Chapter One

Introduction

1.1 Background to the Study

Word problem is a Mathematical question or exercise written in a sentence, story and picture to be interpreted into figure or number. Word problem helps students begin to understand that Mathematics is not just about numbers on a page but a way of representing relationship in the world. Word problems are typically defined as complex, scholastically presented, issue-based descriptions that involve the application of Mathematical concepts to resolve queries or questions arising from a given situation. These problems differ distinctly from traditional arithmetic exercises conveyed through written or oral formats such as 4 + 5 and genuine real-world issues encountered in everyday life. While the latter category of problems can also be addressed using Mathematical techniques, their formulation often lacks clarity regarding specific question(s), relevant numerical information, appropriate mathematical operations, acceptable solutions, and other crucial details[1].

By contrast, word problems offer a structured environment in which students can develop their problem-solving skills by applying mathematical methods to resolve precisely stated issues. However, these academic constructs diverge significantly from the true, authentic problems commonly faced in daily life, which frequently involve imprecise or ambiguous conditions, requiring sophisticated cognitive transfers between the real world and mathematical frameworks. Authentic problems may require flexible thinking, creative problem-solving strategies, and the ability to navigate uncertain or incomplete

information, which are not always present in word problems. Additionally, word problems tend to focus on straightforward calculations based on the explicit numerical data provided in the problem statement, whereas real-world issues often entail multiple variables, complex relationships, and dynamic systems that must be navigated to arrive at a solution[1].

The word 'Mathematics' comes from the ancient Greek word 'Mathema'. Mathema means what one learns or what one get to know. Mathematics is the branch of Science that studies number form and their relationship. Mathematics in a broader sense is a body of knowledge that include topics such as Number (Arithmetic and number theory), Formula and Associated structure (Algebra), Shapes and the spaces in which they exist (Geometry),and so on.

Mathematics holds a prominent position in the academic curriculum from preschool to high school, with its significance, owing to the global emphasis on Science, Technology, Engineering and Mathematics. Proficiency in Mathematics is associated with individuals' decision-making abilities.

Mathematical problems can be classified along a continuum of authenticity, ranging from arithmetic word problems presented in a scholars' problems that reflect real-life situations solvable using Mathematics[2].

Stakeholders in Mathematics globally have expressed thier concern over the decline in academic performance of students, particularly in the area of word problems. This is equally a problem in Oyo State, as buttress by the results of National and School Examination, such as Common Entrance Examination, which Basic 6 pupils take before

entering secondary school. In 2020, 62.29% of pupils received grades A to C in Mathematics in the State Common Entrance Examination, which increased slightly to 64.81% in 2021. However, there was a low percentage compared to the other subjects. The reason for this poor performance is students' lack of skills in solving Mathematics word problems, which are crucial part of the questions in public examinations and the Mathematics syllabus[4].

Mathematical proficiency is an essential skill for contemporary students, enabling them to engage in conceptual reasoning, problem-solving, information analysis and effective communication. This competence is crucial not only in mathematics classrooms but also in everyday life. The aptitude to comprehend and apply mathematical principles has a profound impact on students' prospect in academic achievements as well as their prospects and choices concerning future career paths, as acknowledged by the National Mathematics Advisory Panel and the National Council of Teachers of Mathematics[6].

Mathematics is frequently perceived as a pivotal component that establishes a connection between theoretical concepts and practical real-world applications. Illustrating the correlations between Mathematics and real-life scenarios within the context of everyday experiences is crucial during the initial stages of teaching and learning Mathematics in primary education. Consequently, an effective approach to establishing solid groundwork involves imparting fundamental skills to students, enabling them to effectively solve Mathematical word problems. Notably, the utilization of various forms of representation is closely linked to successful comprehension and resolution of Mathematical word problems[7].

Mathematics plays an indispensable role in modern education because of their profound impact on individual comprehension and the application of diverse aspects of personal, social, and civic life. As a universal language of science, Mathematics facilitates effective communication and description of real-world scenarios, making it an essential tool for problem solving and decision making in everyday existence. Given the paramount significance of Mathematics in contemporary society, particularly in the context of technological advancements, the study of Mathematics remains a fundamental component of the secondary school curriculum. Furthermore, the acquisition of mathematical knowledge serves as a foundation for numerous scientific and technological career paths. Despite its overall importance and crucial value, students' performance in public examinations, such as the West African Senior School Certificate Examinations and the National Examinations Council, has been disappointingly low[8].

Stakeholders are deeply concerned about students' academic achievement in Mathematics. The Trends in Mathematics and Science study conducted in 2020 revealed a distressing situation despite the implementation of a new school curriculum for the past two decades. The nation's education system continues to perform poorly on a global scale, particularly in terms of learner performance. This persistent issue in the education system has compelled the country to recognize the urgent need for a comprehensive reevaluation of its educational practices, with a particular focus on the domain of Mathematics[9].

In the years 2021, and 2022, the Basic Education Certificate Examination Mathematics Chief examiner reports highlighted several concerning issues among students attempting the examination. These reports revealed that a significant number of students encountered

difficulties in reading and comprehending Mathematical problems. Moreover, many struggled to translate word problems into Mathematical equations, with only a few attempting algebraic word problems with some level of success[12]. Furthermore, a study addressing Junior school 2 (JS2) students revealed a specific problem: Students faced challenges in learning algebra word problem. The research findings indicated a general inability among these students to translate word problems into algebraic expressions or represent mathematical statements symbolically. These findings underscore the struggles students face in effectively using algebraic techniques when presented with word problems. Thus, targeted interventions and instructional support are essential to bridge the gap and enhance students' achievement in algebraic problem-solving[12].

Sub-optimal academic performance in Mathematics within the Nigerian context remains a substantial source of apprehension for various stakeholders, including parents, educators, and governmental. Conventional pedagogical approaches have drawn criticism for their passivity, which impedes students' creative potential. To address this concern, there arises a pressing need to embrace more efficacious instructional methodologies, This is in line with the approach of the present study vis-a-vis the investigation of the use of a case-based strategy to teach word problems. The effectiveness of the self-instructional learning strategy shows that the adoption of new teaching strategies is required to improve academic performance in Mathematics, and word problems by extension[13].

Case-based learning is an instructional strategy that utilisoes real-life cases or situational scenarios to teach conceptual understandings to students. This approach involves presenting students with carefully crafted case studies, along with inquiry prompts, to

facilitate deliberate discussion and critical thought processes. The primary objectives of case-based learning are to provide students with hands-on experience in solving real-life dilemmas and to draw attention to key issues that the instructor seeks to convey to the learner, allowing the learner to demonstrate their comprehension by responding to the case situation[14].

Case-based learning originated at Harvard University in the 20th century, offering an alternative to conventional pedagogy. This approach demands proactive preparation from learners and employs a structured technique for knowledge acquisition. Instructors select specific cases to serve as the foundation for teaching, creating a realistic simulation of practical scenarios. Learners engage in multidimensional communication with instructors and peers, integrating theoretical principles with practical experiences. This method has gained popularity across various disciplines, including medicine, law, management, and others. When compared to traditional didactic approaches, case-based learning offers numerous advantages. Firstly, students exhibit higher levels of engagement and motivation, as they actively participate in their learning process. Secondly, case-based learning promotes the application and integration of knowledge, fostering collaborative problem-solving and critical thinking abilities. Additionally, the case study format allows for expert feedback and discussion, facilitating a deeper understanding of complex issues[15]. Case-based teaching method involves presenting students with realistic situations, enabling them to exercise their analytical and decision-making skills. This method emphasises the fusion of theory and practical, encouraging learners to connect abstract concepts with practical implications. By adopting case-based learning approach,

educators can capitalise on the diverse learning needs of their students, stimulating active involvement and enhancing long-term retention of knowledge. Well-designed case studies immerse learners in authentic scenarios, prompting them to grapple with nuanced challenges and derive meaningful insights[15].

Researchers have consistently advocated for the effectiveness of case-based learning in enhancing critical thinking skills, constructing active knowledge, and achieving academic success. A study corroborates and expands upon these findings in the domain of chemistry education, revealing that students taught via cases displayed a superior grasp of chemical kinetics concepts.

School curricula often fail to meet the needs of the people or emphasize practical learning. Furthermore, the monitoring of innovative policies and programs is lacking, exacerbating the challenges faced by education in Nigeria. As a consequence, students are no longer demonstrating self-direction and accountability involving immersion, passion, enthusiastic individualization, and exploration and an investment in the individual learning process[23].

Academic achievement, a subject of extensive research and debate, is closely linked to the impact of homework. Studies investigating the relationship between homework time and school results have produced varying results, indicating both positive and negative effects, as well as instances with no significant. The influence of homework on academic achievement is contingent upon the classroom environment, and the school's overall setting. The ongoing debate on the universality of homework's effects across different countries, regions, and cultures remains a topic of interest. Remarkably, Some countries

tend to assign more homework, and the effects on academic achievement appear to be more pronounced in English-speaking and European contexts compared to Asian students. Despite these observations, a conclusive agreement has not been reached, prompting researchers to continue their efforts in exploring how homework impacts academic achievement in diverse educational settings[26].

The importance of academic achievement cannot be understated, as evidenced by a study examining how learners' emotional intelligence, self-efficacy, and self-esteem relate to their performance in Mathematics. The findings revealed that these three psychological factors (emotional intelligence, self-efficacy, and self-esteem) have a positive connection to students' academic achievement in Mathematics. In other words, students who exhibit higher emotional intelligence, greater self-efficacy, and stronger self-esteem tend to perform better in mathematics. These results highlight the significance of these psychological variables in predicting and fostering academic success, emphasising their role in influencing students' achievements in various subjects, including Mathematics[27].

Academic achievement is crucial for a child's development because skills in subjects like reading and Mathematics influence various aspects of their life. These skills impact educational success, work performance, income, physical and mental health, and even life expectancy. As a result, various studies have focused on studying factors related to academic achievement and finding ways to use this knowledge to enhance learning and address learning difficulties through interventions and better instructional methods[27].

The significance of academic achievement is further buttressed by an investigation into the relationship between classroom environment and Mathematics achievement among

Junior secondary school two (JS2) students in Calabar, Cross River State, Nigeria. Specifically, investigation was carried out on the influence of class size and instructional materials on students' Mathematical performance. The findings of this research showed that academic achievement is affected by class size and the availability of instructional materials. This highlights the need to investigate academic achievement as the sole goal of teaching and learning process[28].

In the Nigerian context, studies have also shown the importance of academic achievement to Nigerian researchers and educators. Academic achievement was found to be positively influenced by students' proficiency in using Mathematical language in the subjects of physics, chemistry, and biology. The ability to apply Mathematical concepts effectively helped students to excel in problem-solving exercises in the subject. Various studies have demonstrated positive links between students' language skills and their academic performance in science and Mathematics especially where word problems are concerned[29].

1.2 Statement of the Problem

Students' academic achievement in word problems related questions has been an area of concern to many researchers in Mathematics over time. Reports from the Chief Examiners of the West African Examination Council (WAEC) have also indicated that many students have weaknesses in interpreting questions in word problems correctly which have severally resulted into students' poor achievement in Mathematics examinations at the Junior school level. Many factors have been identified as contributors to the poor performance exhibited by students in Mathematics among which are lack of

proficiency in English Language due to different types of environmental factors and students' gender. Many studies have been conducted to assist students to improve in word problem in Mathematics especially at the Junior secondary school level but to the best knowledge of the researcher not much has been done in the area of case-based strategy with a specific focus on Junior secondary school and in the Ibadan metropolis. It is on this note that this study filled the research gap and provide a solution with the established problems, hence this study on effect of case-based teaching strategy on academic achievement in Mathematics word problems among Junior Secondary School Students in the Ibadan metropolis, Oyo State.

1.3 Aim and Objectives of the Study

This study determined the effect of case-based teaching strategy on academic achievement in Mathematics word problems among Junior Secondary School Students in the Ibadan metropolis, Oyo State.

The objectives of the study are to:

i. determine the main effect of case-based teaching strategy on Junior |Secondary School Student's academic achievement in Mathematics word problems :

ii. examine the main effect of gender on Junior Secondary School Student's academic achievement in Mathematics word problems;

iii. ascertain the interaction effect of case-based teaching strategy and gender on Students academic achievement in Mathematics word problems.

1.4 Hypotheses

Ho1: There will be no significant main effect of case- based teaching strategy on students academic achievement in Mathematics word problems

Ho2: There will be no significant main effect of gender on Mathematics achievement in word problems among the Students.

Ho3: There will be no significant interaction effect of case-based teaching strategy and gender on academic achievement in Mathematics word problems among Junior secondary school students.

1.5 Significance of the Study

Implementing Case-based teaching strategy in Ibadan metropolis, Oyo State, can bring transformative changes to Mathematics education. By incorporating real-life scenarios that resonate with the local culture in mathematics at this level , this approach enhances students' engagement and academic achievement. Additionally, it help students grasp complex Mathematical concepts more effectively, leading to improved performance in standardised tests and academic assessments.

Overall, case-based teaching strategy would offers valuable and impactful approach to teaching Mathematics . Encouraging practical problem-solving in word problems, it has the potential to elevate students' academic achievement and foster a deeper understanding of Mathematics concepts. Embracing this innovative teaching methodology could be a promising step towards transforming Mathematics education and empowering students to excel academically, while preparing for real-world challenges.

The outcomes of the study would also be presented at learned academic conferences and journal publications for other teachers and academic scholars to benefit from.

1.6 Scope of the Study

This work focused on word problems, which take the form of algebra. The geographical scope covers School in Ibadan north local government and Ibadan south west local Government in the Ibadan metropolis, Oyo state. The study focused on Junior Secondary School Two students (JS2).

1.7 Limitation of the Study

The Study's primary objective centered around the determing the effects of case-based teaching strategy on academic achievement in Mathematics word problems in Algebra. This exploration was specifically conducted within the context of two Junior secondary school located in the Ibadan metropolis namely Humani Alaga High School Sango and Apata Grammar School Logudu Apata. Apata is in Ibadan south-west local government area,while Sango is located in Ibadan north local government area. The Student corporation with the time limit was considered and training of researh assistants.

1.8 Operational Definition of Terms

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

Case-based Teaching Strategy: This refers to the use of real life scenarios/instances or near real-life scenario/instances to teach mathematical word problems and thus facilitate critical cum analytical thinking and problem-solving skills in the students who participated in the study.

Traditional Method of Teaching : It is the use of teacher centered approach which entails learning, lecturing and use of text book for teaching and learning.

Gender: It refers to the categories of students, either male or female. It is a moderating variable that is included to investigate whether the effect of case-based teaching strategies on academic achievement in Mathematics word problems varies between male and female students. This variable was recorded as "male" or "female" to distinguish between the two categories of students.

Word Problem: This refers to the presentation of a mathematical problem mostly in words rather than numbers.

Academic Achievement: It refers to the performance of students in mathematics achievement Test in word problems.

Control group: This is the group that were taught algebraic word problems by research assistant using conventional teaching strategy.

Experimental Group: This is the group that were taught word problems by the research assistant using case-based teaching strategy.

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Chapter Two

Literature Review

This chapter reviewed the related literature in the study under the following sub-headings:

2.1 **Conceptual Review**

2.1.1 Academic Achievement in Mathematics

2.1.2 Word Problem in Mathematics

2.1.3 Case-based Teaching Strategy

2.1.4 Concept of Gender

2.2 **Theoretical Framework**

2.2.1 Cognitive Load Theory

2.2.2 Constructivist Learning Theory

2.3 **Review of Empirical Studies**

2.3.1 Case-based Teaching Strategy and Academic Achievement in word problems in Mathematics

2.3.2 Gender and Academic Achievement in Mathematics

2.4 **Conceptual Model**

2.5 **Summary of Gap in Literature Reviewed**

2.1 Conceptual Review

2.1.1 Academic Achievement in Mathematics

In the domain of academic research, the notion of academic achievement is multifaceted, encompassing a diverse range of factors and results arising from formal educational encounters. While it was formerly considered the primary educational outcome, modern researchers and policymakers have come to recognize the importance of social and emotional factors in shaping the well-being and psychological growth of students. This shift in perspective has spurred a greater examination of the connection between academic achievement and these socio-emotional aspects, prompting the inclusion of metrics like emotional regulation, task performance, and holistic skills within the established measures employed in the field of education[12].

There are several critical dimensions of academic achievement that merit investigation. Firstly, scholars are now paying increasing attention to social and emotional factors, recognizing their contribution to student well-being and success. These factors include emotional regulation, task performance, and multifaceted competencies. Moreover, the concept of academic buoyancy, which reflects students' ability to bounce back from academic setbacks, has emerged as a predictor of academic achievement when considered in conjunction with self-concept. Additionally, psychological capital resources, such as efficacy, hope, optimism, and resilience, have been found to play a significant role in fostering student engagement and accomplishment[12].

Mathematics academic achievement is a major source of concern to researchers in the educational sector all over the world. Its relationship with various factors is investigated

in order to improve the teaching cum learning process. These investigations are carried out by researchers on the global space and also locally. Academic achievement pertains to the advancement made in obtaining educational skills, materials, and knowledge across various subjects. It is focused on accomplishments within academic environments rather than the general acquisition of knowledge in non-academic contexts[24].

Academic achievement is of paramount important, as evidenced by the research findings that highlight its strong correlation with higher levels of mindfulness, as measured by the Mindful Attention Awareness Scale among over 2,000 urban United State students in Grades 5–8. The study reveals that students with greater mindfulness achieved better academic outcomes, including higher Grade Point Averages, improved scores in statewide tests for English Language Arts and Mathematics, better attendance, and fewer suspensions. Remarkably, mindful positive impact on academic achievement persists even after considering demographic factors and previous academic performance, underscoring its unique contribution to academic success beyond individual student characteristics. Furthermore, the study shows that this does not only predicts current academic performance but also fosters improvements in academic achievement over time. These consistent positive associations between mindfulness and academic outcomes across all demographic groups emphasize its significance as a powerful tool for enhancing academic achievement in school settings[25].

Furthermore, research has explored the relationship between academic achievement and learning climate support, post-traumatic stress, depression, self-efficacy, and academic challenges. Notably, self-efficacy, fewer academic challenges, and supportive, autonomy-promoting learning environments have been positively associated with achievement, regardless of depression or post-traumatic stress levels. Achievement goals, including mastery-oriented goals and self-determined motivation, have also been identified as important determinants of academic success. Early autonomous motives have been linked to subsequent mastery-oriented goals and increased autonomous motivations in subsequent years. Lastly, the use of certain social network sites has been found to contribute to procrastination and mal-adaptation to university life. In contrast, less complex sites have been associated with fewer negative outcomes. Considering these insights, it is evident that integrating social and emotional learning strategies into teaching and learning at all educational levels is crucial for enhancing both students' academic achievement and their overall well-being[12].

2.1.2 Word Problems in Mathematics

Word problems are Mathematical problems that are presented in the form of verbal descriptions of problem situations. These problems raise one or more questions, the answer to which can be obtained by applying mathematical operations to numerical data available in the problem statement. Word problems can be viewed as "short stories of adventure and industry with the end omitted" or as "religious or philosophical parables in their non-deictic, 'glancing' referential relationship to our experienced lives." They have also been described in terms of the structural components that characterize them,

including the mathematical structure, semantic structure, context, and format. When viewed as "genuine problems," they are also associated with the position and state of problem solver required to solve them, such as the problem solver wanting something but not knowing immediately how to get it[11].

In a study of Mathematics teachers' thinking in the teaching of contextual or word problems, it was found that teachers conceptualised word problems in eight different ways. These conceptions played a significant role in framing their teaching of word problems in terms of four teaching perspectives, including a paradigmatic and a phenomenological approach. The eight ways of characterizing word problems that emerged from the teachers' thinking and classroom behaviors are:

1. Word problems as computation/algorithm: This view is associated with the simplicity of the word problems based on their transparent semantic structure,that is, they have language that explicitly suggests the solution to the situation.

2. Word problems as problem: This is viewed in three ways:

a. The relationship between student and problem: All word problems are real problems if students have not encountered them before.

b. The nature of problem/solution: This is viewed in terms of two situations. First, there are problems for which students must deduce a structure to determine a solution. Second, there are problems for which students must impose a structure on the problem to create a solution.

c. The teacher's intent: This relates to when and how a word problem is introduced to students by the teacher.

3. Word problems as enigma: This view is associated with word problems that students cannot relate to contextually and/or mathematically.

4. Word problems as object: This view treats word problems as consisting of universal properties independent of the student.

5. Word problems as contextualised mathematics: This view treats word problems as a way to frame mathematics and not seen as a separate topic.

6. Word problems as experience: This view considers word problems in terms of a phenomenological relationship between word problems and the student.

7. Word problems as a model of nesting of Mathematics and social contexts: This view treating word problems as a model of the interplay of Mathematics and social contexts.

8. Word problems as a model of the interplay of Mathematics and language: This view treating word problems as a model of the interplay of Mathematics and language.

These different conceptions of word problems reflect the complexity of the task of teaching and learning Mathematics through word problems. Teachers' conceptions of word problems play a significant role in framing their teaching of word problems, and understanding these conceptions is important for teacher development and improving the teaching of Mathematics[11].

According to some scholars, word problems can be described in terms of four structural components that characterise them. These components are:

i.) The Mathematical structure: This refers to the nature of the given and unknown quantities involved in the problem, as well as the kind of Mathematical operation(s) by which the unknown quantities can be derived from the givens.

ii.) The semantic structure: This refers to the way in which an interpretation of the text points to particular Mathematical relationships. In other words, it is the language used in the problem that suggests the mathematical operations needed to solve it.

iii.) The context: This refers to what the problem is about. The context can be real-world situations, such as problems involving money, time, or distance, or it can be purely mathematical, such as problems involving geometric shapes or algebraic expressions.

iv.) The format: This refers to how the problem is formulated and presented. The format can include the use of diagrams, tables, or graphs, as well as the way in which the problem is worded and structured.

Understanding these four structural components is important for solving word problems effectively. By analyzing the mathematical, semantic, contextual, and formatting aspects of a problem, students can identify the relevant information, determine the appropriate mathematical operations, and arrive at the correct solution[11].

2.1.3 Case-based Teaching Strategy

Case-based teaching strategy in the realm of teacher education refers to an instructional methodology that integrates authentic and complex real-life scenarios, termed "Case," as central catalysts for cultivating a comprehensive understanding of the multifaceted dynamics inherent in the practice of teaching and learning. This approach is grounded in the conviction that the simulation of actual classroom situations through these cases engenders opportunities for students to immerse themselves in reflective and critical processes, ultimately fostering higher-order thinking skills[1].

At its essence, case-based teaching strategy harnesses the potency of storytelling to ignite a sense of curiosity and relevance within students. It acknowledges that stories are an ancient and inherent mode of human sense-making, allowing individuals to interpret their surroundings, create connections, and shape their cultural identities. By integrating captivating narratives into the learning process, this strategy transcends mere dissemination of facts and theories, instead inviting students to immerse themselves in tales that animate abstract concepts, pose inquiries with real-world consequences, or confront challenges intertwined with societal significance[2].

Key attributes of successful cases, encompassing relevance, authenticity, engagement, and instructional value, are pivotal in steering the efficacy of this strategy. These cases, designed to mirror genuine educational challenges, serve as vehicles for students to explore and analyze multifarious aspects of the teaching profession. The strategy acknowledges that prospective teachers may initially engage with cases from singular perspectives, and thus, encourages facilitated discussions, whether in-person or online, to encourage the examination of diverse viewpoints and the reshaping of preconceived notions about teaching and learning[1].

Case-based teaching strategy embodies a dynamic and multifaceted approach that resonates deeply with the educational ideals of inclusivity, engagement, and sustained academic achievement. Rooted in the belief that every learner possesses unique strengths and perspectives, this strategy leverages the power of real-life narratives and complex scenarios to foster a supportive and diverse learning community, enhance student engagement, and bolster the lasting impact of educational pursuits[2].

The potency of case-based teaching strategy is substantiated by a substantial body of literature extolling its merits, encompassing benefits such as heightened reflective cognition, enhanced critical thinking capabilities, and a deeper grasp of the intricate dimensions of pedagogical interactions. Notwithstanding these advantages, challenges persist, necessitating the careful curation of cases in accordance with educational objectives and the incorporation of core attributes. Moreover, the deliberate orchestration of discussions, whether within physical classrooms or virtual platforms, is paramount to fostering effective case-based experiences, thereby enhancing students' learning journeys[1].

In summation, case-based teaching strategy entails an instructional paradigm in teacher education predicated on the integration of authentic cases, mirroring real-world teaching complexities, to stimulate robust reflective thinking, higher-order cognitive skills, and an in-depth grasp of pedagogical intricacies. This pedagogical framework emphasizes experiential learning, critical dialogue, and multifaceted understanding, culminating in the holistic development of prospective educators[1]

A scholar emphasized the intrinsic connection between the process of knowledge construction and learners' endeavors to derive significance from their individual experiences. The educational viewpoint of constructivism underscores the pivotal importance of encountering knowledge firsthand to facilitate its assimilation. This perspective also underscores the necessity for knowledge to be firmly grounded in experiential comprehension for a comprehensive engagement with information. Within the domain of constructivist learning, the focal point shifts from merely tangible learning outcomes to the intricate journey of the learning process[3].

Embedded within the constructivist framework is the advocacy for learners to cultivate their understanding by adeptly utilising information, thereby emphasising the active role of learners as perpetual knowledge seekers. Furthermore, educators are encouraged to provide avenues for learners to explore and gain profound insights into subjects that personally resonate with them. In the constructivist classroom setting, the active participation of every learner stands as a paramount principle, and the establishment of an environment conducive to knowledge construction demands adaptability and a firm commitment to a student-centric approach[3].

Situated Learning: This theory accentuates the significance of learning within the context where its application is intended. Case-based teaching serves as a conduit, offering learners authentic scenarios that emulate real-world situations. This allows them to grasp the practical relevance and application of theoretical concepts in genuine settings. Situated learning exerted a substantial influence on educational discourse. This construct diverges markedly from conventional cognitive learning frameworks, heralding a pivotal shift in the comprehension and organisational principles of knowledge within both pedagogical and vocational domains[4].

Fundamentally, learning theory posits that the most effective transmission of knowledge occurs when it is embedded within authentic contexts. This approach nurtures a seamless amalgamation of theoretical comprehension and pragmatic application. The core of this construct revolves around the proposition that newcomers should be immersed in genuine scenarios reflective of everyday practices. This immersive experience facilitates not only experiential learning but also the practical utilisation of artifacts within meaningful

contexts. This immersive process finds its setting within a community of practice," marked by active social interaction and collaborative engagement. As learners navigate this phase, a natural progression occurs, guiding them towards more complex and dynamic activities, culminating in the role of adept practitioners[4].

In response to this disconnect, some philosophers introduced a pedagogical methodology aimed at immersing learners in authentic practices through active engagement and social interaction. This strategy is thoughtfully designed to acculturate students into authentic practices through activity and social interaction. Concurrently, some delineated learning as a multifaceted process that encompasses the assimilation, preservation, and challenging of meanings embedded within an organization's cultural artifacts. This viewpoint resonates with some assertion that learning embedded within its social and physical fabric yields superior efficacy when contrasted with detached learning paradigms[4].

Consequently, the educational significance of situated experience as a medium for classroom instruction has garnered increasing recognition. This pedagogical approach not only bridges the gap between theoretical knowledge and its real-world applications but also elevates learning efficacy through the fusion of experiential encounters and collaborative interactions. Thus, situated learning emerges as a transformative paradigm in education, steering towards a refined path of comprehensive and contextually meaningful knowledge acquisition[4].

An early recognition of the mismatch between task-related cognitive demands and their objectives stemmed from studies exploring the interrelationship between learning and problem-solving dynamics. These investigations illuminated instances where subjects

managed to solve problems repeatedly, while remaining oblivious to the underlying fundamental structures. This paradox prompted the hypothesis that the employed search strategies, although effective for problem-solving, fell short as conduits for meaningful learning. The cognitive load entailed in these strategies impeded authentic learning experiences[5].

Numerous experiments have unveiled the detrimental repercussions of conventional problem-solving methodologies on learning outcomes. This body of evidence underscores the dubious efficacy of extensive problem-solving exercises particularly in fields such as Mathematics and science[5].

To mitigate the adverse impact of certain problem-solving strategies on learning, the employment of worked examples has been proposed. Research works demonstrated that a significant integration of worked examples led to faster learning compared to a focus on solving numerous problems. These worked examples have shown efficacy, particularly when learners can process and comprehend them adeptly. Notably, proficient students exhibited superior abilities to deconstruct and elucidate worked examples, underscoring the importance of accurate processing[5].

In conclusion, cognitive load theory posits that the presentation of information can inadvertently contribute to extraneous cognitive load, influencing the ease of learning facilitation. This underscores the significance of conveying information in ways that minimize extraneous cognitive load. Conventional problem-solving techniques often fall short in this regard. Alternatives like worked examples can be potent, provided they align

with this principle. As a result, worked examples demanding mental integration of multiple information sources may potentially impede learning progress[5].

Case-based : While distinct, case-based teaching shares commonalities

With Case-based learning. Case learning centers on presenting learners with open-ended problems, encouraging collaborative investigation and problem-solving. Similarly, case-based teaching engages students in critical thinking, problem-solving, and collaborative discussions. Originating at McMaster University in the mid-1960s, case-based learning has evolved significantly from its initial departure from traditional didactic methods, gaining worldwide recognition. This evolution has shifted its original doctrinal stance to accommodate diverse manifestations. Case-based learning contemporary essence revolves around key elements, including the utilization of authentic and intricate problems to initiate learning, the cultivation of self-directed and self-regulated learning, collaborative group engagement for collective problem-solving, and a facilitative role for educators in the learning process. This evolution, while rooted in experiential insights, necessitated reconciliation with contemporary educational and cognitive psychological research[6].

Central to case-based learning current construct are pivotal attributes:

Authentic Problem Engagement: Case-based learning foundation lies in integrating real-world problems as catalysts for learning, aligning with educational design theories advocating experiential knowledge application[6].

Self-Directed Learning: Case-based learning underscores students' autonomy, enabling self-assessment and learning regulation, in alignment with self-determination theory promoting intrinsic motivation and lifelong learning tendencies[6].

Collaborative Group Dynamics: Case-based learning draws from collaborative learning theories, facilitating effective teamwork and collective problem-solving skills, fostering communication, negotiation, and cooperative competencies[6].

Facilitative Educator Role: Case-based learning transforms the traditional teacher-student paradigm, with educators as facilitators guiding discussions, providing resources, and stimulating critical inquiry[6].

Nonetheless, the challenge remains in designing assessments that align with Case-based learning multifaceted objectives. The concept of constructive alignment, proposed by Biggs, underscores the necessity for congruence between intended learning outcomes, instructional activities, and assessment methods[6].

Two critical tensions in case-based learning assessment surface:

Holistic Skill Development: Case-based learning extends beyond knowledge acquisition to encompass skills like clinical reasoning and interpersonal communication. However, assessing these domain-independent skills is intricate, often misaligned with conventional cognitive assessment approaches[6].

Self-regulation and External Evaluation: While case-based learning emphasizes self-regulation, conventional teacher-led assessments endure. Balancing the cultivation of self-assessment skills with external evaluation requirements poses a challenge[6].

This scholarly exploration delves into these tensions and examines assessment paradigms seeking to achieve constructive alignment within the case-based learning framework. It acknowledges broader shifts in education and assessment paradigms influencing the pursuit of constructive alignment within case-based learning, underscoring the dynamic

evolution of education catering to contemporary learners' needs and evolving professional requisites[6].

Social constructivism is a learning theory that emphasizes the importance of social interaction and collaboration in the learning process. It was developed by Lev Vygotsky, a post-revolutionary Soviet psychologist, who believed that learning takes place primarily in social and cultural settings, rather than solely within the individual. The theory focuses heavily on dyads and small groups, with students learning primarily through interactions with their peers, teachers, and parents. Successful teaching and learning is heavily dependent on interpersonal interaction and discussion, with the primary focus on the students' understanding of the discussion. One of the core constructs of Vygotsky's theory is the zone of proximal development (ZPD), which emphasises the role of the teacher in an individual's learning. The ZPD suggests that, with the help of an teacher, students are able to understand and master knowledge and skills that they would not be able to on their own. In this theory, the teacher plays an integral role in the students' acquisition of knowledge, rather than serving as a passive figure[7].

Case-based teaching is an example of social constructivist teaching strategy that often involve group discussions and peer interactions, promoting the exchange of diverse perspectives and fostering collaborative learning. Case base teaching can also be viewed as a form of social constructivist, as it emphasizes the active role of the students within therapy and the didactic nature of case base teaching. The therapist serves as an educator who provides the student with information about their disorder and its causes, as well as instruction on how to engage in cognitive restructuring or behavioral exercises.

Throughout treatment, the therapist helps the students become the expert on their own problems and how to "treat" these problems using case base teaching techniques[7].

Experiential learning is a philosophy of education based on a theory of experience that involves a creative tension among four learning modes that is responsive to contextual demands. Case-based teaching is aligned with the principles of experiential learning, where learners acquire knowledge through direct experiences. Analyzing and discussing cases allows students to reflect on and learn from their experiences, leading to deeper understanding and knowledge retention. Experiential learning theory draws on the work of prominent 20th-century scholars who gave experience a central role in their theories of human learning and development.

2.1.4 Concept of Gender

Gender transcends as the mere classification of individuals as male or female. It encompasses a spectrum of identities and expressions, from masculinity to femininity and everything in between[28]. These identities can be fluid, evolving, and unique to each person. The study of gender goes beyond the surface, delving into the intricate web of norms, stereotypes, and expectations that society has woven around these identities. Gender is a multifaceted concept that permeates every aspect of society, including education. Recognizing its intricate nature and its potential impact on teaching and academic achievement is crucial for creating an equitable educational system. Some key aspects of the concept of gender are:

i. Gender identity is an individual's deeply held sense of their own gender, which may or may not align with the sex assigned to them at birth[29]. Some people identify as gender,

where their gender identity aligns with their assigned sex, while others identify as transgender, where there is a disconnect between their gender identity and assigned sex.

ii. Gender expression refers to the way individuals outwardly express their gender identity, which can include clothing, mannerisms, speech patterns, and more[30]. It can be diverse and is not necessarily tied to one's biological sex.

iii. Gender roles are societal expectations and norms regarding how individuals of different genders should behave and the roles they should fulfill[31]. These roles can vary significantly across cultures and time periods.

iv. Gender stereotypes are preconceived notions and beliefs about what is considered typical or appropriate for individuals of different genders[32]. These stereotypes can be limiting and contribute to inequality and discrimination.

v. Traditionally, many societies have adhered to a binary understanding of gender, recognizing only male and female. However, a more inclusive perspective acknowledges that gender exists on a spectrum, with a wide range of gender identities beyond just male and female[33]

vi. Gender intersects with other aspects of identity, such as race, ethnicity, class, sexual orientation, and disability. This intersectionality can lead to unique experiences and challenges for individuals[34]

vii. Legal and social recognition of gender identity varies around the world35. Many countries have made efforts to acknowledge and protect the rights of transgender and

non-binary individuals, including legal recognition of gender changes and protections against discrimination.

viii. Gender equity advocates work to address inequalities and discrimination based on gender[36]. Feminism is a movement that seeks to promote the rights and equality of women but has evolved to encompass a broader range of gender-related issues.

It is important to note that discussions about gender are evolving, and there is increasing recognition that gender is not solely determined by biological factors but is shaped by social and cultural influences. Respect for diverse gender identities and expressions is a fundamental aspect of promoting inclusivity and equality in society. Gender in Mathematics achievement have been a subject of study and discussion for many years. There have been gender differences in Mathematics achievement, with some studies showing that, on average, boys have outperformed girls in Mathematics. However, these differences have been diminishing over the years and have become much less pronounced in recent research. Stereotype threat can impact gender differences in Mathematics achievement. When individuals believe in gender stereotypes suggesting that one gender is superior in Mathematics, it can create anxiety and hinder performance, particularly for girls. Addressing and dispelling such stereotypes is important[36]. Cultural and societal norms can influence gender differences in Mathematics achievement. In some cultures, girls have been discouraged or faced barriers in pursuing mathematics-related fields.

2.2 Theoretical Framework

2.2.1 Cognitive Load Theory: This theory highlights the finite nature of learners' cognitive capacities, indicating that their ability to process information is influenced by the complexity of the learning materials. Case-based teaching frequently offers information in a contextualized and well-structured manner, a strategy that aids in managing cognitive load and improving the efficiency of learning. Cognitive load theory, delves into the intricate interplay of cognitive resources during learning and problem-solving endeavors. This theory significantly raises concerns about the alignment between cognitive activities and the intended learning and problem-solving objectives, particularly within instructional frameworks. It emphasizes that certain learning and problem-solving approaches inadvertently prompt students to engage in cognitive processes that divert from the core task goals. The surplus cognitive load generated by these supplementary activities could potentially hinder skill acquisition[5]

The global submission on proficiency in Mathematics expressed in the two preceding paragraphs is further buttressed by a study carried out in Borno state, Nigeria aimed at elucidating and evaluating students' proficiency in solving word problems. The outcomes of the study indicate that senior school students encounter challenges in linking Mathematical concepts, solving problems with fractions, and selecting appropriate Mathematical formulas or concepts. Furthermore, the findings highlight difficulties in connecting Mathematical concepts, transforming problems, and verifying answer accuracy. Consequently, the study recommends the adoption of a practical approach centered on real-world Mathematical problems and other strategies that offer students

opportunities to engage in solving Mathematical problems when addressing word problems in learning environments[5].

Cognitive load theory has been instrumental in explaining why the study of worked examples can enhance learning, in contrast to traditional problem-solving approaches. The extensive cognitive effort required for searching problem-solving strategies detracts attention from essential learning components. In contrast, well-structured worked examples similar problems, thereby guiding attention more effectively. However, the efficacy of worked examples isn't uniform in all cases. Instances where worked examples may not boost learning have been identified, particularly when grappling with the integration of multiple information sources. Such examples often necessitate the mental integration of disparate elements, potentially dispersing attention and hindering learning. A research work supports this notion, revealing that worked examples requiring divided attention might be less effective than problem-solving. Nevertheless, modifying these examples to minimize split attention has demonstrated improved learning outcomes[5].

A study further supports this submission and highlights the considerable challenges African immigrant learners present to the learning and teaching environment in South African schools. Among the challenges, a significant concern is faced by early learners, especially in the context of Mathematics word problems, where they grapple with acquiring English proficiency, which serves as the Language of Teaching and Learning for the curriculum. Additionally, these learners must develop their Mathematics word problem-solving skills[10].

Similarly, another study focusing on Ghanaian students reinforces this submission by stating that language barriers often hinder students' ability to understand and learn word problems[11].

The theory is built on six propositions that are shared by these scholars. Learning is best conceived as a process, not in terms of outcomes. All learning is relearning. Learning requires the resolution of conflicts between dialectically opposed modes of adaptation to the world. Learning is a holistic process of adaptation to the world. Learning results from synergetic transactions between the person and the environment. Learning is the process of creating knowledge. Immediate or concrete experiences are the basis for observations and reflections. These reflections are assimilated and distilled into abstract concepts from which new implications for action can be drawn. These implications can be actively tested and serve as guides in creating new experiences. Analyzing and discussing cases allows students to reflect on and learn from their experiences, leading to deeper understanding and knowledge retention. Therefore, experiential learning is a powerful tool for enhancing learning in higher education, and case-based teaching is an effective method for implementing experiential learning principles in the classroom[8].

2.2.2 Constructivist Learning Theory

Constructivism serves as an epistemological viewpoint, offering an explanation for how individuals attain their knowledge. At its core, constructivism posits that individuals formulate their own comprehension and awareness of the world by engaging with experiences and contemplating upon them. This theory emphasizes that learning is a personalized process intrinsic to each learner. This theory postulates that individuals will

endeavor to comprehend all the information they encounter, resulting in each person uniquely "constructing" significance from the given information[33] . The concept of constructivism is commonly associated with Jean Piaget, who detailed how learners internalize knowledge. Piaget proposed that by using accommodation and assimilation, individuals create fresh knowledge based on their experiences. Constructivism proves advantageous in Mathematics education as it fosters a more profound comprehension of mathematical concepts and motivates students to formulate their own approaches to solving problems. To effectively employ constructivist methods, meticulous forethought and groundwork are essential. Several elements impact the efficacy of constructivist methodologies, encompassing variables such as the students' age and skill levels, the duration of the intervention, and the employment of suitable assessment metrics[69]. Furthermore, in cases where an individual's experiences run counter to their internal conceptions, they might adjust their perceptions of those experiences to align with their internal frameworks. Constructivist assessment traditionally, classroom evaluation relies on tests. In this approach, the emphasis is on students providing accurate responses. Nevertheless, in constructivist education, the acquisition of knowledge is seen as equally significant as the end result. Hence, evaluation involves not solely exams, but also the observation of the student, their assignments, and their perspectives[35] .

Several assessment approaches encompass the following methods:

i. Verbal exchanges: The teacher introduces a "focus" question to students, fostering an open dialogue about the subject.

ii. KWL (H) Chart: This method involves documenting "What we know," "What we want to know," "What we have learned," and "How we know it." It serves as a continual assessment tool for monitoring student progress throughout the topic's study period.

iii. Concept Mapping: Students compile and categorize concepts and notions associated with a given topic.

iv. Hands-on tasks: Using manipulative and hands-on activities like geometric shapes, number lines, and other concrete materials can help students develop a deep understanding of mathematical concepts. For example, using physical objects to explore concepts like fractions or geometry can make abstract ideas more tangible. These activities prompt students to interact with their surroundings or specific educational materials. Teachers can employ checklists and observations to gauge students' proficiency with the designated materials.

v. Pre-testing: This assessment aids educators in gauging students' existing knowledge about a new topic, offering guidance for the subsequent course of study. Within the realm of cognitive constructivism, an individual's responses to experiences result in either the attainment or lack of attainment of learning outcomes[36] . Constructivist methodologies involve furnishing activities that leverage children's existing comprehension while aligning with their developmental stage. These activities should also present challenges, which, in turn, facilitate ongoing advancement through the mechanism of accommodation[37] . Both individual and collaborative tasks centered on problem-solving and project-based endeavors are deemed suitable in this context. Concrete activities are prioritized for younger children, whereas activities requiring symbolic and abstract

thinking are reserved for older students[38]. As per the model, the instructor's role is to impart this knowledge to the students, often accomplished through lecturing as the inherent approach.

Conversely, the students' responsibility is to assimilate this knowledge. Guiding Principles of Constructivism Proponents of constructivism offer variations of the following principles for effective instruction:

i. Prior Knowledge and Schema Theory: In mathematics, it's important to acknowledge and build upon students' prior mathematical knowledge and experiences. Teachers can use students' existing understanding of numbers, operations, and patterns as a foundation for new mathematical concepts. Schema theory proposes that individuals organize and categorize knowledge into mental frameworks or schemas. New information is assimilated into existing schemas or can lead to the creation of new ones[39] .

ii. Active Learning: Learning is most effective when learners actively engage with the material. This can involve problem-solving, critical thinking, hands-on activities, discussions, and collaborative projects. Active participation helps learners make connections and adapt their mental frameworks to accommodate new information[40] .

iii. Social Interaction: Social interactions play a crucial role in the construction of knowledge. Collaborative learning, group discussions, and interactions with peers and teachers help learners exchange ideas, challenge assumptions, and negotiate meaning. Vygotsky's socio-cultural theory is closely related to this aspect of constructivism[41] . Zone of Proximal Development (ZPD): Vygotsky's concept of the ZPD refers to the range of tasks that a learner can perform with the help of a more knowledgeable individual,

such as a teacher or a peer. It's the gap between what a learner can do on their own and what they can achieve with guidance. Effective learning occurs when instruction is tailored to a learner's ZPD[42] .

iv. Scaffolding: Just as in general constructivist education, scaffolding is used in Mathematics instruction. Teachers provide guidance and support to students as they work through Mathematical problems, gradually reducing the support as students become more independent[43] .

v. Student-Centered and Individualized Learning: Constructivist learning environments are student-centered, focusing on the learner's interests, needs, and pace[44]. Instruction is adapted to accommodate different learning styles and abilities, promoting a more personalized learning experience.

vi. Reflection and Meta-cognition: Encouraging students to reflect on their problem-solving processes and discuss their thinking helps them develop meta-cognition, or awareness of their own thought processes. This can lead to a deeper understanding of Mathematical concepts. Meta-cognition, or thinking about one's thinking, is essential for self-directed learning and continuous improvement[45] .

vii. Real-World Contexts: Learning is more meaningful when it occurs within authentic, real-world contexts. Showing students how mathematics is used in real-world situations can make the subject more relevant and meaningful. This can enhance students' motivation to learn Mathematics[46].

viii. Ownership and Motivation: When learners have ownership of their learning and can actively shape their educational experiences, they become more motivated and engaged.

Constructivist approaches foster a sense of ownership and empowerment, leading to increased intrinsic motivation[47] .

ix. Assessment as Understanding: Assessment in constructivist settings focuses on understanding and application rather than rote memorization. Performance based assessments, portfolios, and projects that require learners to demonstrate their understanding in practical ways are preferred over traditional exams[48] . These guiding principles of constructivism collectively contribute to a holistic and dynamic approach to learning, where learners are active participants in the process of constructing their knowledge and understanding of the world. Constructivist teaching encourages the development of critical reasoning and cultivates enthusiastic and self-reliant learners. This theoretical approach asserts that the process of learning consistently builds upon a student's existing knowledge, referred to as a schema. Because all learning is perceived through pre-existing mental frameworks, proponents of constructivism propose that active engagement in the learning process, as opposed to passive reception of information, enhances the effectiveness of learning. Numerous methodologies lay claim to being grounded in constructivist learning theory. The majority of these techniques involve some variant of guided exploration, wherein the teacher minimizes direct instruction and instead guides the student through questioning and activities, enabling them to uncover, discuss, value, and articulate new knowledge. Constructivist learning theory asserts that all knowledge is constructed on a foundation of prior understanding. Children aren't blank slates, and knowledge cannot be simply imparted; rather, it must align with the child's current conceptualizations for comprehension to take place. Hence, optimal child learning

occurs when they are given the opportunity to create an individualized comprehension through direct encounters and subsequent contemplation of those experiences[49]. The conventional method of teaching through lectures contradicts each of these principles. Assuming the constructivist learning model is embraced, and considering the substantial supporting research, effective instruction must orchestrate situations that prompt students to independently formulate knowledge. This could involve modifying or discarding their existing beliefs and misunderstandings based on the evidence derived from these experiences. This depiction could essentially be regarded as a characterization of inductive learning. The philosophy of learning known as constructivism is rooted in the idea that our personal comprehension of the world develops when we contemplate our encounters.

Individually, we establish our unique "guidelines" and "cognitive frameworks" that we employ to comprehend our experiences. Consequently, learning entails the straightforward procedure of adapting our cognitive frameworks to incorporate novel experiences. Constructivist learning operates on inductive principles. According to constructivist learning, actions drive the development of concepts rather than concepts guiding actions. Activities pave the way for the emergence of concepts; it's not the concepts that pave the way for the activities. Essentially, in constructivist learning, the conventional classroom approach is reversed – no lectures, no demonstrations, and no presentations. From the beginning, students engage in activities through which they develop skills and acquire concepts[50] . Constructivism as an Instructional Strategy: The Teacher's Role Constructivism entails a cooperative dynamic involving educators,

students, and other members of the community, and is customized to address the unique needs and objectives of each individual learner. This approach facilitates ongoing learning experiences. In a constructivist classroom, the teacher's role extends beyond mere lecturing to that of an adept learner, capable of steering students towards adopting cognitive techniques like self-assessment, articulating comprehension, posing probing inquiries, and reflecting. Within constructivist classrooms, the teacher's responsibility is to structure information around overarching concepts that captivate the students' curiosity, aid students in cultivating fresh perspectives, and bridge these with their earlier learning. The activities are centered around the students, encouraging them to pose their own inquiries, conduct their own experiments, establish their own parallels, and formulate their own conclusions. During typical constructivist sessions, as students tackle a problem, the instructor intervenes only when necessary to channel students in the appropriate direction. Essentially, the instructor presents the challenge and empowers the students to take the lead. Numerous educators and cognitive psychologists have applied constructivist principles to the design of learning environments. From these applications, they have distilled a set of design principles which encompass:

i. develop authentic settings that mirror the real-life contexts where learning holds significance;

ii. emphasize practical methods to address authentic real-world challenges;

iii. the instructor functions as a mentor and evaluator of the strategies applied to resolve these challenges;

iv. highlight the interconnected nature of concepts, offering diverse representations or viewpoints of the subject matter;

v. educational objectives and goals should be collaboratively established, rather than imposed;

vi. assessment should function as a tool for learners to self-assess their progress;

vii. supply tools and environments that aid learners in interpreting the myriad perspectives of the world; and

viii. learning should be driven by the learner's internal control and mediation.

Constructivism empowers educators. In constructivist teaching, instructors motivate students to consistently evaluate the efficacy of activities in fostering comprehension. Through introspection and analysis of their strategies, students within the constructivist framework ideally evolve into "proficient learners," progressively equipping themselves for ongoing learning. With a carefully designed classroom setting, students acquire the skills of learning itself, akin to a spiral progression. As they continually introspect on their experiences, students witness the growth of their ideas in complexity and potency, thereby enhancing their capacity to assimilate novel information. The central responsibility of the teacher shifts towards nurturing this cycle of learning and reflection. Within the framework of constructivist learning, instructors offer a diverse range of learning scenarios to learners, resulting in a shift for students from the role of "acquiring knowledge" to "constructing knowledge." Learning transforms into a process of actively building knowledge. Learners play an active role in shaping their own understanding by linking novel concepts to preexisting ideas, drawing from the materials or activities

presented to them. For instance, the utilization of text, a collection of images, or visual aids concerning a phenomenon or object is followed by group discussions or interactions[51]. Active involvement of learners in pertinent activities contributes significantly to the organization and reorganization of ideas. Collaborative learning fosters opportunities for the exchange of diverse viewpoints and the negotiation of meaning. Each individual learner, both independently and collectively, constructs meaning pertaining to a phenomenon, object, or event as they engage in the learning process. Teachers facilitate an environment where children can pose questions related to their school learning, and they encourage children to respond in their own words, drawing from their personal experiences. The encouragement of "intelligent guessing" is embraced as a valid teaching technique. Students question not only their teachers' ideas but also those of their peers, make predictions about phenomena, design experiments to test their hypotheses, and discuss their findings. They compare their results with those of others, arrive at autonomous conclusions, apply new concepts to familiar scenarios, and familiar concepts to novel situations. This process enables learners to validate their beliefs and notions, showcase solutions and methodologies, and elaborate on and interpret textual information. A habit of self-directed learning is cultivated in the learner. Moreover, constructivism empowers students to pursue their individual interests and objectives. Within this approach, learners harness and enhance their own abilities. The implications of constructivism for teaching and learning are highlighted as follows:

i. teachers function as facilitators, supporters, guides, and exemplars of the learning process;

ii. learning involves adapting our mental frameworks to accommodate new encounters;

iii. learning revolves around establishing connections between various pieces of information;

iv. instruction should revolve around intricate problems that lack straightforward, definitive answers;

v. context and personal knowledge hold significant importance;

vi. student engagement and dedication outweigh the importance of textbook content;

vii. learners excel in the process of discovering and generating their own knowledge; and

viii. emphasis is placed on discovery and guided discovery learning.

Behaviorism Approach to Learning The deductive strategy, as promoted by behaviorists, serves as a clear and direct illustration of conventional teaching, involving the following steps:

1. Presenting overarching principles or generalizations.

2. Reinforcement through methods such as: a. Providing examples, b. Addressing students' inquiries, c. Clarifying and restating the principle.

3. Utilizing tangible manipulation when applicable.

4. Seeking feedback from students through questioning.

5. Implementing drill exercises. The inductive discovery strategy aimed to uncover principles or generalizations. The instructional sequence was structured as follows:

1. Concretely manipulating the facts intended for correlation.

2. Introducing the facts intended for correlation.

3. Facilitating discovery through discussion by: a. Offering specific examples, b. Addressing students' queries, c. Proposing guiding questions if steps a. and b. didn't result in discovery.

4. Reinforcing the identified generalization.

5. Incorporating a drill phase. The theory of behaviorism originated from the contributions of Thorndike, Pavlov, and Skinner to the field of learning[52] . The established principles of stimulus-response, along with classical and operant conditioning, have been employed to elucidate the process of learning by utilizing rewards, penalties, and trial-and-error mechanisms. This perspective is rooted in biological drives and is considered a means of adapting to the environment. In this framework, learners are positively reinforced in a consistent manner for incremental strides in learning and accomplishments. On a broader level, behaviorism advocates for teacher controlled or teacher-centered methodologies where the educator holds the primary authoritative role. Knowledge is distributed across distinct segments of a segregated curriculum, perceived by students as separate subjects, and conveyed from teacher to student in predetermined sequences, with limited room for student choice or interaction. Behaviorism theory centers on the analysis of observable and quantifiable behavior, underscoring that behavior is largely acquired through conditioning and reinforcement, encompassing rewards and punishments. From the behaviorist perspective, the objective of educational psychology is to equip educators with the ability to anticipate, regulate, and modify classroom behavior. This outlook contrasts with the approach that regards educational psychology as a comprehensive area of content, emphasizing information over skill

development. From the forgoing the principles derived from Thorndike's postulates can be summarized as follows:

i. Law of Effect: Behaviors leading to satisfying outcomes are more likely to be repeated, while behaviors leading to unsatisfying outcomes are less likely to be repeated.

ii. Law of Exercise: Connections between stimuli and responses are strengthened through repetition and practice.

iii. Law of Readiness: Learning is most effective when the learner is motivated and ready to engage in the task.

iv. Law of Multiple Responses: In a situation, an organism may exhibit multiple responses, but only one is likely to be correct or successful.

v. Law of Prepotency of Elements: Some elements in a situation are more noticeable and elicit stronger responses.

vi. Law of Belongingness: Connections between stimuli and responses are more effective if they logically belong together.

vii. Law of Analogy: Learning involves making analogies between new and previously learned situations.

viii. Law of Imitation: Learning can occur through observing and imitating the behaviors of others [53]

Social constructivist theory constitutes a pedagogical framework that underscores the pivotal role of social interaction and contextual factors in the formation of knowledge. This theoretical perspective posits that learning is an active, participant-driven process that necessitates learners' active involvement with their environment and the sociocultural

milieu in which learning unfolds. Several components make up this theory including zone of proximal development, scaffolding, situated learning etc[13].

Zone of Proximal Development: The Zone of Proximal Development, as conceived by Lev Vygotsky, serves as a foundational construct in social constructivist theory. It delineates the spectrum of tasks that a learner can execute with the assistance of a more knowledgeable peer or instructor but is unable to perform autonomously. The zone of proximal development is construed as a fertile terrain for learning and developmental progression, wherein learners incrementally acquire novel skills and knowledge through social interaction and mentorship[13].

Scaffolding: Scaffolding emerges as a pedagogical strategy premised on furnishing learners with support and guidance while they grapple with tasks situated within their zone of proximal development. The primary objective of scaffolding is to systematically diminish the level of support as learners accrue competence and self-sufficiency. Scaffolding takes on diverse forms, encompassing modeling, questioning, and feedback, and assumes a pivotal role in facilitating learning within the purview of social constructivist theory[13].

Situated Learning: Situated learning advances the proposition that the most perspicuous comprehension of learning is achieved within the specific contextual milieu in which it transpires. Learning is construed as a sociocultural and contextual endeavor, intricately interwoven with particular settings and practices. Situated learning underscores the import of authentic tasks and activities that resonate with learners' lived experiences,

alongside the salience of social interaction and collaborative engagement in the learning process[14].

Communities of Practice: Communities of practice denote collective assemblages of individuals who share common interests or professional affiliations and partake in ongoing learning and collaborative endeavors. These communities are accorded prominence in social constructivist theory as pivotal arenas for learning. They furnish learners with opportunities to immerse themselves in genuine tasks and undertakings, avail themselves of feedback and mentorship from more seasoned members, and foster a shared understanding of the community's norms and practices[15].

Cognitive Apprenticeship: Cognitive apprenticeship emerges as an instructional tactic that hinges on the modeling and coaching of learners in the utilization of cognitive strategies and problem-solving proficiencies. It assumes a crucial role in supporting learners in the cultivation of expertise by affording them opportunities to observe and practice cognitive strategies within authentic contexts, whilst receiving guidance and feedback from more proficient mentors[16].

Social and Emotional Factors: Recognizing their growing significance, social constructivist theory acknowledges the pivotal role of social and emotional factors in fostering student well-being and success. These factors encompass emotional regulation, task execution, and composite aptitudes such as metacognition and self-efficacy. They are construed as instrumental markers of student well-being and psychological development, and are progressively being integrated into educational evaluation frameworks and interventions[13].

In summation, social constructivist theory underscores the centrality of social interaction, contextual milieu, and genuine tasks and activities in the realm of learning. It delineates learning as a dynamic and active process, intimately intertwined with learners' dynamic engagement with their surroundings and the sociocultural context in which learning transpires. This theoretical framework has profound implications for pedagogy and learning, emphasizing the pivotal roles of scaffolding, situated learning, communities of practice, and cognitive apprenticeship in nurturing learners' growth and triumph[13].

The theoretical basis of case-based teaching strategy exposes the multiplicity of its facets thus it can be understood through several educational and psychological theories:

Constructivism asserts that learners play an active role in constructing knowledge through their interactions with their environment and experiences. This theory finds alignment with case-based teaching, as it encourages students to delve into and dissect real-world scenarios, allowing them to construct their own understanding and meaning through immersive involvement[3].

The enduring influence of situated learning theory has prompted scholars to assert that meaningful learning truly flourishes when deeply entrenched within its social and environmental matrix. This perspective, underscores the distinction between structured classroom learning and the authentic practices inherent within professional spheres. Significantly, educational pursuits within formal settings often remain detached from the societal and cultural practices that shape real-world contexts[4].

2.3 Review of Empirical Studies

2.3.1 Case-based Teaching Strategy and Academic Achievement

A research work on case-based teaching and the current study both aim to investigate the effectiveness of different teaching approaches on student learning outcomes. The research work describes the creation of an active learning teaching approach called the collaborative, Case-based classroom, which combines three pedagogical strategies: peer-assisted learning, Case-based learning, and just-in-time teaching. The study collected data from student surveys of a second-year cardiology elective and found that the collaborative, Case-based classroom approach was preferred by students compared to a case-based lecture. The current study will use a quasi-experimental design with two groups, the experimental group and the control group, to assess the effectiveness of Case-based teaching strategy on academic achievement in word problems in Mathematics among Junior secondary school students in Ibadan metropolis, Oyo State. The study will use a pre-test and post-test, a questionnaire, observation, case studies, as research instruments to collect data. Both studies emphasize the importance of active learning methods in improving student learning outcomes and suggest that integrating active and passive learning methods may have greater benefits in terms of student preference and performance than either method alone[33].

A research work on case-based teaching and the current study both use a quasi-experimental design with two groups to investigate the effectiveness of case-based teaching on student learning outcomes. However, the research work focuses on developing a practical e-learning framework with the implementation of case method and

project-based learning, while the current study aims to assess the effectiveness of case-based teaching strategy on academic achievement in word problems in mathematics among Junior secondary school students. The research work collected data through a case study in Ukraine involving[54] master students, while the current study will collect data using pre-test and post-test design, a questionnaire, observation, case studies, and interviews among Junior senior secondary school students in Ibadan Metropolis, Oyo State. The research work proposes a taxonomy for indicators of e-learning effectiveness, while the current study will analyze data using descriptive and inferential statistics such as mean, standard deviation, frequency distribution, t-test, and ANOVA. Both studies emphasize the importance of active learning methods in improving student learning outcomes and suggest that integrating active and passive learning methods may have greater benefits in terms of student preference and performance than either method alone[34].

Another research work and the current study both use a quasi-experimental design with two groups to investigate the effectiveness of different teaching approaches on student learning outcomes. However, the research work focuses on developing a new blended teaching mode that combines Team-based Learning, Problem-based Learning (PBL), and Case-based Learning to improve students' academic performance and promote class enthusiasm and satisfaction with the course. The blended teaching mode consists of online and offline modules, and an objective achievement scale model with five educational objectives was designed to evaluate teaching efficiency. On the other hand, the current study aims to assess the effectiveness of Case-based teaching strategy on

academic achievement in word problems in Mathematics among Junior secondary school students. The study will collect data using pre-test and post-test design, a questionnaire, observation, case studies, and interviews, and analyze data using descriptive and inferential statistics such as mean, standard deviation, frequency distribution, t-test, and ANOVA. Both studies emphasize the importance of active learning methods in improving student learning outcomes and suggest that integrating active and passive learning methods may have greater benefits in terms of student preference and performance than either method alone. However, Another research work focuses on developing a new teaching mode, while the current study focuses on assessing the effectiveness of a specific teaching strategy[35].

A research work study differ significantly in their research objectives, methodologies, and contexts. The research work is primarily concerned with undergraduate attrition in science, technology, engineering, and mathematics (STEM) fields, particularly during the intermediate years of college. It examines the impact of case-based learning versus traditional lectures on the learning gains of undergraduates in an intermediate physiology course. The study is rooted in cognitive load theory and explores how the timing of pedagogical approaches relates to students' cognitive abilities. Surprisingly, the results indicate that case-based learning doesn't guarantee improved learning gains for all students. Those with lower ACT scores or fewer credit hours completed had lower learning gains with case-based learning, suggesting that it might overwhelm inexperienced students' cognitive abilities[36].

In contrast, the current study focuses on a different context, namely Junior secondary school students in Ibadan Metropolis, Oyo State. It employs a quasi-experimental design with two groups: an experimental group exposed to case-based teaching and a control group receiving traditional instruction over a 6-week period. The primary goal is to assess academic achievement in Mathematics word problems. The study employs a range of research instruments, including pre-tests, post-tests, questionnaires, observations, descriptive and inferential statistics for data analysis. Content validity of the research instruments is established through literature review, and instrument reliability is assessed through a pilot study[36].

In summary, the research work and the current study differ in their educational levels (college vs. secondary school), research questions (impact of teaching methods vs. instructional strategies in Mathematics), and the theoretical framework (cognitive load theory vs. not specified) guiding their investigations. While both studies use case-based instruction, their aims and findings are tailored to distinct educational contexts and research objectives[36].

A research work and the current study differ in their research focus and methodology.

The research work delves into the impact of Case study-based learning on university students in Pakistan, specifically examining its effects on engagement, learning motivation, and learning performance. Employing structural equation modeling, the findings indicate a positive relationship between Case-based learning and various aspects of engagement (behavioral, emotional, cognitive, and agentic). It also suggests that Case-based learning leads to a better understanding of concepts, skill development, and

enhanced learning motivation. Interestingly, the study highlights that the influence of student engagement on learning performance varies depending on the specific aspect, with agentic engagement showing the strongest statistically significant relationship[37].

On the other hand, the current study focuses on Junior secondary school students in Ibadan metropolis, Oyo State, Nigeria. It adopts a quasi-experimental design, comparing case-based teaching with traditional instruction over a 6-week period. The study aims to assess academic achievemnt in Mathematics word problems using various research instruments, including pre-tests, post-tests, questionnaires, observations, case studies, and interviews. Data analysis involves descriptive and inferential statistics. The study also places importance on establishing the content validity of research instruments through a thorough literature review and assessing instrument reliability via a pilot study[37].

In summary, while the research work explores the impact of case-based learning on university students in Pakistan, emphasizing its effects on engagement, motivation, and learning performance, the current study centers on secondary school students in Nigeria, focusing on the comparison between case-based teaching and traditional instruction in terms of academic achievement in Mathematics. The two studies differ in their contexts, participants, and research objectives[37].

A research work and the current study differ significantly in their research objectives, methodologies, and contexts. The research work focuses on evaluating the effectiveness of Case-based learning in medical students' education through a meta-analysis of randomized controlled trials. It spans studies published from 1995 to 2020 and involves a systematic search of various databases. The findings, based on 8 included studies with a

total of 939 students, suggest that case-based learning is an effective teaching method for medical students, leading to improvements in academic performance and case analysis ability. This study employs a quantitative approach, utilizing statistical analysis and risk bias assessment tools[38].

In contrast, the current study adopts a quasi-experimental design with two groups of Junior secondary school students in Nigeria. It focuses on comparing the impact of case-based teaching with traditional instruction on academic achievement in Mathematics word problems over a 6-week period. Data collection includes pre-tests, post-tests, questionnaires, observations, case studies, and interviews. The analysis relies on descriptive and inferential statistics. Moreover, this study emphasizes the establishment of content validity through literature review and instrument reliability through a pilot study[38].

In summary, the research work assesses the effectiveness of case-based learning in medical education through a meta-analysis of randomized controlled trials, while the current study examines the impact of Case-based teaching on academic achievement in mathematics among secondary school students in Nigeria. These studies differ significantly in their research goals, participants, methodologies, and educational contexts[38].

A study evaluated the effectiveness and efficiency of case -based learning combined teaching in thyroid surgery, while the current study aims to evaluate the effectiveness of the case-based teaching strategy in improving students' academic achievement in Mathematics. While the first study used a prospective enrollment of 354 fourth-year students majoring in clinical medicine and 232 residents, the current study will use a

quasi-experimental design with Junior secondary school students in Ibadan metropolis, Oyo State. Both studies will use pre-tests and post-tests to evaluate the effectiveness of the teaching strategies, but the first study will also administer an anonymous questionnaire to evaluate the students' perceptions and experiences. The first study found that the case -based learning group's performance improvement was significantly higher than the traditional group's, and the scores for learning motivation, understanding, student-teacher interaction, and clinical thinking skills were significantly higher in the case -based learning group than in the traditional group. Meanwhile, the survey scores representing the amount of students' free time the course consumed were significantly lower in the case -based learning group than in the traditional group. The current study will use a variety of research instruments, including observation, case studies, and interviews, to evaluate the effectiveness of the case-based teaching strategy in improving students' academic achievement in Mathematics[39].

A study conducted in Isfahan University of Medical Sciences compared the effectiveness of Case-based teaching and flipped classroom methods with the traditional lecture method on students' learning and satisfaction at internship in the Department of General Surgery. The study found that flipped classroom methods improved students' learning and the quality of teaching, and students were more satisfied with these methods compared to the lecture method. Another study, which will be conducted in Ibadan metropolis, Oyo State, will evaluate the effectiveness of the Case-based teaching strategy in improving students' academic achievement in Mathematics. This study will use a quasi-experimental design with two groups: the experimental group and the control group. The experimental group

will receive instruction using the Case-based teaching strategy, while the control group will receive traditional instruction. The study will be conducted over a period of 6 weeks with Junior secondary school students. The research instruments that will be used in this study include a pre-test and post-test, a questionnaire, observation, case studies, and interviews. The data will be analyzed using descriptive statistics and inferential statistics. Both studies aim to evaluate the effectiveness of case-based teaching strategies, but the first study focuses on medical students' learning and satisfaction in the Department of General Surgery, while the second study focuses on Junior secondary school students' academic achievement in Mathematics[40].

A study conducted among nursing students evaluated the effect of Case-based learning with or without conceptual mapping on critical thinking and academic self-efficacy. The study found that using integrative education methods such as conceptual mapping in combination with Case-based education had a significant effect on enhancing student's critical thinking and academic self-efficacy[41].

The current study aims to evaluate the effectiveness of the Case-based teaching strategy in improving Junior secondary school students' academic achievement in Mathematics. The study will use a quasi-experimental design with two groups: the experimental group and the control group. The experimental group will receive instruction using the case-based teaching strategy, while the control group will receive traditional instruction. The study will be conducted over a period of 8 weeks. Both studies aim to evaluate the effectiveness of Case-based teaching/learning strategies, but the first study focuses on

nursing students' critical thinking and academic self-efficacy, while the second study focuses on Junior secondary school students' academic achievement in Mathematics[41].

A study evaluated the effectiveness of Case-based Games Learning using Quizizz and Case-based Learning without Quiz on students' conceptual understanding in mathematics. The study found that the average conceptual understanding of Case-based Games Learning using Quiz application strategy was more effective than Case-base learning without Quiz application in evaluating student work results quickly, precisely, and accurately. The current study aims to evaluate the effectiveness of the Case-based teaching strategy in improving Junior secondary school students' academic achievement in Mathematics. The study will use a quasi-experimental design with two groups: the experimental group and the control group. The study will be conducted over a period of 6 weeks, and the data will be analyzed using descriptive statistics and inferential statistics. Both studies aim to evaluate the effectiveness of case-based teaching/learning strategies, but they have different focuses. The reviewed study focuses on the effectiveness of Case-based Games Learning using Quiz and Case-base Learning without Quiz on students' conceptual understanding in Mathematics, while the current study focuses on the effectiveness of the case-based teaching strategy in improving Junior secondary school students' academic achievement in Mathematics[42].

A study explored the factors in Case-based Learning sessions that promote a deep learning approach in medical students. The study used a mix method research methodology with an explanatory sequential design. The quantitative part of the study collected data through a survey of second-year medical students, while the qualitative part

conducted semi-structured interviews with deep learners to explore the factors that promote deep learning through Case-base Learning guided inquiry approach. The study found that active participation of students in the Case-base Learning session, relevance of the case with their clinical practice, complexity of the case for future practice, intrinsic motivation, guided inquiry approach with tutor's involvement, role-playing, and changes in learning approaches of the students were responsible for inculcating a deep learning approach in medical students in their pre-clinical years[43].

The current study aims to evaluate the effectiveness of the case-based teaching strategy in improving Junior secondary school students' academic achievement in Mathematics. The study will use a quasi-experimental design with two groups: the experimental group and the control group. The experimental group will receive instruction using the case-based teaching strategy, while the control group will receive traditional instruction. The study will be conducted over a period of 6 weeks, and the data will be analyzed using descriptive statistics and inferential statistics. The study aims to evaluate the effectiveness of the Case-based teaching strategy in improving students' academic achievement in Mathematics[43].

Both studies aim to evaluate the effectiveness of Case-based teaching/learning strategies, but they have different focuses. A study focuses on exploring the factors that promote a deep learning approach in medical students through Case-based learning guided inquiry approach, while the current study focuses on evaluating the effectiveness of the case-based teaching strategy in improving Junior secondary school students' academic achievement in Mathematics[43].

A study evaluated the effectiveness of Case-based Games Learning using Quizizz and Case-based Learning without Quizizz on students' conceptual understanding in mathematics. The study found that the average conceptual understanding of CBGL using Quizizz application strategy was more effective than Case-base Learning without Quizizz application in evaluating student work results quickly, precisely, and accurately. The second study aims to evaluate the effectiveness of the Case-based teaching strategy in improving senior secondary school students' academic achievement in Mathematics. The study will use a quasi-experimental design with two groups: the experimental group and the control group. The study will be conducted over a period of 6 weeks, and the data will be analyzed using descriptive statistics and inferential statistics. Both studies aim to evaluate the effectiveness of Case-based teaching/learning strategies, but they have different focuses. A study focuses on the effectiveness of Case-based Games Learning using Quizizz and Case-base Learning without Quizizz on students' conceptual understanding in Mathematics, while the current study focuses on the effectiveness of the case-based teaching strategy in improving Junior secondary school students' academic achievement in Mathematics[44].

The first study aimed to assess the effectiveness of flipped classroom approach in comparison to the current teaching methodology in nursing students. The study found that the quiz and the class engagement scores were highly significant at post-cycle II where the flipped classroom approach was used with extra class time compared to post-cycle I and pre-cycle. The participants reported gaining a deeper understanding of concepts, being motivated, and more confident in learning the course material. The second study

aims to evaluate the effectiveness of the Case-based teaching strategy in improving Junior secondary school students' academic achievement in Mathematics. The study will use a quasi-experimental design with two groups: the experimental group and the control group. The study will be conducted over a period of 6 weeks, and the data will be analyzed using descriptive statistics and inferential statistics. Both studies aim to evaluate the effectiveness of different teaching methodologies, but they differ in the specific methodologies used and the subjects of study. The first study focused on the effectiveness of flipped classroom approach in learning pediatric course content among nursing students, while the second study focuses on the effectiveness of case-based teaching strategy in improving academic achievement in Mathematics among Junior secondary school students[45].

A study aimed to explore student and facilitator perceptions of Case-based learning and Team-based learning in medical education, using Experience-based learning as a conceptual lens. The study found that the experience in Case-based Learning was positive, with many favorable aspects that built on and complemented their Team-base Learning experience. The learning environment was enriched by the Case-base Learning framework that allowed application of knowledge to solve clinical problems within the small groups with consistent facilitator guidance and feedback. The current study aims to evaluate the effectiveness of the Case-based teaching strategy in improving Junior secondary school students' academic achievement in Mathematics. The study will use a quasi-experimental design with two groups: the experimental group and the control group. The study will be conducted over a period of 6 weeks, and the data will be analyzed using

descriptive statistics and inferential statistics. Both studies aim to evaluate the effectiveness of Case-based teaching/learning strategies, but the first study focuses on comparing Case-base Learning and Team-base Learning in medical education, while the current study focuses on the effectiveness of the case-based teaching strategy in improving academic achievement in Mathematics for Junior secondary school students[46].

A study reviewed the efficiency of instructional interventions in improving academic motivation in nursing students. The study found that educational interventions such as simulation, case-based learning, cooperative learning, learning contract, peer assessment, and self-assessment using video typing improved academic motivation in nursing students. The second study aimed to evaluate the effectiveness of case-based teaching strategy in improving students' academic achievement in Mathematics. The study will use a quasi-experimental design with two groups: the experimental group and the control group. The study will be conducted over a period of 6 weeks with Junior secondary school students in Ibadan Metropolis, Oyo State. The study will use pre-test and post-test design, questionnaires, observation, case studies, and interviews to collect data. Both studies aim to evaluate the effectiveness of teaching strategies in improving students' academic performance. However, the first study focuses on instructional interventions to improve academic motivation in nursing students, while the second study focuses on the effectiveness of case-based teaching strategy in improving students' academic achievement in Mathematics[47].

A study which examined the effect of computer simulation on achievement of students in Algebra at Junior secondary school level is similar to the current study. The research

employed quasi experimental design of pre-test post-test control group type like the current study. Both studies are similar in that they are focused on junior secondary school students. Both studies employ pre-test and post-tests scores. The current study uses ANCOVA at 0.05 level of significance whereas the reviewed study made use of Special Package for Social Sciences (SPSS)[48].

Another study investigated how case-based learning affected students' Mathematics communication skills. The study used a posttest-only design in similarity with the current study. Also, it was a quasi-experimental investigation. The control class received standard instruction, whereas the experiment class received case-based learning instruction; this makes it similar to the current study. This study is similar to the present study in terms of its use of quasi expermental design. However, it differs from the current study in terms of the topic of focus: while the study investigates how students' Mathematics communication skills, the current study examines the effect of case-based teaching strategy on the teaching and learning of word problems[49].

A study aimed to describe the differences in mathematical connection ability between students who studied with the Problem Based Learning and those who used the Case-based Learning approach is also similar to the current study. A quasi-experiment with a pretest-post-test non-equivalent group design was conducted for the purpose; in this regard, the study is similar to the current study. The data was analyzed using inferential statistics, this also makes it similar to the current study. The current study is study from this study in terms of aim: while the current study investigates the difference between

case-based teaching and traditional teaching method, the reviewed study compares Problem Based Learning and those who used the Case-Based Learning[50].

The present study focuses on a 2x2 factorial design involving a case-based learning intervention for an experimental group and conventional methods for a control group, targeting three levels of academic achievement among JS2 gender at two-levels. In contrast, the reviewed study examines the development of an integrated case-based curriculum, specifically in Mathematics teacher education, emphasizing cognitive flexibility and knowledge transfer theory proposed by Rand Spiro. While the first study aims to analyze the effects of case-based learning on academic achievement using pre- and post-tests, descriptive statistics, and inferential analyses, the second source explores the potential of subject-specific cases to enhance Mathematics teachers' pedagogical thinking and reasoning through the design of a case-based curriculum[51].

A study on the impact of the case-based learning on science process skills is similar to the current study. The reviewed study focused on investigating the impact of problem-based learning (PBL) on science process skills (SPS) and learning achievement regarding 'Safety in Our Environment' in Tanzanian secondary schools. It utilized a quasi-experimental design with Form One 'Stream E' students in the experimental school and Form One 'Stream D' students in the control school. Data collection involved a structured questionnaire and an achievement test, revealing that PBL significantly improved SPS and learning achievement compared to traditional teaching methods. Notably, PBL was found to enhance cognitive abilities and eliminate gender-based achievement differences,

recommending the continued use of learner-centered approaches like PBL in science education, particularly Biology[52].

In contrast, the current study implemented a 2x2 factorial design in a quasi-experimental setup, where an experimental group received a case-based learning intervention while a control group followed conventional methods across varying levels of academic achievement (low, medium, high) among 366 JS2 students in Oyo State, Nigeria. The study employed researcher-developed lesson plans and a Mathematics Achievement Test, validated and tested for reliability. Data analysis involved pre- and post-tests over 6 weeks, utilizing descriptive statistics, t-tests, ANOVA, and ANCOVA to assess the impact of the case-based learning intervention on students' academic achievement in word problems[52].

Another study which examined Case-based study is also similar to the current study. The two studies differ in several key aspects. The first study was conducted with undergraduate students in an intermediate physiology course, whereas the second study involved grade 8 secondary school students in Nigeria. The interventions also varied, with the first study comparing case-based learning and traditional lectures, and the second study employing a 2x2 factorial design with an experimental group receiving a case-based learning intervention and a control group using conventional methods. Additionally, the outcome measures differed, with the first study focusing on learning gains and the second study examining academic achievement in word problems.

Despite these differences, the studies share some similarities. Both used a quasi-experimental design to compare the effectiveness of case-based learning with traditional

methods. The first study drew on cognitive load theory to understand the potential challenges of case-based learning for inexperienced students. Both studies used researcher-developed instruments, such as lesson plans and achievement tests, to assess the impact of the interventions. Finally, both studies employed descriptive and inferential statistics, including t-tests and ANOVA, to analyze the data.

Overall, while the studies have distinct contexts and foci, they both contribute to the growing body of research on the effectiveness of case-based learning in improving student learning outcomes compared to traditional teaching methods[53].

2.3.2 Gender and Academic Achievement in Mathematics

The belief that men possess a natural advantage in Mathematics compared to women has persisted throughout history. This belief has also manifested in the education system, where girls were frequently dissuaded from pursuing studies in Mathematics and science. It's worth noting that gender differences in Mathematics are generally marginal and subject to variations depending on the particular task or measurement being considered. Several factors contribute to these gender differences in Mathematics, including:

i. Teacher expectations: teachers often have lower expectation for girls' mathematical ability than boys[55]. This can lead to girls receiving less challenging Mathematics instruction leading to girls having less confidence in their mathematical abilities.

ii.Parental involvement: Parent often encourages their sons to pursue Mathematics more than their daughter[56]. This can lead to boys having more opportunities to learn

Mathematics outside of school and to boys having more positive attitude towards Mathematics. [39]

iii. Peer pressure: peer pressure can also influence gender difference in Mathematics[57.] For example, girls may be less likely to participate in Mathematics activities if their friends are not interested in Mathematics.

iv. Cultural factors: In some cultures, Mathematics is seen as a masculine domain which can discourage girls from pursuing Mathematics and Mathematics related disciplines[58] .

Gender, as a multifaceted and intricate aspect of human identity, has permeated every corner of society[63]. It is an integral part of the social fabric, influencing behavior, expectations, and opportunities[64]. Understanding gender is not just a matter of acknowledging the binary distinction between male and female; rather, it entails recognizing the complex interplay of biological, social, cultural, and psychological factors that shape an individual's sense of self and their role in society[64]. Gender, a fundamental aspect of human identity, transcends mere biological distinctions. It is a complex social construct that encompasses a spectrum of roles, behaviors, and expectations assigned to individuals based on their perceived masculinity or femininity. Gender is deeply intertwined with culture, history, and societal norms, shaping how people perceive themselves and interact with the world[65].The finding underscore the enduring influence of the past on higher education, resulting in an environment that is legally desegregated but socially segregated. The results showed that how students get involved with their studies, considering behavioural, emotional, and cognitive aspects,

depends on their race and gender at the university being studied. And this engagement is closely related to how well they perform academically[62].

A study conducted on a sample of Chinese middle school students utilized data from the Trends in International Mathematics and Science Study (TIMSS) to explore the gender gap in Mathematics achievement and its potential contributing factors to this gap. The findings indicated that, on the average, male students achieved higher Mathematics scores compared to their female counterparts. However, the observed gender gap in Mathematics achievement was found to be partially attributed to differences in students' attitudes toward Mathematics and their approach to learning. Specifically, female students demonstrated lower levels of confidence in their mathematical abilities and were less inclined to employ advanced learning strategies like planning and monitoring, in comparison to their male counterparts[59]. Furthermore, the gender disparities in Mathematics achievement exhibited variations based on the specific type of Mathematics being studied. Male students tended to perform better than female students in geometry and data analysis[60]. Female students tended to outperform male students in the domains of number and algebra[61] .

A research work on analytics of multimodal learning developed a real-time, multimodal Student Engagement Analytics Technology to support teachers in providing just-in-time personalized support to students who risk disengagement. The study used a multi-method approach consisting of a quasi-experimental design to evaluate the impact of the technology and a case study design to understand the environmental and social factors surrounding the classroom setting. The results showed that the technology had a

significant impact on the teacher's classroom practices and student engagement. On the other hand, the current study aims to compare the effectiveness of case-based teaching strategy versus traditional instruction in improving senior secondary school students' academic achievement in word problems in mathematics. The current study uses a quasi-experimental design with two groups, the experimental group, and the control group, and will be conducted over a period of 6 weeks. The research instruments that will be used in this study include a pre-test and post-test, a questionnaire, observation, case studies, and interviews. While both studies focus on teaching and learning, they differ in their specific research questions, designs, and methods[21].

A research work on the longitudinal relationship between hope, academic achievement, and engagement explores the reciprocal relations between hope and academic achievement and the mediating effect of behavioral engagement in a sample of Chinese elementary school students. The study uses a multi-method approach to assess hope, behavioral engagement, and academic achievement. On the other hand, the current study aims to compare the effectiveness of case-based teaching strategy versus traditional instruction in improving Junior secondary school students' academic achievement in word problems in Mathematics. The current study uses a quasi-experimental design with two groups, the experimental group, and the control group, and will be conducted over a period of 6 weeks. The research instruments that will be used in this study include a pre-test and post-test, a questionnaire, observation, case studies, and interviews. While both studies focus on teaching and learning, they differ in their specific research questions, designs, and methods[22].

A study conducted in the context of the changing economic landscape emphasized the increasing necessity of a college degree for employment in an information-based society. It focused on the importance of student engagement in predicting and preventing high school dropout and improving student outcomes. This study examined the relationship between secondary school engagement and postsecondary enrollment and persistence. Its findings suggested that secondary student engagement predicts post-secondary matriculation and persistence, even after accounting for demographic and school-level variables. Notably, the Future Goals and Aspirations scale emerged as a strong predictor of engagement, with implications for early warning systems and college retention efforts. In contrast, the current study outlined a quasi-experimental design involving two groups: an experimental group exposed to case-based teaching and a control group receiving traditional instruction over 6 weeks. It targeted Junior secondary school students in Ibadan Metropolis, Oyo State, randomly assigned to these groups. The research instruments in this study included pre-tests, post-tests, questionnaires, observations, case studies, and interviews, primarily focused on assessing academic achievement in Mathematics word problems. Data analysis techniques encompassed descriptive and inferential statistics such as mean, standard deviation, frequency distribution, t-tests, and ANOVA. Content validity of the research instruments was established through an exhaustive literature review, and reliability was assessed through a pilot study on a small sample of participants[23].

In summary, while the first study explored the relationship between student engagement and postsecondary outcomes in the context of a changing job market, the current study

employed a quasi-experimental approach to investigate the effectiveness of case-based teaching in improving academic achievement in Mathematics among Junior secondary school students in Ibadan Metropolis. These studies address different aspects of education, with the former focusing on engagement and post-secondary outcomes and the latter on instructional methods and academic achievement[23].

A study conducted in China explored the relationship between two educational technology tools, Superstar—Xuexitong and WeChat, and three dimensions of student engagement. The study found that emotional engagement has the strongest positive effect on educational technology engagement and that using LMS could engage students more than adopting social networking systems. On the other hand, the current study will use a quasi-experimental design with two groups, the experimental group and the control group, to assess academic achievement in word problems in mathematics. The study will be conducted over a period of 6 weeks, and the data will be analyzed using descriptive and inferential statistics such as mean, standard deviation, frequency distribution, t-test, and ANOVA. The two studies are different in terms of their research design, research instruments, and data analysis methods. While the first study is exploratory and uses an adopted and revised questionnaire from previous researches, the current study is quasi-experimental and uses a pre-test and post-test, a questionnaire, observation, case studies, and interviews[24].

Another study investigated the relationship between self-efficacy beliefs, engagement, and academic performance in Mathematics essons among secondary school sixth, seventh, and eighth graders. The study found that students' self-efficacy beliefs in learning and

performance in Mathematics ignificantly and positively predicted their Mathematics achievement. On the other hand, the current study will use a quasi-experimental design with two groups, the experimental group and the control group, to assess academic achievement in word problems in mathematics. The two studies are different in terms of their research questions, research design, research instruments, and data analysis methods. While the first study is correlational and uses a self-efficacy sub-dimension of a motivation scale related to learning and performance, the current study is quasi-experimental and uses a pre-test and post-test, a questionnaire, observation, case studies, and interviews. However, both studies focus on academic achievement in Mathematics and the factors that affect it, such as self-efficacy beliefs and engagement[25].

Another study investigated the extent of student engagement and its correlation with academic performance at Partido State University. The study found that the level of student engagement along behavioral, emotional, and cognitive engagements were high, and academic performance was very good. The study also revealed that teacher, school, and family factors were positively related to student engagement, and behavioral, emotional, and cognitive engagements were positively correlated to academic performance. On the other hand, the current study will use a quasi-experimental design with two groups to assess academic achievement in word problems in Mathematics. The two studies are different in terms of their research questions, research design, research instruments, and data analysis methods. While the first study is descriptive-correlational and uses a teacher-made questionnaire, the current study is quasi-experimental and uses a pre-test and post-test, a questionnaire, observation, case studies, and interviews. However,

both studies focus on student engagement and academic performance and highlight the importance of factors such as teacher, school, and family in promoting student engagement[26].

Another study conducted a systematic review of the literature on student engagement in Latin American higher education institutions during the COVID-19 pandemic. The study identified the main characteristics of student engagement from behavioral, cognitive, and affective dimensions and provided implications for online learning in Latin American higher education, such as transforming higher education, providing adequate professional training, improving internet connectivity, ensuring quality online learning, and providing emotional support. On the other hand, the current study will use a quasi-experimental design with two groups to assess academic achievement in word problems in mathematics. The two studies are different in terms of their research questions, research design, research instruments, and data analysis methods. While the first study focuses on student engagement in Latin American higher education institutions during the COVID-19 pandemic, the current study focuses on academic achievement in mathematics among Junior secondary school students in Ibadan Metropolis, Oyo State. However, both studies highlight the importance of providing adequate support and training to students and teachers to promote effective online learning and academic achievement[27].

Another study examined the characteristics of student engagement in online courses and their impact on academic achievements, distinguishing between course completers and non-completers. The study found that engagement with course materials and reading the forums predicted final exam success, emphasizing the significant importance of

engagement in various activities in the online course. On the other hand, the current study will use a quasi-experimental design with two groups to assess academic achievement in word problems in Mathematics among Junior secondary school students in Ibadan metropolis, Oyo State. The two studies are different in terms of their research questions, research design, research instruments, and data analysis methods. While the first study focuses on student engagement in online courses and its impact on academic achievements, the current study focuses on academic achievement in mathematics among Junior secondary school students. However, both studies highlight the importance of engagement in promoting academic achievement and success[28].

Another study explored the developmental cascades linking students' self-efficacy, behavioral engagement, emotional engagement, and academic achievement, finding that student self-efficacy and academic achievement are mutually associated from 4th to 6th grades. On the other hand, the current study will use a quasi-experimental design with two groups to assess academic achievement in word problems in Mathematics among Junior secondary school students in the Ibadan Metropolis, Oyo State. The search results also include studies on cultural values and student self-efficacy, self-esteem and academic engagement among adolescents, school engagement and students at risk, the combined effects of motivation, learning, and personality traits on academic performance, and supporting disadvantaged students and schools. The studies highlight the importance of various factors, such as self-efficacy, engagement, motivation, and equity, in promoting academic achievement and well-being among students[29].

Another study conducted at the Faculty of Industrial Engineering Telkom University examined the relationship between student engagement and academic achievement, finding that student engagement was at a high category, and learning achievement was in honors, but student engagement had no effect on academic achievement. On the other hand, the current study will use a quasi-experimental design with two groups to assess academic achievement in word problems in mathematics among Junior secondary school students in Ibadan metropolis, Oyo State. The search results also include studies on students' engagement and academic outcomes in live online learning, comparing students' engagement in classroom education between China and Germany, the longitudinal association between engagement and achievement, and the effects of student engagement on academic achievement among college students. The studies highlight the importance of engagement in promoting academic achievement and the need to consider various factors, such as gender, education level, and student profiles, in understanding the relationship between engagement and academic outcomes[30].

Another study conducted in the Dominican Republic examined the relationship between hope, self-efficacy, engagement, and academic success, finding that behavioral engagement was the best predictor of academic success, and interventions should target variables such as hope or engagement to increase academic success. On the other hand, the current study will use a quasi-experimental design with two groups to assess academic achievement in word problems in Mathematics among Junior secondary school students in Ibadan Metropolis, Oyo State. The search results also include studies on the relationship between teacher multicultural attitudes and culturally responsive teaching,

the effects of teacher feedback on student engagement and academic performance, the impact of parental involvement on student engagement and academic achievement, and the role of motivation and self-regulated learning in academic achievement. The studies highlight the importance of various factors, such as teacher and parental involvement, feedback, motivation, and self-regulated learning, in promoting academic engagement and achievement among students[31].

A research work investigated the relationship between student engagement and academic achievement in state and non-state universities in Sri Lanka. The study used a deductive research design and collected data through primary data using both quantitative and qualitative approaches. The sample size was 350 undergraduates from both state and non-state universities. The results showed a statistically significant strong positive relationship between student engagement and academic achievement, with campus engagement having a stronger relationship than class engagement. The current study will use a quasi-experimental design with two groups, the experimental group and the control group, to assess the effectiveness of case-based teaching strategy on academic achievement in word problems in Mathematics among Junior secondary school students in Ibadan Metropolis, Oyo State. The study will be conducted over a period of 6 weeks and will use a pre-test and post-test, a questionnaire, observation, case studies, and interviews as research instruments. The data will be analyzed using descriptive and inferential statistics such as mean, standard deviation, frequency distribution, t-test, and ANOVA. The two studies are different in terms of research design, sample size, research instruments, and data analysis methods. However, both studies aim to investigate the relationship between student

engagement and academic achievement, albeit in different contexts and with different approaches[32].

2.4 Conceptual Model

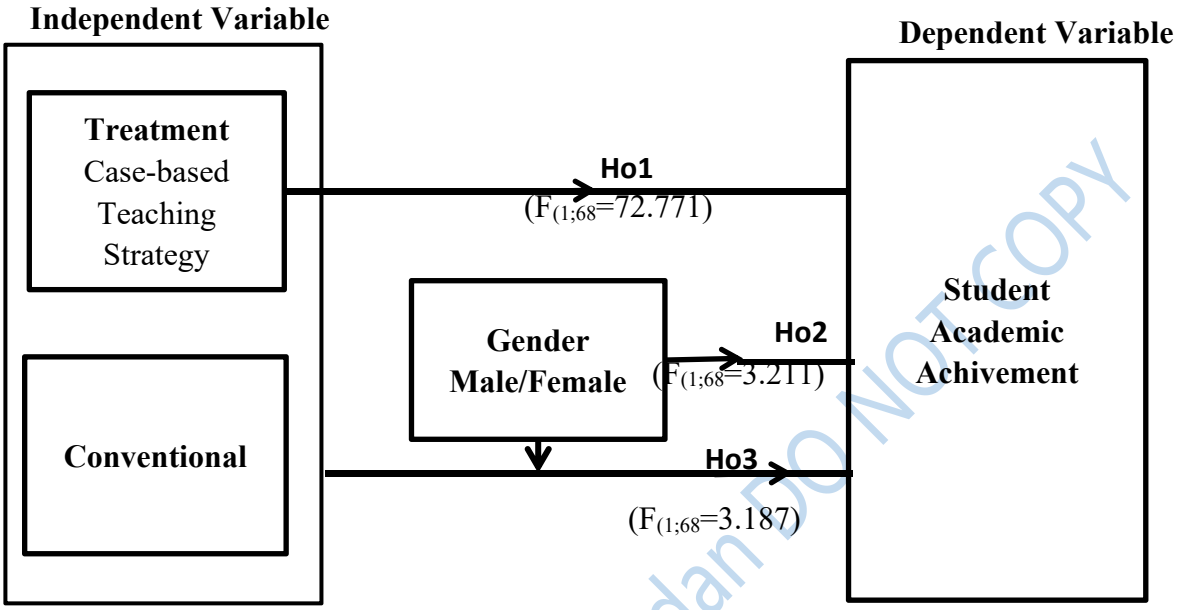

Fig. 2.1 : Conceptual Model showing the relationship between Variables

Source: Research's Field work 2024

Figure 2.1 shows the relationship between the following: Independent variable and dependent variable, Moderating variable and the dependent variable, Independent variable, Moderating variable and the dependent variable.

The figure shows the relationship between the dependent variable which is academic achievement and the independent variable which is case-based Strategy and conventional. It also shows the relationship the moderating variable which is gender, on with the dependent variable.

2.5 Summary of Gap in Literature Reviewed

The review contains various studies related to the current study. One study found that engagement with course materials and reading forums predicted final exam success in

online learning during the COVID-19 pandemic, emphasizing the importance of engagement in promoting academic achievement. Another study explored the characteristics of student engagement in online courses and their impact on academic achievements, while another study predicted success and completion of online courses based on engagement characteristics. A study on developmental cascades linking student self-efficacy, behavioral engagement, emotional engagement, and academic achievement found that student self-efficacy and academic achievement are mutually associated from 4th to 6th grades. A study emphasized the importance of teachers equipping students with the necessary tools for social and academic success, critical thinking, and higher-level thinking skills. Another study evaluated the effectiveness of a newly-introduced integrated learning model on students' engagement and learning outcomes. A research paper proposed a re-conceptualized model of the student engagement construct by adding agentic engagement as a new component and reconsidering the status of emotional engagement. A research work on analytic of multimodal learning developed a real-time, multimodal Student Engagement Analytic Technology to support teachers in providing just-in-time personalized support to students who risk disengagement. A research work on the longitudinal relationship between hope, academic achievement, and engagement explored the reciprocal relations between hope and academic achievement and the mediating effect of behavioral engagement in a sample of Chinese elementary school students. A study conducted in the context of the changing economic landscape emphasized the increasing necessity of a college degree for employment in an information-based society and focused on the importance of student engagement in

predicting and preventing high school dropout and improving student outcomes. Overall, while some of the studies share a focus on engagement and academic achievement with the current study, they differ in terms of research questions, design, instruments, and data analysis methods.

The current study and the empirical studies reviewed differ in several areas, including research focus, methodology, participants, and educational context. The research work on case-based learning in medical education aims to assess the effectiveness of case-based learning in medical education through a meta-analysis of randomized controlled trials. In contrast, the current study aims to evaluate the effectiveness of case-based teaching strategy on academic achievement in Mathematics among Junior secondary school students in Nigeria using a quasi-experimental design with two groups. The research work on collaborative, case-based learning experience in a large-enrollment classroom describes the creation of a collaborative, case-based learning experience in a large-enrollment classroom and compares it with a case-based lecture. The study collected data from student surveys of a third-year cardiology elective. In contrast, the current study aims to assess the effectiveness of Case-based strategy on academic achievement in word problems in mathematics among Junior secondary school students in Ibadan Metropolis, Oyo State, Nigeria using a quasi-experimental design with two groups. The research work on Case-based and Project-based methods for effective e-learning in ICT safety and security aims to develop a practical e-learning framework with the implementation of Case method and Project-based learning to improve students' academic performance and promote class enthusiasm and satisfaction with the course. The study collected data

through a case study in Ukraine involving 40 master students. In contrast, the current study aims to evaluate the effectiveness of case-based strategy on academic achievement in word problems in Mathematics among Junior secondary school students in Nigeria using a quasi-experimental design with two groups. The research work on developing advanced skills in early-years medical students focuses on developing a new blended teaching mode that combines Team-based Learning, Problem-based Learning, and Case-based Learning to improve students' academic performance and promote class enthusiasm and satisfaction with the course. The study employs a quasi-experimental design with two groups and an objective achievement scale model with five educational objectives to evaluate teaching efficiency. In contrast, the current study aims to evaluate the effectiveness of case-based strategy on academic achievement in word problems in ,Mathematics among Junior secondary school students in Nigeria using a quasi-experimental design for two groups. The research work on the value of case-based learning within STEM courses examines the impact of Case-based learning versus traditional lectures on the learning gains of undergraduates in an intermediate physiology course. The study is rooted in cognitive load theory and explores how the timing of pedagogical approaches relates to students' cognitive abilities. In contrast, the current study aims to evaluate the effectiveness of the case-based strategy on academic achievement in word problems in Mathematics among Junior secondary school students in Nigeria using a quasi-experimental design with two groups.

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Chapter Three

Methodology

This chapter discusses the methodology employed for the study under the following sub-headings: Research design; Population of the study; Sample and sampling techniques; description of the research Instrument; Validity of Research Instruments; Reliability of Research Instrument; Data Collection; Data Analysis; and Ethical Approval.

3.1 Research Design

This study adopted quasi experimental design consisting of experimental group and control group. The study made use of 2x2 factorial matrix with treatment focusing on case-based group and control group; gender categorised as male and female students,

Table 3.1: Schematic Representation of the Design

Group	Pretest	Treatment	Post test
E_1	O_1	X_1	O_2
E_2	O_3	X_2	O_4

Source: Researcher's Field work, 2024

Where:

E_1= Experimental Group

E_2=Control Group

X_1=Treatment for Experimental Group (Case-based strategy)

X_2= Conventional method used for teaching the ontrol group

O_1 = Pre-test for Experimental group

O_2= Post-test for Experimental group

O_3= Pre-test for Control group

O_4 =Post-test for Control group

Table 3.2: Schematic Representation of the 2 x 2 Factorial Matrix

Treatment	Gender
Case-based Strategy	Female
	Male
Conventional	Female
	Male

Source: Researcher's Field work 2024

Variables in the Study

1. Independent Variable: Treatment Method at two levels which are:

   Case- based strategy and the Conventional strategy

2. Moderating Variable: Gender (Male and Female students)

3. Dependent Variable: Academic achievement in word problem

3.2 Population of the Study

The population of this study was all the (64,841) Junior Secondary School Two Students as at time of this study from 134 Junior secondary schools in the Ibadan metropolis, Oyo state[1].

Table 3.3: Population of the Study

S/N	Local Government	No of Schools	No of Students
1.	Ibadan North	32	15,641
2.	Ibadan North East	23	11,411
3.	Ibadan North West	20	9,541
4.	Ibadan South East	25	12,321
5.	Ibadan South West	34	15,927
	Total	134	64,841

Source: Researcher's Field work 2024

3.3 Sample and Sampling Techniques

The study adopted multistage sampling procedure. At the first stage, considering the fact that, Ibadan metropolis consist of 11 Local Government Areas (L.G.A), two Local Government Areas were randomly selected. The second stage involved a random selection of one Junior Secondary school from each of the two Local Government Areas. From the two schools selected, one school was randomly assigned to Experimental (treatment) group using case-based teaching Strategy and the Control group using the conventional teaching Strategy. Detail information on selected Junior Secondary schools for the study can be found in Table 3.4.

Table 3.4: Names of Schools in the Study

S/N	School	Population of JS2 in each sch
1	Apata Grammar School, Logudu	202
2.	Humani Alaga High School, Sango	164
	Total:	366

Source: Researcher's Field Work 2024

3.4 Research Instruments

Three research instruments were used for the study:

1) Lesson Notes for Case-based Teaching Strategy (CbTS) prepared by the researcher and specifically designed to align with the curriculum content of the Basic Education Certificate Examination (BECE) as outlined in the Second Term Scheme of work for JS2. The topic selected for this note was Word Problem in Algebra. The lesson note was employed as instructional tools. Detail in Appendix I.

2) Lesson Notes for Conventional Teaching Method (CTM) prepared by the researcher as a traditional approach to education, where a teacher provides instruction and assigns tasks to students in a class room using a standardised curriculum with little room for creativity on word problem in Algebra. Detail in Appendix II

3) Word Problem in Mathematics Achievement Test (WPMAT): This was derived from Basic Education Certificate Examination questions. It comprehensively covers all sub-topics related to the Word Problem in Algebra. WPMAT consist of a set of 40 multiple

choice questions, each offering four options labeled A to D. The Table of specification for the WPMAT is shown in Appendix III.

3.5 Validity of the Research Instrument

The face, content and construct validity of the research instruments was done by the researcher's supervisor and two experts in the Department of Science Education. All corrections and modifications were effected before the final draft was produced.

3.6 Reliability of the Research Instrument

The reliability of the instruments was carried out on two intact classes of two Junior School Students JSS2 from two public school which did not partake in the main study. Kuder–Richardson 20 formula (KR-20) was used to calculate the reliability of WPMAT and a value of 0.77 was obtained from the exercise.

3.7 Administration of collection of Data

The data collection for the study involved the researcher obtaining a letter of introduction from the Head of Department of Science Education, Lead City University, Ibadan to Principals of the selected schools. Also, the cooperations of the respective Mathematics teachers and the participating students were also sought. The Mathematics teachers of the participating schools were employed as research assistants and were trained on what the focus of the case-based teaching strategy entails in teaching word problems and how to go about it. The procedures taken to conduct study was also emphasized and the period of the study lasted Eight weeks.

Week One: Training of research assistants

Week Two: Administration of pre-test

Week Three to week Seven: Carrying out the treatment

Week Eight: Administration of post-test

3.8 Method of Data Analysis

The data generated were analysed using descriptive statistics and Analysis of covariance at 0.05 level of significance.

Endnote

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Chapter Four

Results and Discussion of Findings

This chapter presents results of the analyses and discussion of findings. The results and discussion of findings are presented based on demographic characteristics of the participants and hypotheses as follows

4.1 Demographic Data Analysis

Table 4.1 display the demographic characteristics of the participants.

Table 4.1: Distribution of the Participants by Gender

Gender	Frequency	Percent
Male	36	53.0
Female	32	47.0
Total	68	100.0

Source: Researcher's Field Survey, 2024

Table 4.1 revealed that 36 (53.0%) of the participants were males, while 32 (47.0%) were females. This means that, most of the participants were males.

Table 4.2: Distribution of the Participants by Age

Age	Frequency	Percent
<15 years	61	90.0
>16 years	7	10.0
Total	68	100.0

Source: Researcher's Field Survey, 2024

Table 4.2 revealed that 61 (90.0%) of the participants were below the age of 15 years, while 7 (10.0%) were 16 years and above. This means that, most of the participants were below the age of 15 years.

Table 4.3: Distribution of the Participants by Groups

Treatment Groups	Frequency	Percent
Experimental Group (case-based strategy)	35	51.0
Control Group (conventional method)	33	49.0
Total	68	100.0

Source: Researcher's Field Survey, 2024

Table 4.3 revealed that 35 (51.0%) participants were exposed to case-based strategy, while 33 (49.0%) participants were in control group.

4.2 Testing of Hypotheses

The following hypotheses were tested in this study at 0.05 level of significance.

$H_0$1: There will be no significant main effect of Case-based teaching strategy on Mathematics achievement in word problems among Junior secondary school students in Ibadan metropolis.

Table 4.4.1: Analysis of Covariance of Main Effect of Case-based Strategy on Mathematics Achievement in Word Problem

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3868.464	2	1934.232	196.683	0.000	0.858
Intercept	966.790	1	966.790	98.308	0.000	0.602
Pretest	1.640	1	1.640	0.167	0.684	0.003
Case-based	715.653	1	715.653	72.771	0.000	0.528
Error	639.227	65	9.834			
Total	47761.000	68				
Corrected Total	4507.691	67				

Source: Researcher's Field Survey, 2024

Table 4.7.1 showed that that there was a significant main effect of case-based teaching strategy on Mathematics achievement in word problem among Junior secondary school students ($F_{(1;68)}$=72.771, p<0.05, partial η^2=0.528). The null hypothesis was therefore rejected. This implies that the treatment was effective on Mathematics achievement in

word problem among Junior secondary school students . Also, the partial eta square value of 0.528 shows the contributing effect size of 52.8%.

Table 4.4.2: Estimated Marginal Means of Case-based Strategy on Mathematics Achievement in Word Problems

			95% Confidence Interval	
Treatment	Mean	Std. Error	Lower Bound	Upper Bound
Experimental	32.242	0.907	30.432	34.053
Control	17.773	0.952	15.871	19.675

Source: Researcher's Field Survey, 2024

Table 4.7.2 shows that participants exposed to case-based teaching strategy had a higher post-mean score of 32.242 on students' Mathematics achievement in word problem among junior secondary school students, than their participants in the control group with posttest mean score of 17.773. This means that participants exposed to case-based Teaching strategy performed better than those in the control group (conventional method). It implies that case-based strategy was an effective approach that improved students' Mathematics achievement in word problem among junior secondary school students

$H_0$2: There will be no significant main effect of gender on Mathematics achievement in word problem among Junior secondary school students

Table 4.5.1: Analysis of Covariance of Main Effect of Gender on Mathematics Achievement in Word Problems

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3216.583	2	1608.292	80.968	0.000	0.714
Intercept	271.507	1	271.507	13.669	0.000	0.174
Pretest	855.020	1	855.020	43.045	0.000	0.398
Gender	63.772	1	63.772	3.211	0.078	0.047
Error	1291.108	65	19.863			
Total	47761.000	68				
Corrected Total	4507.691	67				

Source: Researcher's Field Survey, 2024

Table 4.8.1 shows that there was no significant main effect of gender on Mathematics achievement in word problem among junior secondary school students ($F_{(1;68)}$ =3.211, p>0.05,partial η^2=0.047). The null hypothesis was therefore not rejected. This implies that the gender had no significant effect on Mathematics achievement in word problems among junior secondary school students . Also, the partial eta square value of 0.047 shows the contributing effect size of 4.7%.

Table 4.5.2: Estimated Marginal Means of Gender on Mathematics Achievement in Word Problems

Gender	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Male	26.711	0.992	24.730	28.691
Female	23.640	1.034	21.574	25.706

Source: Researcher's Field Survey, 2024

Table 4.8.2 shows that male participants had a higher posttest mean score (26.711) than their female (23.640) counterparts. This implied that male out performed slightly better in Mathematics achievement in word problem than their female counterparts.

$H_0$3: There will be no significant interaction effect of treatment and gender on Mathematics achievement in word problem among Junior secondary school students.

Table 4.6.1: Analysis of Covariance of Interaction Effect of Case-based Strategy and Gender on Mathematics Achievement in Word Problems

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3921.632	4	980.408	105.392	0.000	0.870
Intercept	921.552	1	921.552	99.065	0.000	0.611
Pretest	7.516	1	7.516	0.808	0.372	0.013
Treatment	642.916	1	642.916	69.112	0.000	0.523
Gender	24.503	1	24.503	2.634	0.110	0.040
Treatment* Gender	29.645	1	29.645	3.187	0.079	0.048
Error	586.059	63	9.303			
Total	47761.000	68				
Corrected Total	4507.691	67				

Source: Researcher's Field Survey, 2024

Table 4.9.1 shows that there was no significant interaction effect of case-based strategy and gender on Mathematics achievement in word problems among junior secondary school students in Ibadan Metropolis ($F_{(1;68)}$=3.187, p>0.05, partial η^2=0.048). The null hypothesis was therefore not rejected. This implies that case-based teaching strategy and gender had no significant interaction effect on Mathematics achievement in word problem among junior secondary school students. Also, the partial eta square value of 0.048 shows the contributing effect size of 4.8%.

Table 4.6.2: Estimated Marginal Means of Interaction Effect of Case-based Strategy and Gender on Mathematics Achievement in Word Problems

Treatment Groups	Gender	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Experimental (Case-based Strategy)	Male	31.501	0.935	29.632	33.370
	Female	35.993	1.801	32.394	39.593
Control (Conventional Method)	Male	18.339	1.913	14.516	22.162
	Female	18.133	0.957	16.221	20.045

Source: Researcher's Field Survey, 2024

Table 4.9.2 shows that female participants in the treatment group had a higher mean score (35.993) than their male (31.501) counterparts. This implies that the interaction of treatment and gender had a better effect on Mathematics achievement in word problems among female students who were exposed to case-based strategy than their male counterparts. In the control group, the male participants had a higher mean score (18.339) than their female (18.133) counterparts. This implies that the interaction of treatment and gender had a better effect on Mathematics achievement in word problems among male students in the control group than their female counterparts.

The overall comparison shows that female participants in treatment group had a higher mean score (35.993), followed by male participants in treatment group with a mean score of 31.501, while the female participants in control group had the least mean score (18.133). It implies that the interaction of treatment and gender had a better effect on Mathematics achievement in word problem among female participants who were exposed to case-based strategy than their male counterparts in the treatment and both male and female participants in control group, respectively.

Discussion of Findings

The findings of this study on the socio-demographic characteristics reveal that, most of the participants were males, of which the majority of the participants were below the age of 15 years. Also, majority of the participants were exposed to case-based strategy, while few participants were in control group.

The finding of this study revealed that there was a significant main effect of Case-based strategy on Mathematics achievement in word problem among Junior secondary school students in Ibadan Metropolis. This implies that the treatment was effective on Mathematics achievement in word problem among junior secondary school students. In addition, it was established that participants exposed to case-based strategy had a higher post - mean score on students' Mathematics achievement in word problem among the students, than their counterparts in the control group (conventional strategy). This means that participants exposed to case-based strategy performed better than those in the control group. It implies that case-based strategy was an effective approach that improved students' Mathematics achievement in word problem among the students. The outcome of this study was in line with the outcome of developing Mathematics written communication through case-based learning[1]. This means that case-based learning has affected the ability of students' mathematical communication. The communication abilities used to present data or mathematical issues in writing were tested in this study. The current result is also in line with case-based learning which is effective for fostering mathematical connection?[2].

The current result is not in line with the previous result of case-based learning within STEM Courses: Is It the Method or Is It the Student?[3]. From the previous result we found that the means of posttest scores for students in the case study group were not statistically different from students in the conventional lecture group, $F(1,119) = 0.025$, $p = 0.874$. Furthermore, learning gains of students in the case study group were not statistically different from those of students in the conventional lecture group, $F(1,119) = 0.027$, $p = 0.946$. Though the current and previous studies are not limited to the same educational level and subject matter but limited to the same contextuality.

The finding of this study revealed that there was no significant effect of gender on Mathematics achievement in word problem among junior secondary school students. This implies that gender had no significant effect on Mathematics achievement in word problems among junior secondary school students. The finding further established that male participants had a higher posttest mean score than their female counterparts. This implied that gender had a better effect on Mathematics achievement in word problems among male junior secondary school students, than their female counterparts. The outcome of this study was in line with the outcome of effect of computer simulation on achievement of students in Algebra at junior secondary school level[4]. The previous findings shows that the probability of obtaining the F-value (2.082) is 0.162, which is higher than the 0.05 level of significance. Thus, the null hypothesis of no significant difference for gender was not rejected since gender was not significant. In spite of different independent variable and areas of focus in the same subject matter (Mathematics)

in both current and previous studies, the effect of gender was examined at the same educational level with the same results.

The finding further established that male participants had a higher posttest mean score than their female counterparts. This implied that gender had a better effect on Mathematics achievement in word problem among male Junior Secondary School Students, than their female counterparts.

The finding of this study revealed that there was no significant interaction effect of case-based strategy (treatment) and gender on Mathematics achievement in word problems among Junior secondary school students. This implies that case-based teaching strategy and gender had no significant main effect on Mathematics achievement in word problem among Junior secondary school students in Ibadan metropolis. The outcome of this study was in line with the outcome of effect of computer simulation on achievement of students in Algebra at Junior secondary school level[4]. The previous result revealed that the probability of getting the F-value (0.181) is 0.672, exceeding the 0.05 significance level, indicating that the interaction effect of computer simulation approach and gender was not significant. This implies that the null hypothesis of no significant interaction effect between the computer simulation approach and gender was upheld. The interaction effect was examined at the same educational level in-spite of different in independent variables.

The current result also in line with the previous result of effect of problem-based Learning on developing science process skills and learning achievement on the topic of Safety in Our Environment[5]. The study found that (PBL) did not result in a statistically

significant difference in achievement between genders compared to traditional teaching methods. It suggests that utilising learner-centered approaches like PBL in teaching science subjects, including Biology, should be continued for effective learning outcomes. Inspite that both studies are different in dependent variable. They both examine interaction effect with the same results and limited contextually to the same independent and moderating variables but limited to different geographical locations.

The estimated marginal means of interaction effect further established that the female participants in the treatment group had a higher mean than their male counterparts. This implies that the interaction of treatment and gender had a better effect on Mathematics achievement in word problem among the participants who were exposed to case-based strategy than their male counterparts. In the control group, the male participants had a higher mean score than their female counterparts. This implies that the interaction of treatment and gender had a better effect on Mathematics achievement in word problem among male junior secondary school students in Ibadan Metropolis in the control group than their female counterparts. The overall comparison shows that female participants in treatment group had the highest mean score, followed by male participants in treatment group, while the female participants in control group had the least mean score. It implies that the interaction of treatment and gender had a better effect on academics achievement in word problem among female participants in junior secondary school students who were exposed to case-based teaching strategy than their male counterparts in the same group and control group respectively.

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Chapter Five

Conclusion

This chapter deals with summary of findings, conclusion, recommendations based on the finding of the study, contributions to Knowledge and suggestion for further research.

5.1 Summary of Findings

The finding of this study revealed that there was a significant main effect of case-based strategy on Mathematics achievement in word problem among Junior secondary school students ($F_{(1;68)} = 72.771$, $P < 0.05$, partial $\acute{\eta}^2 = 0.528$). This implies that the treatment was effective on academic achievement in word problem among junior secondary school students.

There was no significant main effect of gender on academic achievement in word problems among junior secondary school students ($F_{(1;68)} = 3.211$, $p > 005$,partial $\acute{\eta}^2 = 0.047$).

The finding of this study revealed that there was no significant interaction effect of case-based teaching strategy and gender on academic achievement in word Problems among Junior Secondary school students. ($F_{(1;68)} = 3.187$, $P > 0.05$,partial $\acute{\eta}^2 = 0.048$). This implied that case-based teaching strategy and gender has no significant interaction effect on Mathematics achievement in word problems among junior secondary school students. But it was further established that the female participants in the treatment group had a higher mean than their male counterparts. This implied that the interaction of treatment and gender had a better effect in Mathematics achievement in word problems among Junior secondary school students in the treatment group than their male counterparts.

5.2 Conclusion

The study reached the following conclusion based on the collected data, discussion.

This study was carried out as one of such efforts to improve students performance in word problem in Junior secondary schools.

To achieve this, the study determined effects of case--based teaching strategy on junior secondary school students academic achievement in Ibadan metropolis, Oyo State. However, case-based teaching strategy was found more effective in students academic achievement in word problems. Also, the female participants had a higher academic achievement than their counterparts in word problems. Although, there is no main effect of gender on Mathematics achievement scores of junior secondary school students in word problems.

5.3 Recommendations

Based on the findings, drawn from this research, the following recommendations were made:

1. Case-based teaching strategy should be used to improve students academic achivement in Mathematics word problem,

2. Case-based teaching strategy should be use to sustain student acadenic achivememt in Mathematics word problems at the junior secondary school,

3. Case-based teaching strategy should be used for areas or other topics in Mathematics,

4. Male and Female gender should be encouraged and assisted for better achievement in Mathematics word problems,

5. Teacher should be mindful of the interaction effect between case-based teaching strategy and gender on academic achievement. This suggests that teachers may need to tailor their teaching method to suit the diverse learning needs of male and female students. It is important to foster an inclusive learning environment that accommodates various learning styles.

5.4 Contribution to Knowledge

1. Conceptual contribution

Conceptually, this study has enhanced the conceptual definitions of the following terms, such as the 'effects of Case-based teaching strategy',' students', 'academic achievement' and 'word problem'.

2. Experimental contribution

This research significantly contributes to the growing body of evidence supporting the effectiveness of case-based teaching strategy in teaching word problems.

3. Implications for education and policy makers.

Education and policy makers are encouraged to consider the interaction of case- based teaching strategy into teaching of word problem as a means to foster improved learning outcomes.

5.5 Suggested Area for Further Research:

1. Future study could consider diverse educational levels, such as primary schools and senior secondary schools, in varied contexts.

2. Long-term effects: Exploring the Long-term effects of case-based strategy on students word problem proficiency and retention could also be a valuable avenue for further

investigation. This would provide insights into the lasting impact of this teaching approach on students' learning outcomes.

3. This study could be conducted in other states in Nigeria

4. More investigations need to be carried out on Case-based teaching strategy using other moderating variable like student attitude and school location.

5. This study can be extended to other concepts in Mathematics not examined.

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Appendix I

Lesson Note on Word Problems

Name: Olubukola Aderemi OGUNSAJU

Matric No: LCU/PG/002999

Degree In View: M.(Ed)Mathematics Education

Subject: Mathematics

Class: Junior Secondary School Two (JS2)

Duration: **40** minutes **(1 period)**

Date: January 15, 2024 – January 19, 2024

Topic: Word Problems

Sub-Topic: Algebra From Words

Specific Objectives: at the end of lesson, Students should be able to**:**

i) Use letters to express Mathematical Statements

ii) Solve simple word problems using algebra.

Instructional material (Control group): New General Mathematics for Junior Secondary School 2 by M.F Macrae, A.O Kalejaiye, Z.I Chima & G.U Garba

Instructional material (Experimental group):

i) Stories ii) Pictures

Previous Knowledge: The students are required to already have an idea of what Word Problems is all about.

Content:

Word Problems

Algebra from Words

Letters can be used to express Mathematical Statements from stories and Pictures.

1) Here is a story in words.

- Ugwu has a bag with some mangoes in it .
- He buys 2 more mangoes.
- Ugwu now has a bag with some mangoes and 2 more mangoes.

Here is the same story with algebraic symbols.

a. Ugwu has m mangoes

b Ugwu buys 2 mangoes

c. Ugwu now has a bag with m + 2 mangoes

In the above story, m represents the number of mangoes in the bag, m + 2 represents the number of mangoes that Ugwu has altogether.

2) Here is another story in words

a) Audu has some money in his saving account.

b) Audu uses some of the money to buy a suit

c) Audu has 6,570 naira left in his account.

Here is the same story with algebraic symbols.

- Audu has ₦S in his savings account
- Audu uses ₦t to buy a suit
- ₦S – ₦t = ₦6,570

In the above story, S represents the money in Audu's savings account, t represents the money that he used to buy a suit.

Example I

Baba is 13 years old.

- How old will he be 8 years from now?
- How old he be y years from now?

Answer

a) Baba will be (13 + 8) years old, 8 years from now.

b) Baba will be (13 + y) years old, 9 years from now

Example 2

A book has X pages. A boy reads 30 pages of the book. How many pages has the boy not read?

Answer

The boy has not read (30 – X) pages of the book.

Example 3

A girl is a years old. How old will she be in X years' time?

Note : Sometimes a problem seems difficult because letter are used for numbers. If this happens, first change the letter to an easy number. Use that number instead of the letter.

Answer (Example 3)

Use 2 and 10 instead of a X.

In 2 years' time, the girl will be 14 + 2 years old (16 years old).

In 10 years' time, the girl will be 14 + 10 years old (24 years old).

So, in X years' time, the girl will be 14 + X years old.

Lesson Note on Word Problems

Name: Olubukola Aderemi OGUNSAJU

Matric No: LCU/PG/002999

Degree In View: M.(Ed)Mathematics Education

Subject: Mathematics

Class: Junior Secondary School Two (JS2)

Duration: 40 Minutes (1 Period)

Date: January 22 – January 26, 2024

Topic: Word Problems

Sub-Topic: Sum and Difference

Specific Objectives: at the end of lesson, Students should be able to:

Use appropriate symbols for word such as sum, difference and product

Instructional material (Control group): New General Mathematics for Junior Secondary School 2 by M.F Macrae, A.O Kalejaiye, Z.I Chima & G.U Garba

Instructional material (Experimental group):

i Flash cards with words and symbols.

ii. Plastic fruits

Previous Knowledge: The students are required to already have an idea of what is all about.

Content:

Word Problems

Sum and Difference

The sum of a set of numbers is the result you get when you add the numbers .

Example 1 : The sum of four consecutive numbers is 58. Find the numbers

Answer

Let the numbers be n, $n + 1, n + 2, n + 3$.

$n + (n + 1) + (n + 2) + (n + 3) = 58$

$4n + 6 = 58$

Subtract $6n$ from both sides

$4n = 58 - 6$

$4n = 52$

Divide both sides by 4

$4n =$

$n = 13$

The numbers are 13, 14, 15, 16

Example 2: The manager of a company bought 60 mangoes, 10 pineapples and X coconuts for his staff to share among themselves. If the total number of fruits he bought was 94, how many coconuts did he buy?

Answer

60 mangoes + 10 pineapples + X coconuts = 94

$70 + X = 94$

Subtract 70 from both sides

$X = 24$

This implies that the number of coconuts bought were 24

Example 3: The sum of a certain number and 13 is 30. Find the number.

Answer

Let the certain number be P

$P + 13 = 30$

Subtract 13 from both sides.

$P = 17$

This implies that the number is 17.

Example 4: Find the sum of 23, 27 and 33

Answer

$23 + 27 + 33 = 83$

This implies that the sum of 23, 27 and 33 is 83

The difference between two numbers is the result of subtracting one from the other. It is usual to subtract the smaller number from the larger. This gives a positive difference.

Example 1 : The difference between 8 and another number is 17. Find the two possible values for the number. Let the number be X

Answer

i. Assuming $X > 8$, then

$X - 8 = 17$

Add 8 to both sides

$X = 17 + 18 = 25$

ii. Assuming $X < 8$, then

$8 = 17 + X$

Subtract 17 from both sides

$8 - 17 = X - 17$

$X = -9$

Thus, the number could be 25 or - 9.

Example 2: Find the positive difference between 3¾ and 2

Answer

3 ¾ can be written as

2 can be written as

3 ¾ - 2 = -

= = = 1 ½

Lesson Note On Word Problems

Name: Olubukola Aderemi OGUNSAJU

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Degree In View: M.(Ed)Mathematics Education

Subject: Mathematics

Class: Junior Secondary School Two (JS2)

Duration: 40 Minutes (1 Period)

Date: January 29 – February 2, 2024

Topic: Word Problems

Sub-Topic: Product and Fractions

Specific Objectives: at the end of lesson, Students should be able to:

i) Use appropriate symbols for words such as product.

ii) Solve word problems involving fractions.

Instructional material (Control group): New General Mathematics for Junior Secondary School 2 by M.F Macrae, A.O Kalejaiye, Z.I Chima & G.U Garba

Instructional material (Experimental group):

i) Stories

ii) Pictures

iii) Flash cards with fractions

Previous Knowledge: The students are required to already have an idea of multiplication and how to solve simple Problems involving fractions.

Content:

Word Problems

Product and Fractions

Product

The product of two or more numbers is the result when the numbers are multiplied together.

Example 1

Find the product of – 6, 0.7 and 6

Solution

- 6 x = -

= - 2 x 7 x 2

= - 28

Example 2

The product of two numbers is 8. If one of the numbers is ¼ , find the other.

Solution

Let the number be x

¼ x x = 8

Multiply both sides by 4.

X = 8 x 4

= 33

Expressions with Fractions

Example 1

Find one – quarter of the positive difference 29 and 11.

Solution

Required value = ¼ (29 – 11)

= ¼ (18)

= 4 ½

Example 2

Divide 40 by the sum of 3 and 5

Solution

Required Value = 40/ 3+5

=40/8 = 5

Example 3

Find one-ninth of the positive difference between 55 and the sum of 12 and 7.

Solution

Required Value = 1/9÷(55) - (12+7)

= 1/9÷55 -19

= 1/9÷36 = 4

Appendix ii

Control Group

Teacher's activities: Teacher will do the following:-

1. Carry out classroom instruction using her lesson note alone.
2. Give definitions, explanations and solve some examples.
3. Give room for students to ask questions on areas not clear to them.
4. Call out students, one after the other to solve problems on the board.
5. Write note on the board for students.

Students' activities: Students will do the following:

1. Pay rapt attention to classroom instruction.
2. Ask teacher questions on areas not clear to them.
3. Go to the board when called out by teacher to solve some problems on the board.
4. Write note from the board into their notebooks.

Experimental Group

Teacher's activities: Teacher will do the following:

1. Carry out classroom instruction using the instructional material best suitable for each sub-topic.
2. Display the different instructional materials in front of the class.
3. Explain the term "word Problems" with the help of the instructional materials.
4. Write some problems on the board.
5. Use the different instructional materials to represent the problems on the board
6. Solve Word Problems on the board while referring to the different instructional materials
7. Write examples on the board.
8. Call students randomly to illustrate the examples on the board using the suitable instructional materials.

Appendix iii

Word Problem in Mathematics Achievement Test (WPMAT)

Dear respondents,

This achievement test of 40 questions is for Junior Secondary School Two (JS2) students. It is meant to test your knowledge of Word Problems. Please adhere to the instructions and attempt all questions.

Thank you.

Class: …… Age: …… Gender……. Time: 1hr

Instruction: Each question has options A to D. Tick the most appropriate option for each question.

Word Problem Questions

1. Musa's age is two third of Abu's age. If the sum of their ages is 30, what age is Abu?
   (a) 24 (b) 18 (c) 15 (d) 13
2. A man is 55 years old. 5 years ago, he was twice his sons age. How old is the son presently? (a) 20 (b) 25 (c) 30 (d) 26
3. Pobese was 62 years old 18 years ago. What will be his age in 6 years time? (a) 96 (b) 66 (c) 76 (d) 86
4. A man spent
   (a)
5. The difference between 12.6 and a number is 5.4. what are the two possible values for the number? (a) 12 or 6.5 (b) 18 or 7.2 (c) 10 or 3 (d) None
6. One-quarter of the difference between 17 and the square of 3 is certain number. What is the number? (a) 12 (b) 11 (c) 7 (d) 2
7. If 45 is added to a certain number and the result is divided by 9 and the quotient is 8. What is the number? (a) 28 (b) 27 (c) 25 (d) 14
8. Niyi thinks of a number and subtracts 2 from it. He divides 32 by the result and he gets 4. What is the number? (a) 12 (b) 6 (c) 8 (d) 10
9. Bolaji subtracts 4 from a certain number. He divides 24 by the result and his answer is 8. What is the number? (a) 7 (b) 17 (c) 27 (d) 15
10. Mrs. Oni was 84 years old 12 years ago. What will be her age in 2 year's time? (a) 96 (b) 98 (c) 99 (d) 100

11. of the spectators in a football match are males. If 200 of them are females, how many of them are there in the competition? (a) 180 (b) 360 (c) 270 (d) 240
12. Bidemi thinks of a number. He adds 14 to the number and multiplies the result by 3. If his final answer is 51, what number did he think of? (a) 2 (b) 7 (c) 3 (d) 4
13. ¼ of a certain number is added to 4 . The sum is the same as when of it is subtracted from 20 find the number. (a) 28 (b) 27 (c) 29 (d) 33
14. Find the number such that when ¾ of it is added to 3 ½ , the sum is the same as when of it is subtracted from 6 ½ . (a) 2
15. Solomon adds 7 to a certain number, he doubles the result. His final answer is 34. What was his number? (a) 15 (b) 19 (c) 26)(d) 10
16. When Agnes adds 45 to a certain number ad divides the sum by 2, the result is the same as 5 times the number. What is the number? (a) 2 (b) 5 (c) 25 (d) 8
17. Tambuwal was asked to find one-eight of the sum of 14, 15 and 19. He got it right. What was his answer? (a) 4 (b) 5 (c) 9 (d) 6
18. Kelechi was asked to divide 48 by the difference between 4 and 8. What answer was she to get? (a) 12 (b) 10 (c) 9 (d) 16
19. When 8 is added to a certain number and the sum is multiplied by 3, the result is 57. Find the number. (a) 10 (b) 7 (c) 11 (d) 4
20. Kemi thinks of a number. She adds 14 to the number and multiplies the result by 3. If her final answer is 51, what number did she think of? (a) 3 (b) 4 (c) 1 (d) o
21. The sum of two numbers is 38. When 8 is added to twice one of the numbers, the result is 5 times the other number. Find the two numbers. (a) 26, 11 (b) 11, 26 (c) 26, 12 (d) 12, 24
22. Audu has a naira in his savings account. He uses some of this to buy a suit that costs t naira. How much does he have left in his savings? (a) ₦ (S __ t) (b) ₦ (St) (c) ₦(S + t) (d) None
23. A farmer has 6 goats, z cows and 16 tubers of yam. How many animals does he have altogether? (a) 6+z (b) 6z (c) 6+z+16 (d) z+16
24. Last year, the body mass of a student was 48kg. The increase in the student's body mass this year is m kg. What is the student's body mass this year? (a) (24+2m) kg (b) 48mkg (c) m kg (d) (48+m) kg
25. A rubber band is x mm long when un-stretched. It is stretched to three times its un-stretched length. What is the stretched length? (a) 33mm (b) 3x mm (c) x+3 mm (d) None
26. If 22 is added to a number and then the sum is divided by 2. The result is 6 times the number, find the number. (a) 7 (b) 1 (c) 2 (d) 5
27. There are two numbers, the sum of 4 times the first number and 3 times the second number is equal to 24. The difference between 2 times the first number and 3 times the second number is 12. Find the 2 numbers. (a) 2, 0 (b) 6, 0 (c) 0, 1 (d) 0, 5
28. 2 is added to twice a certain number and the sum is added. The result is 10 less than 5 times the original number. Find the original number. (a) 14 (b) 16 (c) 17 (d) 23

29. What number will you get when you divide 56 by the sum of 3 and ? (a) 6 (b) 4 (c) 3 (d) 2
30. The product of two numbers is 54. If one of the numbers is 27, find the other number. (a) 2 (b) 4 (c) 3 (d) 5
31. What is the product of the sum of -2 and 9 and the difference between 2 and 7 and the sum of 2 and 7? (a) 54 (b) 47 (c) 45 (d) 42
32. of a number is subtracted from of the number. Their positive difference is 7 less then of the number. What is the number? (a) 17 (b) 9 (c) 14 (d) 5
33. A student chose a number, multiplied it by 2, then subtracted 138 from the result and got 102. What was the number he chose? (a) 400 (b) 800 (c) 200 (d) 420
34. Mary, Peter, and Lucy were picking chestnuts. Mary picked twice as much chestnuts than Peter. Lucy took 2kg more than Peter. Together, the three of them picked 26kg of chestnuts. How many kilograms did each of them pick? (a) 4, 6, and 8kg (b) 6, 12, and 8kg (c) 12, 8, and 16kg (d) 6, 7, 10kg
35. A salesman sold twice as much pears in the afternoon than in the morning. If he sold 360 kilograms of pears that day, how many kilograms did he sell in the morning and how many in the afternoon? (a) 120kg, 240kg (b) 160kg, 320kg (c) 40kg, 80kg (d) 100kg, 200kg
36. The sum of numbers is 21. Five times the first number added to 2 times the second number is 66. Find the two numbers. (a) 13, 2 (b) 6, 13 (c) 7, 13 (d) 8, 13
37. A girl guesses that a line is 15cm long. She measures the line. She finds that her guess is x cm too long. What is the length of the line? (a) (15-x) cm (b) (14-x) cm (c) (x-15) cm (d) None
38. A man cycles x cm towards a village that is 20km away. How far does he still have to cycle? (a) (20+x) cm (b) (20-x) cm (c) (18-x) cm (d) (18x) cm
39. A man has 16 kolanuts, 9 pears, and 22 mangoes. A friend gives him k kolanuts, 13 pears and 4 mangoes. How many kolanuts, pears, and mangoes does the man have? (a) 16+k kolanuts, 20 pears, and 26 mangoes (b) 16+k kolanuts, 22 pears and 24 mangoes (c) 16k kolanuts, 22 pears, and 24 mangoes (d) None
40. A book has x pages. A boy reads 30 pages of the book. How many pages has not read? (a) x pages (b) 30x pages (c) (x+30) pages (d) (x-30) pages

Answer

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

Appendix iv

Table 3.3 Table of Specification

Content Word Problem	Knowledge	Comprehension	Application	100%
Algebra from Word	7	7	-	14(35%)
Sum & Difference	5	4	5	14(35%)
Product & Fraction	3	7	2	12(30%)
Total	15 (37.5%)	18 (45%)	17(5%)	40 (100%)

Bio-data

A. Personal Data

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B Educational Background

Educational Institution Attended	**Qualification**	**Year**
i. Methodist N5 Primary School Agodi Ibadan	Leaving Cert	1983
ii. Queens of Apostle Commercial grammar school Oluyoro Oke -ofa ibadan	WAEC	1989
iii. Ondo College of Education Ikere Ekiti	NCE	1996
iv. Ekiti State University, Ado Ekiti Ekiti State	BSc (ED)	2006

C. Work Experience with Date :

1.Oyo State Teaching Service Commission Feb. 3rd, 2000- Till date

D. Awards and Fellowship: nil

E. Membership: Nigeria Union of Teacher **(**NUT), Mathematics Association of Nigeria (MAN) .

F. Publication: O. A. OGUNSAJU & C. O. SAM-KAYODE. (2024)**.** Effects of Case-based Strategy on Academic Achievement in Mathematics Algebraic Word Problems Among Junior Secondary School Students in Ibadan Metropolis, Oyo State, Nigeria. ***International Journal of Research and Innovation in Social Sciences (IJRISS)***, 8(6),

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G. Major Conference Attended with Date:

International Seminal on the Occasion of UN and UNESCO Word Day for Cultural Diversity for Dialogue and Development

Theme: Diversity & Inclusion: Driving Force to Innovation for Substainable Development May 21,2024

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The University Compliance Certification

This is to certify that the thesis by Olubukola Aderemi OGUNSAJU, LCU/PG/002999, in the Department of Science Education, Faculty of Education, Lead, City University, Ibadan Oyo State is in full compliance with the approval University Format and Style

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Signature **Date**