates empirical evidence regarding gender differences in academic achievement, particularly in Mathematics and reviews research on the effectiveness of various teaching strategies, including case-based and team-based approaches, in improving academic outcomes. Then, also explores studies investigating the impact of word problem-solving skills on overall academic achievement in Mathematics.

Overall, this literature review provides a comprehensive overview of relevant theoretical frameworks and empirical evidence to support the investigation into the effect of case-based and team-based teaching strategies on word problems in primary school Mathematics in the specified geographical area.

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Chapter Three

Methodology

This chapter shows the techniques that was used to carry out this study. It consists of research design, population of the study, sample and sampling techniques, description of the instruments, validity of the instruments, reliability of the instruments, method of data collection, data administration and method of data analysis.

3.1 Research Design

This study used the pretest – posttest method of quasi-experimental research design (Independent variable – teaching strategy manipulated into case-based, team-based and traditional teaching strategies and dependent variable – Academic Achievement). The teaching strategies are the treatments for the study that focus on two groups (Experimental Group and Control Group). Experimental Group sub-divided into two groups with two different teaching strategies (Group I using Case-based Teaching Strategy and Group II using Team-based Teaching Strategy), while Control Group involves using Traditional Teaching Strategy. The treatments were carried out after the pretest have been administered on participants, thereafter the posttest was administered on the same participants to assess their academic achievement from both the pretest and posttest scores. Further information regarding research design and schema setting were provided in Table 3.1 and Table 3.2.

Table 3.1: Schema denotation of the study

Group	Pretest	Treatment	Posttest
I_1	P_1	T_1	P_2
I_2	P_3	T_2	P_4
I_3	P_5	T_3	P_6

Source*: Fieldwork 2024.*

Where; P_1, P_3, P_5 = Pretest Scores

P_2, P_4, P_6 = Posttest Scores

I_1, I_2, I_3 = Treatment Groups

T_1 = Treatment 1 (Case-based Teaching Strategy)

T_2 = Treatment 2 (Team-based Teaching Strategy)

T_3 = Control (Traditional Based Teaching Strategy)

Table 3.2: Variables of the study

Independent (Treatment)	Dependent (Academic Achievement in word problems)
Case-based Teaching Strategy T_1	
Team-based Teaching Strategy T_2	
Traditional Based Teaching Strategy T_3	

Source*: Fieldwork 2024.*

3.2 Population of the Study

The population of study consists of 2,560 pupils comprises 1,160 boys and 1,400 girls from all Primary 4 Classes In 128 private primary schools found in 11 wards of Ibadan North-West Local Government Area, Oyo state. Further information regarding the population of study were in Table 3.3.

Table 3.3: Population of Study

Wards	**Numbers of Schools**	**Primary 4 Enrollments**		**Total**
		Boys	**Girls**	
Ward 1	9	103	112	215
Ward 2	16	123	112	235
Ward 3	11	106	119	225
Ward 4	8	92	116	208
Ward 5	10	100	113	213
Ward 6	7	45	128	173
Ward 7	15	159	167	326
Ward 8	8	83	119	202
Ward 9	14	143	119	262
Ward 10	17	120	159	279
Ward 11	13	86	136	222
Total	**128**	**1,160**	**1,400**	**2,560**

Source[1]

3.3 Sample and Sampling Techniques

This study employed multistage sampling procedure that comprises two stages. Stage one involves stratification of 11 wards in Ibadan North-West Local Government Area into three stratified groups – first group consists of four wards with 44 private primary schools comprises 883 pupils (424 boys and 459 girls), second group also consists of four wards with 40 private primary schools comprises 914 pupils (387 boys 527 girls) and the third group consists of three wards with 44 private primary schools comprises 763 pupils (349 boys and 414 girls). Further information regarding the stratified sampling for grouping of wards were in Table 3.4.

Table 3.4: Stratified Sampling for Grouping of Wards

Stratified Group	Numbers of Stratified Wards	Schools	Primary 4 Enrollments Boys	Girls	Total
First	4	44	424	459	883
Second	4	40	387	527	914
Third	3	44	349	414	763
Total	**11**	**128**	**1,160**	**1,400**	**2,560**

Source*: Fieldwork 2024.*

Stage two involves the purposive selection of three private primary schools, one from each stratified group. From group one: St. Mary's Model School, Oke Padre, Ibadan was selected. From group two: All Saints' Church School, Jericho, Ibadan was selected while from group three: Sacred Heart Private School, Onireke, Ibadan was selected. Further information regarding the purposive sampling for selected schools were in Table 3.5.

Table 3.5: Purposive Sampling for Selected Schools

Stratified Ward Range	Purposive Selected Wards	Private Primary Schools (Ibadan)
Wards 1 – 4	Ward 2	St. Mary's Model School, Oke Padre
Wards 5 – 8	Ward 7	All Saints' Church School, Jericho
Wards 9 – 11	Ward 10	Sacred Heart Private School, Onireke
Total	**3**	**3**

Source*: Fieldwork 2024.*

The three private primary schools in Ibadan North-west Local Government Area, Oyo State were purposively selected for this study because they are the oldest mission schools from each stratified ward range.

An intact class was used as sample size in each of the purposive selected private primary schools for this study.

Twenty-eight participants (14 boys and 14 girls) were found in St. Mary's Model School, Oke Padre, Primary 4B intact class randomly assigned to Case-based Teaching Strategy.

Thirty-two participants (16 boys and 16 girls) were found in All Saints' Church School, Jericho, Primary 4C intact class randomly assigned to Team-based Teaching Strategy.

Twenty-six participants (13 boys and 13 girls) were found in Sacred Heart Private School, Onireke, Primary 4A intact class randomly assigned to Traditional Teaching Strategy. Further information regarding the sample size for selected schools were in Table 3.6

Table 3.6: Sample Size

Schools	Classes	Gender		Total
		Boys	Girls	
St. Mary's Model School	Pry 4B	14	14	28
All Saints' Church School	Pry 4C	16	16	32
Sacred Heart Private School	Pry 4A	13	13	26
Total		**43**	**43**	**86**

Source*: Fieldwork 2024.*

3.4 Description of Research Instruments

This study used the following two instruments to collect data, namely:

1. Primary Mathematics Word Problems Academic Achievement Test (PMWPAT)
2. Teaching Instructional Guides (TIG)

3.4.1 Primary Mathematics Word Problems Achievement Test (PMWPAT)

This instrument was used to collect data to assess pupils' academic achievement in Primary school Mathematics word problems. The instrument consists of 30 items source from Common Entrance Examination past questions. The items are multiple-choice, in term of options labelled lettered A – E for the participants to underline only one correct answer at a time. The given time frame to answer all the items was 45 minutes.

The PMWPAT consists of two sections (A and B). Section A are meant for the participants demographic information such as: school name, class, gender, group and test type. Section B are the 30 multiple choice items which consist of the following word problems in: algebra, fraction, probability and proportion. Table 3.7 below shows the higher order of cognitive level (remember, understand, apply, analyse and evaluate) of item specifications for the 30 items as follows:

Table 3.7: Item specification Primary Mathematics Word Problems Achievement Test (PMWPAT)

Contents	Cognitive Level			Total
	Remember	Understand	Apply	
1. Addition	1	2	2	5
2. Subtraction	2	1	2	5
3. Multiplication	2	2	1	5
4. Division	1	1	-	2
5. Fractions	2	3	3	8
6. Algebra	2	2	1	5
Total	**10**	**11**	**9**	**30**

Source*: Fieldwork 2024.*

3.4.2 Teaching Instructional Guides

These are the treatments (Case-based, Team-based and Traditional Teaching Strategies) lesson notes to guide the teaching and learning process in selected schools for the study during fieldwork which consist of school, subject, class, date, average age, population, duration, topic, instructional materials, behavioral objectives, entry behavior, introduction, presentations (step 1, step 2…), evaluation. The following are the steps taken in each treatment (lesson note):

Lesson Note 1: Experimental Group I (Case-based Teaching Strategy) Instructional guides are as follows:

First step: Selection of relevant cases

Second step: Introduction of the cases

Third step: Identification of key mathematical concepts

Fourth step: Connection of prior knowledge

Fifth step: Assessment of understanding

Further information regarding lesson note 1 can be found in Appendix II

Lesson Note 2: Experimental Group II (Team-based Teaching Strategy) Instructional guides are as follows:

First step: Formation of teams

Second step: Assigning of roles

Third step: Introduction of word problems

Fourth step: Collaboration of problem solving

Fifth step: Assessment of understanding

Further information regarding lesson note 2 can be found in Appendix III

Lesson Note 3: Control Group III (Traditional Teaching Strategy) Instructional guides are as follows:

First step: Introduction

Second step: Presentation of word problems

Third step: Explanation of problem-solving strategies

Fourth step: Independent practice

Fifth step: Assessment of understanding

Further information regarding lesson note 3 can be found in Appendix IV

3.5 Validity of Research Instrument (PMWPAT)

Face and content validity assessment of the instrument (PMWPAT) was used for validation by the supervisor through vetting of the instrument (PMWPAT) for necessary correction before being used to assess achievement of the participants in primary school Mathematics.

3.6 Reliability of Research Instrument (PMWPAT)

Kuder-Richardson (KR-20) was used to calculate the reliability value of the instrument (PMWPAT) by administer the instrument on another set of participants from another school apart from the selected schools but share the same characteristics. The reliability value of the instrument (PMWPAT) was r = 0.86.

3.7 Method of Data Collection

Data collection in a quasi-experimental study including an achievement test entails methodically obtaining information about participants' performances or outcomes about the specific construct under investigation. In order to properly administer the accomplishment test for data collection, the researcher obtained a letter of introduction from the Head of Department requesting authorisation to approach the Head-teachers and individual class teachers of the chosen schools. The participants' parents were given written informed consent that covered the purpose, design, and potential benefits and challenges of the study. Research assistants (teachers) were trained. The training session included a detailed discussion of the study's objectives as well as the procedures that needed to be done in order to complete the study in eight weeks.

The first week of fieldwork involved training research assistants on teaching strategies for the study. The second week involved administering the pretest to participants. The following five weeks (week three to seven) were dedicated to implementing the treatment plan based on the designated teaching strategy for each of the selected schools for the study. The posttest was given at the week eight.

3.7.1 Data Administration

Class teachers (research assistants) from the study's selected schools received training on how to lead pupils in experimental group I through the use of case-based teaching strategy while in experimental group II through the use of team-based teaching strategy, and in control group III through the use of traditional teaching strategy by utilising the researcher's prepared lesson notes. Following the training, the researcher observed the research assistants or class teachers while they continued the experiment under the supervision of the researcher for 30 minutes, testing their knowledge of the material. Both the experimental and control groups' participants were exposed to the same duration of time (periods). Every week for five weeks (week three to week seven), a period was used in each of the schools where the treatment was administered. Before the commencement of the experiment, the participants took the pre-test, and at the end of experiment, they took the post-test.

3.8 Method of Data Analysis

Analysis of Covariance (ANCOVA) was used to test the data collected and all the hypotheses were tested at 0.05 level of significant.

Endnote

1. Local Inspector of Education (LIE), *Private Schools Primary Four Enrollments in Eleven (11) wards of Ibadan North-West Local Government Area, Oyo State,* Ibadan North-West LGA Local Inspection of Education (LIE), 2024.

Chapter Four

Results and Discussion of Findings

This chapter reveals demographic data analysis, presentations of data, Analysis of Covariance (ANCOVA) results, and discussion of findings.

4.1 Demographic Data Analysis

Table 4.1.0: Treatment Participants

Treatments	Gender		Total
	Boys	Girls	
Case-based	14	14	28
Team-based	16	16	32
Traditional	13	13	26
Total	**43**	**43**	**86**

Source*: Fieldwork 2024.*

4.2 Testing of hypotheses

4.2.1 Hypotheses

$H_0$1: There will be no significant main effect of Case-based Teaching Strategy on Academic Achievement of Primary School Pupils in Mathematics word problems.

The Analysis of Covariance (ANCOVA) result on the effect of Case-based Teaching Strategy on Academic Achievement of Primary School Pupils in Mathematics word problems was; $F_{(1,51)}$=58.624; $p < 0.05$ and η^2= 0.535. The null hypothesis $H_0$1 is rejected. There was significant main effect of case-based teaching strategy on Achievement of Primary School Pupils in Mathematics word problems [$F_{(1,51)}$=58.624, $p < 0.05$, η^2= 0.535] as revealed in Table 4.1.1

Table 4.1.1: Test of Between–Subject Effects of Case-Based Teaching Strategy on Primary School Pupils' Academic Achievement in Mathematics word problems
Dependent Variable: Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1175.513[a]	2	587.757	60.436	0.000	0.703
Intercept	54.840	1	54.840	5.639	0.021	0.100
PRETEST	977.505	1	977.505	100.512	0.000	0.663
STRATEGY	570.129	1	570.129	58.624*	0.000	0.535
Error	495.987	51	9.725			
Total	18845.000	54				
Corrected Total	1671.500	53				

a. R Squared = 0.703 (Adjusted R Squared = 0.692)
* denote significant difference at $p < 0.05$
Source*: Fieldwork 2024.*

$H_0$2: There will be no significant main effect of Team-based Teaching Strategy on Academic Achievement of Primary School Pupils in Mathematics word problems.

The Analysis of Covariance (ANCOVA) result on the effect of Team-based Teaching Strategy on Academic Achievement of Primary School Pupils in Mathematics word problems was; $F_{(1,55)}$=45.008, $P < 0.05$ and η^2= 0.450. The null hypothesis $H_0$2 is rejected. There was significant main effect of Team-based Teaching Strategy on Academic Achievement of Primary School Pupils in Mathematics word problems [$F_{(1,55)}$=45.008; $p < 0.05$, η^2= 0.450] as revealed in Table 4.2.1.

Table 4.2.1: Test of Between–Subject Effects of Team-Based Teaching Strategy on Primary School Pupils' Academic Achievement in Mathematics word problems.

Dependent Variable: Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1493.238[a]	2	746.619	52.419	0.000	0.656
Intercept	152.723	1	152.723	10.722	0.002	0.163
PRETEST	950.002	1	950.002	66.698	0.000	0.548
STRATEGY	641.067	1	641.067	45.008*	0.000	0.450
Error	783.382	55	14.243			
Total	23750.000	58				
Corrected Total	2276.621	57				

a. R Squared = 0.656 (Adjusted R Squared = 0.643)

* denote significant difference at $p < 0.05$

Source*: Fieldwork 2024.*

H_03: There will be no significant main effect of Gender on academic achievement of primary school pupils in Mathematics word problems.

The Analysis of Covariance (ANCOVA) result on the effect of Gender on academic achievement of primary school pupils in Mathematics word problems was; $F_{(1,83)}= 0.006$, $P > 0.05$ and $\eta^2= 0.000$. The null hypothesis H_03 is accepted. There was no significant main effect of Gender on academic achievement of primary school pupils in Mathematics word problems [$F_{(1,83)}= 0.006$; $p > 0.05$, $\eta^2= 0.000$] as revealed in Table 4.3.1.

Table 4.3.1: Test of Between–Subject Effects of Gender on Primary School Pupils' Academic Achievement in Mathematics word problems.

Dependent Variable: Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1348.084[a]	2	674.042	28.834	0.000	0.410
Intercept	450.586	1	450.586	19.275	0.000	0.188
PRETEST	1338.305	1	1338.305	57.250	0.000	0.408
Gender	0.129	1	0.129	0.006*	0.941	0.000
Error	1940.253	83	23.377			
Total	35601.000	86				
Corrected Total	3288.337	85				

a. R Squared = 0.410 (Adjusted R Squared = 0.396)
* denote significant difference at p > 0.05
Source*: Fieldwork 2024.*

$H_0$4: There will be no significant interaction effect of Case-based, Team-based and Gender on academic achievement of primary school pupils in Mathematics word problems.

The Analysis of Covariance (ANCOVA) result on the effect of Case-based, Team-based and Gender on academic achievement of primary school pupils in Mathematics word problems was; $F_{(2,79)}= 0.763$, $P > 0.05$ and $\eta^2= 0.470$. The null hypothesis $H_0$4 is accepted. There was no significant interaction effect of Case-based, Team-based and Gender on academic achievement of primary school pupils in Mathematics word problems [$F_{(2,79)}= 0.763$; $p > 0.05$, $\eta^2= 0.470$] as revealed in Table 4.4.1.

Table 4.4.1: Test of Between–Subject Effects of Case-based, Team-based and Gender on Primary School Pupils' Academic Achievement in Mathematics word problems.
Dependent Variable: Posttest

Dependent Variable: POSTTEST	Type III sum of squares	df	Mean square	F	Sig.	Partial eta squared
Corrected model	2169.267[a]	6	361.544	25.523	0.000	0.660
Intercept	232.508	1	232.508	16.414	0.000	0.172
Pretest	1529.638	1	1529.638	107.984	0.000	0.578
Strategy	797.955	2	398.978	28.166	0.000	0.416
Gender	0.013	1	0.013	0.001	0.976	0.000
Strategy * Gender	21.621	2	10.810	0.763*	0.470	0.019
Error	1119.070	79	14.165			
Total	35601.000	86				
Corrected total	3288.337	85				

A. R squared = 0.660 (adjusted r squared = 0.634)
* denote significant difference at $p > 0.05$
Source*: Fieldwork 2024.*

4.3 Discussion of Findings

There was a significant main effect of case-based teaching strategy on Achievement of Primary School Pupils in Mathematics word problems which is in line with previous studies. Developing Mathematics Written Communication through Case-Based Learning[1]. The results of earlier research indicate that students who were assigned to learning instruction and those who receive conventional teaching differ in their aptitude for mathematical communication. Students in the experiment class were better at communicating than those in the control group. Thus, one choice for improving students' communication skills is case-based learning. Also the result is in line with this previous study: Effect of Visualized Case-Based Learning Strategy (VCBL) on Students' Performance in Chemistry in Ibadan Metropolis, Nigeria[2]. The findings indicated a significant main effect of treatment on students' accomplishment in Chemistry; this suggests that there is a substantial difference in posttest scores between the treatment and conventional groups in terms of students' achievement. It was determined that by encouraging learning transfer, the VCBL approach has the potential to help students comprehend chemistry. This led to a discussion of the ramifications and the making of pertinent recommendations. In spite of the fact that this study and the previous studies were contrast in subject matter. They both applied the same teaching strategy (Case-based Learning) during the course of study with the same result.

There was a significant main effect of team-based teaching strategy on achievement of primary school pupils in Mathematics word problems which is in line with previous study: Students' Perception of the Application of Team-based Problem-Solving Method and its Effect on Mathematics Performance: The Case of Secondary Schools in Awi-zone, Ethiopia[3]. The study's findings demonstrated that students' reactions to the use of team-based problem-solving learning were favorable. The quantitative results showed that team-based problem-solving instruction has a significant impact on students' learning and, in turn, their performance in Mathematics. The qualitative information revealed the students' general skills and assisted teachers in comprehending how the students saw the knowledge they had acquired from the learning exercises. Additionally, it was shown that students were accustomed to collaborative projects in Mathematics classes. In conclusion, team-based problem-solving learning is an effective strategy for helping students learn Mathematics more quickly and more effectively than they have in the past. In respective of their different in geographical location and educational levels, the findings still shows the same results that team teaching strategy is significantly effective to improve academic achievement in Mathematics.

There was a significant interaction effect of Case-based and Team-based Teaching Strategies on Academic Achievement of Primary School Pupils in Mathematics word problems which opposes previous study: Problem-based learning and Case-based learning: Which is more Effective for Fostering Mathematical Connection[4]. The outcomes demonstrated that improving Mathematical connection ability was a successful goal of both the PBL and CBL strategies. But there was no discernible difference in the students' capacity to make Mathematical connections between the PBL and CBL study methods. The findings of this study lead educators to design suitable lessons that will develop students' capacity for Mathematical connection. There are notable distinctions in significance and approaches to teaching tactics even though both research look at the effect of interactions on different topic matters.

Endnotes

1. J. Suratno, I. Hamid & I. K. Waliyanti, *Developing Mathematics Written Communication through Case-Based Learning,* **JTAM (Jurnal Teori dan Aplikasi Matematika)**, 7(2), 2023, 443-451. Available online: https://doi.org/10.31764/jtam.v7i2.13318

2. M. I. Idika, *Effect of Visualized Case-Based Learning Strategy on Students' Academic Performance in Chemistry in Ibadan Metropolis, Nigeria,* **African Journal of Teacher Education AJOTE***,* 10(1), 2021, 106-126.

3. A. Ahmed, S. Melesse & T. Wondimuneh, *Students' Perception of the Application of Team-based Problem-Solving Method and its Effect on Mathematics Performance: The Case of Secondary Schools in Awi-zone, Ethiopia,* **Research in Pedagogy,** 10(1), 2020, 1-12. Available online: DOI: 10.5937/istrped2001001A

4. E. R. Dewi & A. Nurjanah, *Problem-based learning and case-based learning: Which is more effective for fostering mathematical connection?* **Jurnal Riset Pendidikan Matematika**, 9(2), 2022, 124-136. Available online: doi:https://doi.org/10.21831/jrpm.v9i2.53276

Chapter Five

Conclusion

5.1 Summary of Findings

This study investigated the effects of case-based and team-based teaching strategies on Word Problems in Primary School Mathematics in Ibadan North-West Local Government Area, Oyo State. Twenty-eight participants 14 boys and 14 girls were taught with case-based teaching strategy. Thirty-two participants (16 boys and 16 girls) were taught with team-based teaching strategy and 26 participants (13 boys and 13 girls) were taught with traditional teaching strategy.

From the Analysis of Covariance (ANCOVA) results: There was a significant main effect of case-based teaching strategy on Academic Achievement of Primary School Pupils in Mathematics Word Problems [$F_{(1,51)}$=58.624; $p < 0.05$, η^2= 0.535]. The null hypothesis $H_0$1 is rejected.

There was a significant main effect of team-based teaching strategy on Academic Achievement of Primary School Pupils in Mathematics Word Problems [$F_{(1,55)}$=45.008; $p< 0.05$, η^2= 0.450]. The null hypothesis $H_0$2 is rejected.

There was no significant main effect of Gender on academic achievement of primary school pupils in Mathematics word problems [$F_{(1,83)}$= 0.006; $p > 0.05$, η^2= 0.000]. The null hypothesis $H_0$3 is accepted.

There was no significant interaction effect of Case-based, Team-based and Gender on academic achievement of primary school pupils in Mathematics word problems [$F_{(2,79)}$= 0.763; $p > 0.05$, η^2= 0.470]. The null hypothesis $H_0$4 is accepted.

5.2 Conclusion

From the findings of this study, it is concluded that case-based teaching strategy [$F_{(1,51)}$=58.624; $p < 0.05$, η^2= 0.535] and team-based teaching strategy [$F_{(1,55)}$=45.008; $p < 0.05$, η^2= 0.450] were effective to teach word problems in Primary school Mathematics

5.3 Recommendations

Base on the findings, the following recommendations are made.

Base on the findings, the following recommendations are made.

i. Class teachers should be encouraged to use Cased-based teaching strategy to teach word problems in Primary school Mathematics.

ii. Team-based teaching strategy should be used to teach word problems in Primary school Mathematics.

iii. Gender disparities should not be considered by stakeholders to improve academic achievement of primary school pupils in mathematics word problems.

iv. Interaction effect of Cased- based, Team-based and Gender should not be considered as factors to enhance academic achievement in primary school mathematics word problems

5.4 Suggested Area for Further Research

The study “Effects of Case-based and Team based Teaching Strategies on Word Problems in Primary School Mathematics in Ibadan North-West Local Government Area, Oyo State” can be investigated in other Local Governments or States in Nigeria.

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Dissertation

Local Inspector of Education (LIE), *Private Schools Primary Four Enrollments in Eleven (11) wards of Ibadan North-West Local Government Area, Oyo State,* Ibadan North-West LGA Local Inspection of Education (LIE), 2024.

Appendix I

Primary Mathematics Word Problems Academic Achievement Test (PMWPAT)

Instructions: Section A: Give an appropriate information as presented below
Section B: underline only one correct answer at a time from the provided option A - E

Time: 45 minutes

Section A

Participants Demographic Information

School Name: ______________________________

Class: ______________________________

Gender: Male ☐ Female ☐

Group Type: Group I ☐ Group II ☐ Group III ☐

Test Type: Pre-Test ☐ Post Test ☐

Section B

1. A man is 3 times as old as his son. The sum of their ages is 60 years. How old was the man when his son was born?
   (a) 50 years
   (b) 65 years
   (c) 30 years
   (d) 45 years
   (e) 38 years

2. In a class, $^4/_5$ of the students have mathematical instrument, $^1/_4$ of these students have lost their protractors. What fraction of the students in the class has protractors?
   (a) $^5/_8$
   (b) $^3/_5$
   (c) $^5/_7$
   (d) $^7/_8$
   (e) $^6/_7$

3. 60 men can do a piece of work in 35 days, how long will hundred people take to do it of the work are the same rate?
   (a) 25 days
   (b) 24 days

(c) 21 days
(d) 20 days
(e) 10 days

4. A mother is 10 times as old as her daughter. In 6 years' time she will be 4 time as old as her daughter. Find the age of the mother.
(a) 25 years
(b) 30 years
(c) 40 years
(d) 45 years
(e) 48 years

5. A clock loses $2\,{}^{1}\!/_{2}$ minutes every hour. It was correctly set at 8:00 am one day. What was the correct time when the clock showed 1:45 pm on that day?
(a) 1:30 pm
(b) 1:40 pm
(c) 1:50 pm
(d) 2:00 pm
(e) 2:15 pm

6. A father is 25 years older than his son. . If the sum of their ages is 53, find the age of the son.
(a) 14
(b) 28
(c) 39
(d) 78
(e) 22

7. Every year, a school is in session for a total of 39 weeks. If first term vacation is 3 weeks and second term vacation is 3 weeks, how long is the third term vacation?
(a) 10 weeks
(b) 7 weeks
(c) 12 weeks
(d) 4 weeks
(e) 3 weeks

8. Wilson runs at 10 m/s and Harmony runs at 9 m/s. the two of them take part in a 100 meters race. When the winner crosses the finish line, how far behind is the other?
(a) 1 metre
(b) 5 metres
(c) 9 metres
(d) 10 metres
(e) 18 metres

9. The sum of two numbers is 156. Their difference is 18, find the smaller number.
(a) 84

(b) 69
(c) 120
(d) 57
(e) 40

10. John and his three sisters shared 1,228 oranges. John has 20 oranges more than each of his three sisters. What was his share?
(a) 632
(b) 460
(c) 750
(d) 107
(e) 322

11. If 10 is multiplied by a number x and the is added to 5, this statement maybe written in algebra as
(a) (10x + 5)
(b) 20
(c) 35
(d) 15 x $^3/_4$
(e) 5x + 20

12. A farmer buys n sheep at ₦a each and sells them at ₦b each. Which of the following is his profit in naira?
(a) an- bn
(b) bn - an
(c) a - b
(d) $\frac{\text{b} - \text{an}}{n}$
(e) ab - an

13. M pencils cost ₦x and N pens cost ₦y. What is the cost of 10 pencils and 5pens?
(a) ₦ (Mx + Ny)
(b) ₦5(Mx + Ny)
(c) ₦ (10Mx + Ny)
(d) ₦ $(\frac{10x}{M} + \frac{5y}{N})$
(e) ₦ $(\frac{10x}{N} + \frac{5y}{M})$

14. Charles is 0.04m taller than Emeka. If Emaka's height is 1.48m, what is Charles' height?
(a) 1. 88m
(b) 1.52m
(c) 1.44m
(d) 1.40 m
(e) 1.42m

15. Two consecutive whole numbers are such that twice the smaller added to the greater make a total of 52. Find the smaller number.

(a) 17
(b) 18
(c) 25
(d) 26
(e) 38

16. Ife is older than Feranmi, Tolu is older that Ife, and Feranmi is older than Fikayo. Who is the oldest?
(a) Ife
(b) Tolu
(c) Feranmi
(d) Fikayo
(e) Ayo

17. Tom and Henry share 102 sweets so that Henry has 5 times as many as Tom. How many does Tom gets?
(a) 85
(b) 58
(c) 29
(d) 17
(e) 71

18. In a school, there are twice as many boys as there as girls. If the school population is 540, how many boys are in the school?
(a) 80
(b) 280
(c) 360
(d) 420
(e) 95

19. In an examination, a girl has to spend x minutes in part A and 25minutes in part B of the questions. How long is the examination?
(a) x minutes
(b) 25x minutes
(c) x/25 minutes
(d) 25/x minutes
(e) (25 + x) minutes

20. A man is four times as old as his son, if the difference between their ages is 21, what is the son's age?
(a) 7years
(b) 19years
(c) 21years
(d) 9years
(e) 28years

21. Two taps running at the same rate can fill a tank in 45minutes. How long will it take one tap to fill the same tank?
    (a) 120 minutes
    (b) 90 minutes
    (c) 80 minutes
    (d) 60 minutes
    (e) 22 ½ minutes

22. Adeyemi who is 15 years old is 3 years older than his younger brother Ojo. If Oloyede their eldest brother is 21 years old, what is the average age of the three brothers?
    (a) 18 years
    (b) 16 years
    (c) 15 years
    (d) 13 years
    (e) 9 years

23. A gardener has 68 bundles of flowers each containing 10 flowers. How many bundles would he have made if he had put 17 flowers in each bundle?
    (a) 170
    (b) 168
    (c) 25
    (d) 40
    (e) 115

24. If a father is 20years older than his son. What was the sum of their ages 7 years ago assuming the son's present age x years?
    (a) x + 6
    (b) 2x + 6
    (c) X+ 7
    (d) 2x + 13
    (e) 5x + 4

25. Twice Biola's age now is the same as four times her age two years ago. How old is Biola now?
    (a) 12 years
    (b) 18 years
    (c) 8 years
    (d) 6 years
    (e) 4 years

26. Three bells toll at intervals of 3 minutes, 6 minutes and 8 minute. If they toll together at 12 noon, when will they toll together again?
    (a) 12:03 pm
    (b) 12:06 pm
    (c) 12:08 pm
    (d) 12:24 pm
    (e) 12:36 pm

27. The sum of two numbers is 531, one of them is 410. By how much is one greater than other?
    (a) 289
    (b) 189
    (c) 179
    (d) 169
    (e) 159

28. A man who is 5 times as old as his son. If the father is presently 50 years old, what will be age of the son in 5 years' time?
    (a) 5 years
    (b) 10 years
    (c) 15 years
    (d) 20 years
    (e) 25 years

29. Three years ago a woman was 3 times as old as her daughter. Their total age now is 46 years. How old was the daughter 3 years ago?
    (a) 10 years
    (b) 11 ½ years
    (c) 12 years
    (d) 9 years
    (e) 15 years

30. In a village, half the population is made up of children, two-fifth are women and the rest are men. If there are 100 men, find the total population of the village.
    (a) 200
    (b) 500
    (c) 2000
    (d) 1000
    (e) 1500

Appendix II

Teaching Instructional Guides

Experimental Group I (Case-based Teaching Strategy)

Lesson Note 1

School:	As Applicable
Subject:	Mathematics
Class:	Primary 4
Date:	As Applicable
Average Age:	9 years
Population:	As Applicable
Period:	1
Duration:	35 Minutes
Topic:	Word Problems
Instructional Materials:	Concrete objects (sweet, bread, bell, flowers etc.)
Behavioral Objectives:	At the end of the lesson, pupils would be able to: (a) identify the nature of various word problems (b) interpret different types of word problems in Primary school Mathematics and (c) solve various word problems involve in Primary school Mathematics
Entry Behavior:	pupils are familiar with basic arithmetic operations (addition, subtraction, multiplication and division)

Presentations:

Content Development	Time (Mins)	Teacher's Activities	Pupils' Activities
Step 1 Selection of relevant cases	5	The teacher uses familiar real-life scenarios which involve mathematical concepts and align with the objectives	Pupils contribute to the real-life scenarios and relate them to mathematical concepts.
Step 2 Introduction of the cases	10	The teacher introduces the case by presenting the selected case to the pupils with necessary background information and describing the problem situation for pupils to understand scenario and its relevance to the mathematical concepts.	Pupils connect the scenario to the mathematical concepts and state its relevance to mathematical concepts.
Step 3 Identification of key mathematical concepts	5	The teacher highlights the mathematical concepts embedded within the case and uses the relevant strategies to solve the problem for the	Pupils identify the key mathematical concepts and solve the

		pupils.	problem with relevant strategies.
Step 4 Connection of prior knowledge	5	The teacher assists the pupils to connect the case and their prior knowledge and encourages them to draw on their existing understanding of mathematical concepts to tackle the case effectively.	Pupils connect the case and the prior knowledge and tackle the case effectively.
Step 5 Assessment of understanding	10	The teacher assesses the pupils' understanding of the problem-solving by giving them some questions to solve using problem-solving skills. <u>Questions:</u> 1. Two consecutive whole numbers are such that twice the smaller added to the greater make a total of 52. Find the smaller number. 2. Ife is older than Feranmi, Tolu is older that Ife, and Feranmi is older than Fikayo. Who is the oldest? 3. Tom and Henry share 102	Pupils solve the given questions for assessment of understanding.

		sweets so that Henry has 5 times as many as Tom. How many does Tom gets? 4. In a school, there are twice as many boys as there as girls. If the school population is 540, how many boys are in the school? 5. In an examination, a girl has to spend x minutes in part A and 25minutes in part B of the questions. How long is the examination? 6. A man is four times as old as his son, if the difference between their ages is 21, what is the son's age? 7. Two taps running at the same rate can fill a tank in 45minutes. How long will it take one tap to fill the same tank? 8. Adeyemi who is 15 years old is 3 years older than his younger brother Ojo. If oloyede their eldest brother is 21 years old, what is the average age of the three brothers? 9. A gardener has 68 bundles of flowers each containing 10 flowers. How many bundles would he have made if he had put 17 flowers in each bundle? 10. If a father is 20years older than his son. What was the	

		sum of their ages 7 years ago assuming the son's present age x years? 11. Twice Biola's age now is the same as four times her age two years ago. How old is Biola now?	

Appendix III

Teaching Instructional Guides

Experimental Group II (Team-based Teaching Strategy)

Lesson Note 2

School:	As Applicable
Subject:	Mathematics
Class:	Primary 4
Date:	As Applicable
Average Age:	9 years
Population:	As Applicable
Period:	1
Duration:	35 Minutes
Topic:	Word Problems
Instructional Materials:	Concrete objects (sweet, bread, bell, flowers etc.)
Behavioral Objectives:	At the end of the lesson, pupils would be able to:

(a) identify the nature of various word problems

(b) interpret different types of word problems in Primary school Mathematics and

(c) solve various word problems involve in Primary school Mathematics

Entry Behavior: pupils are familiar with basic arithmetic operations (addition, subtraction, multiplication and division)

Presentations:

Content Development	Time (Mins)	Teacher's Activities	Pupils' Activities
Step 1 Formation of teams	5	Teacher divides the class into small teams consist of 4 pupils with vary abilities and backgrounds to foster collaboration and peer learning.	Pupils move to different groups.
Step 2 Assigning of roles	5	Teacher assigns the role of leader, recorder, time keeper and presenter to each team members and asks them to rotate these roles periodically to ensure that all pupils have opportunities to contribute and develop different skills.	Pupils assume different roles as agreed by members.
Step 3 Introduction of word problems	5	Teacher presents a challenging word problem to the class which align with the mathematical concepts and provides sufficient context to facilitate understanding and engagement.	Pupils engage with the challenging word problem and provide solution to the problem.

Step 4 Collaboration of problem solving	10	Teacher encourages the teams to work together by allowing the pupils to take ownership of the problem-solving process and devise strategies to solve it.	Pupils analyse the word problem, identify relevant information and devise strategies for solving it.
Step 5 Assessment of understanding	10	The teacher assesses the pupils' understanding of the problem-solving by giving them some questions to solve using problem-solving skills. <u>Questions:</u> 1. Two consecutive whole numbers are such that twice the smaller added to the greater make a total of 52. Find the smaller number. 2. Ife is older than Feranmi, Tolu is older that Ife, and Feranmi is older than Fikayo. Who is the oldest? 3. Tom and Henry share 102 sweets so that Henry has 5 times as many as Tom.	Pupils solve the given questions for assessment of understanding.

		How many does Tom gets? 4. In a school, there are twice as many boys as there as girls. If the school population is 540, how many boys are in the school? 5. In an examination, a girl has to spend x minutes in part A and 25minutes in part B of the questions. How long is the examination? 6. A man is four times as old as his son, if the difference between their ages is 21, what is the son's age? 7. Two taps running at the same rate can fill a tank in 45minutes. How long will it take one tap to fill the same tank? 8. Adeyemi who is 15 years old is 3 years older than his younger brother Ojo. If oloyede their eldest brother is 21 years old, what is the average age of the three brothers? 9. A gardener has 68 bundles of flowers each containing 10 flowers. How many bundles would he have made if he had put 17 flowers in each bundle? 10. If a father is 20years older than his son. What was the sum of their ages 7 years ago assuming the son's	

		present age x years? 11. Twice Biola's age now is the same as four times her age two years ago. How old is Biola now?	

Appendix IV

Teaching Instructional Guides

Control Group III (Traditional Teaching Strategy)

Lesson Note 3

School:	As Applicable
Subject:	Mathematics
Class:	Primary 4
Date:	As Applicable
Average Age:	9 years
Population:	As Applicable
Period:	1
Duration:	35 Minutes
Topic:	Word Problems
Instructional Materials:	Concrete objects (sweet, bread, bell, flowers etc.)
Behavioral Objectives:	At the end of the lesson, pupils would be able to:
	(a) identify the nature of various word problems
	(b) interpret different types of word problems in Primary school Mathematics and
	(c) solve various word problems involve in Primary school Mathematics
Entry Behavior:	pupils are familiar with basic arithmetic operations (addition, subtraction, multiplication and division)

Presentations:

Content Development	Time (Mins)	Teacher's Activities	Pupils' Activities
Step 1 Introduction	5	Teacher introduces the topic of word problems and its relevance to everyday life by emphasising the importance of applying mathematical concepts to solve real-world problems.	Pupils apply mathematical concepts in solving word problems.
Step 2 Presentation of word problems	5	Teacher presents a series of word problems to the class starting with simpler examples and generally increasing in complexity.	Pupils learn some given word problems questions.
Step 3 Explanation of problem-solving strategies	10	Teacher teaches the pupils various common problem-solving strategies by identifying key information translating words into mathematical expressions or equations, choosing appropriate operations and checking solutions for	Pupils translate word into mathematical expressions or equations and solve them correctly.

		reasonableness.	
Step 4 Independent practice	5	Teacher allows the pupils to work independently to solve a set of word problems which provide opportunities for them to apply the problem-solving strategies they have learned.	Pupils solve a set of word problems independently.
Step 5 Assessment of understanding	10	The teacher assesses the pupils' understanding of the problem-solving by giving them some questions to solve using problem-solving skills. <u>Questions:</u> 1. Two consecutive whole numbers are such that twice the smaller added to the greater make a total of 52. Find the smaller number. 2. Ife is older than Feranmi, Tolu is older that Ife, and Feranmi is older than Fikayo. Who is the oldest? 3. Tom and Henry share 102 sweets so that Henry has 5 times as many as Tom. How many does Tom gets? 4. In a school, there are twice	Pupils solve the given questions for assessment of understanding.

		as many boys as there as girls. If the school population is 540, how many boys are in the school? 5. In an examination, a girl has to spend x minutes in part A and 25minutes in part B of the questions. How long is the examination? 6. A man is four times as old as his son, if the difference between their ages is 21, what is the son's age? 7. Two taps running at the same rate can fill a tank in 45minutes. How long will it take one tap to fill the same tank? 8. Adeyemi who is 15 years old is 3 years older than his younger brother Ojo. if Oloyede their eldest brother is 21 years old, what is the average age of the three brothers? 9. A gardener has 68 bundles of flowers each containing 10 flowers. How many bundles would he have made if he had put 17 flowers in each bundle? 10. If a father is 20years older than his son. What was the sum of their ages 7 years ago assuming the son's present age x years? 11. Twice Biola's age now is the same as four times her	

		age two years ago. How old is Biola now?	

Bio–data

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Educational Background with dates

- **Primary Education**

  St. Micheal Primary School, Oke Seni, Ibadan
  Primary School Leaving Certificate (Testimonial) July, 1990

- **Secondary Education**

  Baptist Secondary School, Oke-Ado, Ibadan
  Senior Secondary Certificate Examination (SSCE) July, 1996

- **Tertiary Education**

  Nigerian Institute of Journalism, Iyaganku, Ibadan
  National Diploma in Journalism (ND) March, 2000

  Oyo State College of Education, Oyo
  National Certificate of Education (NCE) May, 2006
  (*Mathematics/Economics*)

  Lead City University, Ibadan
  B.Sc. (Edu) Mathematics Education 2021

  Lead City University, Ibadan
  M.Sc. (Edu) Mathematics Education (in view) 2022 –

Work Experience with dates

Today's Total Academy, Eleyele, Ibadan *(HeadTeacher)*	2001 – 2003
Sacred Heart Private School, Onireke, Ibadan (*Class Teacher/Head of Department*)	2003 – 2006
All Saints' Church School, Jericho, Ibadan (*Assistant Head-Teacher*)	2006 till date

Membership of Professional Organisation

Teachers Registration Council of Nigeria (TRCN)	2013

Referees:

- Awotoye Olayiwola Simon

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The University Compliance Certification

This is to certify that this Thesis by Stephen Sunday AWOTOYE with the matriculation number LCU/PG/003151 in the Department of Science Education, Faculty of Education, Lead City University, Ibadan, Oyo State is in full compliance with the approved University format and style.

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Signature **Date**