Chapter One

Introduction

Background to the Study

At all educational levels, mathematics becomes a required subject in Nigeria. It is an important subject that has played crucial role in all human activities up to the present. Mathematics is the study of numbers, their relationships, combinations, generalizations, and spatial abstractions, as well as configurations, their structures, measurements, and transformations[1].

Mathematical studies are known as máthma ('knowledge, study, learning') in Greek. It encompasses the study of issues like quantity (numerical theory), structure (algebra), space (geometry), and change (analysis)[1]. Mathematics was developed by counting, estimation, and the careful examination of the shapes and motions of actual objects. Practical mathematics has been a human endeavor from the time of the ancient Greeks, who left written records behind[2].

Mathematicians look for and exploit patterns to generate new hypotheses; they employ mathematical proof to establish the truth or falsity of these assumptions. When mathematical constructs are accurate representations of reality, mathematical reasoning can be used to infer or make predictions about nature[2]. The researchers are empowered to carry out their work, address problems, decipher disclosures, study and predict the future, and generally advance the world by using mathematics as both the language and the tool of the sciences[1].

It is usual to use mathematics in daily life; it is a body of knowledge and application derived from the theories of individuals from all over the world[2]. Due to its high level of abstraction, emphasis on interrelated notions and reliance on symbol manipulation, mathematics has not caught the interest of many students despite its importance and relevance on a worldwide scale[4].

Mathematical proficiency directly correlates with economic prosperity in societies, it is essential for nations' scientific and technological development[3]. This is because knowledge of mathematics is necessary to comprehend other subjects, including engineering, the sciences, social sciences, and even the arts. The significance of mathematics in science and technology is diverse; therefore make mathematics to be commonly used in all areas of science, technology, and business. Due to its importance, mathematics has become an integral part of the school curriculum. The goal of the mathematics curriculum is to equip students with the knowledge and abilities necessary for today's rapidly evolving technological environment[6].

Mathematics is the cornerstone of the Nigerian educational system, both for basic education and post-basic education[6]. The Colleges of Education are the institution mainly for teacher preparation, it is a place where elementary school teachers are being trained in Nigeria. According to information in the National Policy on Education, a Nigerian Certificate in Education (NCE) is the minimal requirement for the teaching profession in the country[6]. Therefore, NCE holders must work as teachers in elementary or junior secondary schools. The National Commission for Colleges of Education (NCCE) was created by an act of the Federal Ministry of Education in 1989 as the third leg of the excellence tripod for the oversight of tertiary institutions in Nigeria in order to effectively carry out this task.[8] The Commission was directed and charged with the responsibility of laying down standards for all programme of Teacher Education, to monitor and control quality among Colleges of Education, accredited certificates, academic awards and approved guidelines for accreditation. With the above objective, NCCE has a document, which spells out the curriculum for the NCE programme. The document is called “Minimum Standards for NCE Teachers”.

The NCE Minimum Standard was reviewed in 2020, which is the current document being used in the Colleges of Education and it is refers to as the “NCE minimum standard 2020”. In the

review, relevant subject such as Mathematics, English and Computer Education are made compulsory for all NCE students. The disclosure of students to these subjects supposed to enable them to teach the subject effectively at the primary school and junior secondary level. The subjects are designed in the NCE curriculum in form of General Studies Education (GSE). GSE are core courses and must be passed by every prospective NCE holder.

The name given to General Mathematics in Colleges of Education is Basic General Mathematics. Pre-service teachers in Colleges of Education at 100 level to 300 level are required to offer this course. The course is categorized as follows:

i. GSE 113 & 122 (Basic General Mathematics I and Basic General Mathematics II) for 100 level students

ii. GSE 212&222 (Basic General Mathematics III and Basic General Mathematics IV) for 200 level students

iii. GSE 322 (Basic General Mathematics V) for 300 level students

The course contents were extracted from both Junior and Senior Secondary School General Mathematics curriculum. The Course contents in Basic General Mathematics are:

- GSE 113 (Basic General Mathematics I): 100 level students first semester, we have Number Base, Set Theory, Mathematical Operation on Fractions, Decimal and Whole Numbers, Indices and Logarithm, and Surds
- GSE 122 (Basic General Mathematics II) for 100 level students, second semester, we have Expansion and Factorization of Simple Algebra, Simple Algebra and Method of Solution, Simple word problem, Ratio, Percentages, Simple and Compound Interests and Variation (Direct and Inverse)

- GSE 212 (Basic General Mathematics III): For 200 level first semester, course contents are: Change the Subject of the Formula, Unit of Measurement, Area and volume of Plane shape, Area and volume of Solid Shapes,
- GSE 222 (Basic General Mathematics IV): 200 level second semester, we have Data Collection, Data Presentation and Angles.
- GSE 322 (Basic General Mathematics V): For 300 level, the course contents are: Frequency Distribution, Measure of Central Tendency, Range, Quartile, Mean Deviation, Variance and Standard Deviation, Simple Probability and Application[6].

All of these contents were offered in Secondary School Mathematics, in which it is expected of all NCE pre-service teachers to have acquired basic knowledge of the subject matter, however, reverse was the case. The pre-service teachers in their secondary schools education have learned the majority of the contents in Basic General Mathematics, but their level of performance in the course demonstrates that they still have a low level of achievement and a negative attitude toward the subject.

Change of Subject of the Formula is one of the contents to offer by 200 level students in first semester. This topic deals with making a variable out of a given formula the subject of the formula, that is, to express a variable in terms of others variable. From my own observation, most students found it difficult to express a variable in terms of others, which is one of the reasons they were unable to substitute any given variable correctly in any mathematical equation and solve for the correct answer. Despite the fact that the topic is not new to the students, their academic achievement and attitude in the course over time show that they lack the necessary understanding of how to manipulate variables to distinguish one subject variable from the others. Knowledge of subject of formulae is applicable to almost all of the remaining contents in the

course, students who do not understand basic rudiment for solving mathematical problems will always perfom low in the course.

Low achievement in Basic General Mathematics is an element of cross-factors connected with students, educators and schools[7]. Many researchers believe that students' attitudes are of a significant factor in whether they perform better or worse in mathematics[9,4]. A person's learned tendency to respond positively or negatively to an object, situation, idea, or another person is referred to as their attitude[5]. Out of a number of factors affecting Students' learning and performance in mathematics is students' attitude towards the subject, teachers instructional practices, and school environment[10].

Attitudes can change and develop over time, however, a negative attitude affects the learning outcome and prevents effective learning[11]. As a result, attitude is a crucial aspect that cannot be overlooked. Depending on the individual student, the impact of a student's attitude on their achievement in Basic General Mathematics may be positive or negative, this is because a student's attitude has long way to determine their academics achievement. These include the student's self-confidence in their ability to solve mathematics, their anxiety or phobia regarding mathematics, their enjoyment of mathematics, and their perception of the utility of mathematics.

Good teaching and student comprehension of the topic taught are also factors that aids positive attitude of students toward mathematics. While students' dislike of mathematics is related to things like boring teachers, inability to solve mathematics problems, a lack of understanding of the material covered, being distracted during lectures by talking or playing on their cell phones, and receiving a poor grade in an examination.

In mathematics education, teacher competency ought to be closely linked to student thinking, comprehension, and learning. It is important not to undervalue the role that teachers play in assisting students in learning. With the help of the teachers, students may be eager to learn and

gained mathematical knowledge. The primary responsibility of the educator in the classroom is to establish an appropriate learning environment in which students can engage in mathematical thinking, activities and view mathematics as a subject that demands "exploration, conjecture, representation, generalization, verification, and reflection"[9].

How to provide instructional environments, conditions, methods, and solutions that enable students of varying skill and ability levels to achieve their learning objectives is a central and persistent problem. To ensure that students are successful learners, innovative teaching methods and approaches should be developed.

Showing helps through cooperation in learning are a viable method for easing many squeezing issues in schooling. Unless the designers of teaching aids are aware of crucial factors that influence students' learning and construct a link between goals and student achievement, teaching aids alone cannot improve learning and achievement. Realizing these elements will empower the instructor to actually utilize accessible assets and time more to improve student learning ability. The use of WhatsApp and Cooperative learning for efficient teaching and learning of Basic General Mathematics are two examples of such intermediaries between teachers and students.

There are numerous Cooperative Learning procedures that are intended to accomplish various goals.

Cooperative Learning options include Learning Together (LT); Group Investigation (GI); Jigsaw Procedure (JP); Student Team Achievement Divisions (STAD); Team Assissted Instruction/ Individualization (TAI); as well as CIRC (Cooperative Integrated Reading and Composition)[11]. Student Teams Achievement Divisions (STAD) was used to measure Pre-service teachers' Cooperative Learning in this study.

Student Teams Achievement Divisions (STAD) is a Cooperative learning system wherein little gatherings of students with various degrees of capacity cooperate to achieve a typical learning objective[12]. Among all cooperative learning methods, STAD is regarded as one of the most researched and straightforward. It is used to achieve clearly stated instructional goals.

It is fundamentally collaboration, yet students will be reviewed exclusively as indicated by their commitment that they make towards their group. Generally in STAD, students are assembled into various groups that are blended in execution level, orientation, and ethnicity. The lesson will be taught by the teacher, and the students will work in teams to make sure they understand it. The material is tested on individual students by the teacher. Students' scores are compared to their previous averages, and points are given based on how well they meet or exceed their previous performance. It urges the students to get a sense of belonging with different individuals in their gathering along with themselves. As a result, it is guaranteed that members of the group at all levels are equally motivated to perform at their best[13].

Team rewards, individual accountability, and equal opportunities for success are the three main concepts in STAD. If a STAD group surpasses a predetermined level, certificates or other rewards are given to the team. All or none of the groups would be rewarded based on their scores, fostering a spirit of positive competition. The success of the team is determined by the individual growth of each group member in terms of individual accountability.

Positive interdependence, in which each student must believe that they have a significant role to play in the group, is one of the key components of cooperative learning. individual accountability in which each group member is held accountable for mastery of the instructional material; rewards for the group that provide enough motivation for the group to work together; and group instruction, in which students are required to learn the social skills necessary for collaboration before being placed in a group setting and expected to work together[14].

Integration of technology into the classroom has emerged as a crucial component of effective instruction and learning. Subsequently, integration of Information and Commucation Technology (ICT) into teaching stays a pivotal issue for successful teaching-learning process, therefore, ICT into teacher education and teaching practices is a complicated and difficult issue. In this regard, simply providing schools with the necessary ICT tools does not create more effective learning environments or improve the quality of instruction, in lieu of this, the government has, in the past, attempted to increase school mathematics achievement and implemented curriculum reforms that place a significant emphasis on ICT as a means of teaching mathematics[15].

Information and communication technology, or ICT for short, has grown to be a crucial tool for encouraging innovative teaching methods and enhancing students' capacity for continuous learning process. For example, when technology is utilized with appropriate teaching method in Basic General Mathematics classroom, it further improves students' academics achievement[14]. Also, understanding and application learning are possible because Basic General Mathematics is seen as a way to solve problems and is thoughtfully paired with technology. Students are provided with opportunities to create and modify representational forms, develop skills in creating and exploring virtual environments, and are emphasized as a fundamental means of making sense of the world in the ICT learning environment. Since strategic use of technology provides access to mathematics for all students, all schools must ensure that every student maximized the potential of technology to develop students' understanding, pique their interest, and increase their proficiency in Basic General Mathematics. Technology is an important tool for learning mathematics in the 21st century[16].

The teaching competency for stimulating students' interest in lessons required both College Tutors and Pre-service Teachers to use ICT in their lesson delivery[15]. Because of the significance of ICT in the general public and conceivably coming down the line for training, distinguishing

the potential impression of the reconciliation of these advancements in schools would be a significant platform for teaching and learning. In the needs and priorities survey conducted by Association of African Universities, it was revealed that the incorporation of ICT into teaching and learning was needed by 77.9 percent of college and university students[14].

In both developed and developing nations, the incorporation of technology into education has emerged as an increasingly pressing issue; because Lecture-based teaching method was depend upon by most of the instructor at the teacher education program[15]. The significant hindrances to technology integration into Basic General Mathematics teaching and learning were the current teaching methodologies utilized and absence of Pre-service teachers' knowledge on ways of applying technology to teaching which brought about chalk and talk approach in which educators did the vast majority of the talking and scholarly work, while students were detached repositories of the data provided[15].

The utilization of ICT on Pre-service teachers' Basic General Mathematics requires thoroughly prepared teaching staff on the utilization of ICT and visionary school initiative. Where these qualities are lacking, opportunities to implement desired school reforms are frequently missed by government policies and ICT implementation investments[16]. It is extremely beneficial for teachers to use ICTs in the classroom. This is due to the fact that ICT enables them to demonstrate comprehension of the opportunities and repercussions of curriculum-based uses of learning and teaching; plan, execute, and oversee learning and showing in open and adaptable learning climate. If ICT is conceived of as a tool that facilitates a shift in pedagogical approach, then its integration may have a significant impact on teachers' work. Teachers must be able to combine new pedagogies and technology for ICT integration to work.

For teachers to have the knowledge, abilities, and self-assurance necessary to teach with ICT, extensive preparation, ample time and ongoing support are necessary. The need to give instructor

schooling projects and expert improvement offices for rehearsing educators and pre-service teachers can't be overemphasized. The most major barriers to ICT integration in the classroom will undoubtedly be the pedagogical implications, the impact on curriculum structure and content, classroom organization and practice, and the transformed role of the teacher[13]. The objective of ICT literacy should be for all instructors and students to be proficient in using ICT as well as able to take advantage of it in their teaching and learning exercice. ICT literacy is now a major focus of school reform initiatives, moving from the periphery to the center.

An elevated degree of capability in the use of innovation has become important for individuals to work in an information society or the data age. There are numerous ICT subfields. Among various branches are webs, cloud, figuring word handling, Social media, etc. One of the most popular aspects of social media, WhatsApp Platform Use, is the focus of this study.

In Nigeria, virtually all households and young people are glued to social media, particularly WhatsApp, and this consumes more than half of their daily time. It is thusly vital to consider such medium which the students have a lot of acquainted with and generally dependent on, be changed into learning gadgets and conditions to appropriately draw in them in scholarly exercises as opposed to social use only[17]. The utilization of social media, particularly WhatsApp is so prevalent among young people in schools. This is why the study's focus is on pre-service teachers in colleges of education, one of the places with the most social media users.

Since its introduction, social media, particularly WhatsApp, has been well-received by everyone, particularly young people. Various organizations in Nigeria today, as well as others across the world, can address the way that most of students and speakers utilizing cell phones are taken part in web-based correspondence and social communications. Nowadays, social media play a significant role in daily life. It gives an unfathomably extended course to data conveyance, trade, and cooperative commitment among individuals and innovation that is not restricted by

geography[15,16]. Nowadays, people, particularly young people, spend more time online than in the "real world" for the majority of their daily activities. Most of the time, people only use these powerful and multifunctional platforms for audio and video communications, perhaps to reconnect with former classmates[17].

There are numerous platforms for social media networking. Facebook, Google+, Linkedin, WhatsApp, Instagram, Reddit, Telegram, Messenger, Twitter, YouTube, Google+, Zoom, and Skype are the most widely used social networking sites in Nigeria[18]. These platforms may be transformed into useful learning conditions to further the development of students' commitment to their academics, so as to upgrade their learning outcome.

Online platforms known as social media network sites enable two-way communication, screen sharing, video and audio conferencing, and manipulation. WhatsApp, Zoom, Google Classroom, Google Docs, Google Forms, AZ Recorder, Cisco Web-Ex, Team Viewer, Join Me, Apache, Open Meeting, Google Hangouts, Go To Meeting, Skype, Mikogo, WeChat, Screenleap, Discord, JitsiMeeting, Proficonf, Uber Conference, and a variety of other social media network applications are just a few examples[18].

The WhatsApp platform has the potential to be transformed into a mobile classroom in which all students can register to participate in learning activities due to its widespread use and popularity among Nigerian youths. WhatsApp has a few instruments like live recordings, Photograph Occasions, Documents, Collections, Declarations, and Watch parties among different elements which are reasonable for classroom activities[18].

WhatsApp use as of late has changed correspondence and this could make educating and learning exercises more straightforward. One of the most important tools for youth communication is the WhatsApp platform. A term is often used to depict a methodology that

consolidates on the web and in-person growth opportunities. WhatsApp is an application for smartphones and computers that lets users communicate with one another[20]. In recent years, educators have stressed the significance of using WhatsApp in the classroom, since education is nothing more than communication at its most fundamental level, using WhatsApp makes communication easier.

WhatsApp makes it easier and faster for teachers to communicate with their students. It can likewise assist students with imparting better in any given environment[21]. The gathering talk elements can be utilized to organize learning and concentrates inside and outside the school premises to deliver illustrations that could be paid attention to at students' recreation, and keep in touch with students beyond the classroom[21].

Students may be able to develop skills in teamwork and communication as well as create an environment for self-directed learning when they are encouraged to participate in learning and research through social networks [20]. WhatsApp is a tool for unlimited, free messaging that can be used both inside and outside of the classroom. WhatsApp Web is a web-based version of WhatsApp that lets you use it over the internet directly. Teachers can easily and effectively manage large classes by using WhatsApp groups. It may assist students in gaining confidence[22].

A website that enables users to engage, communicate, socialize, entertain themselves, and exchange information with others is referred to as a social networking site or social website[18]. If they are not translated into meaningful academic pursuits, social networking activities are time-consuming and pointless[21]. This kind of social networking could put a country's educational goals at risk[21]. A confined environment where individuals can connect at any time is referred to as social networking. This setting can be made into an academic learning environment that works well with mobile classrooms, virtual classrooms, e-learning, and remote learning[22, 23].

As the world keeps on spinning around innovation, educators need to keep consolidating these new advances in teaching their students for productivity and viability.

Mathematics instruction necessitates a manipulative and constructive approach that makes concepts tangible and applicable[23]. Because of this, innovative approaches like the use of social media and the electronic classroom are gaining ground in Nigerian classrooms[24].

This study will look into how WhatsApp use and the cooperative learning strategy (Students' Team Achievement Division) affect the learning outcome of pre-service teachers in Oyo's colleges of education in Basic General Mathematics.

1.2 Statement of the Problem

All parties involved which are students, teachers, parents, college administrators, the government, and the general public, have expressed concern about the declining general performance of students in Basic General Mathematics courses taught in educational institutions. This poor performance could be caused by a variety of factors, including gender, the use of instructional materials, the provided materials, and teachers' mastery of the material[25]. Over the years, researchers have been interested in all of these factors that affect how students perform in Basic General Mathematics. Numerous efforts have been made to enhance student learning, including the development of a more effective teaching method. This review, subsequently, needs to research the effects of Cooperative Learning (Students' Team Achievement Division) and WhatsApp Use on Pre-service teachers' Basic General Mathematics Learning Outcome in Colleges of Education, Oyo.

1.3 Aim and Objectives of the Study

The aim of this study is to examine the effects of Cooperative Learning and WhatsApp Use on Pre-service teachers' Basic General Mathematics Learning Outcome in Colleges of Education, in Oyo. Specific objectives of the study are to:

i. investigate the effects of cooperative learning on pre-service teachers' Basic General Mathematics Academics Achievement and Attitude in Colleges of Education in Oyo, Oyo State.

ii. examine the effects of WhatsApp Use on Pre-service Teachers' Basic General Mathematics academics achievement and attitude in Colleges of Education in Oyo, Oyo State.

iii. investigate the significant interaction effect of Cooperative Learning and WhatsApp Usage on Pre-Service Teachers' Basic General Mathematics Academics Achievement and Attitude in Colleges of Education in Oyo, Oyo State.

1.5. Research Question

1. What are the frequency distribution of pre-service teachers' pretest and posttest mean scores in BGMAT?

1.4 Hypotheses

The following hypotheses were tested in the study at 0.05 level of significance:

Ho1: There is no significant main effects of Cooperative Strategy on Pre-service Teachers' Basic General Mathematics

i. achievement in Basic General Mathematics in Colleges of Education in Oyo State

ii. attitudes towards Basic General Mathematics in Colleges of Education in Oyo State

Ho2: There is no significant main effects of WhatsApp Platform Use on Pre-service Teachers' Basic General Mathematics

i. achievement in Basic General Mathematics in Colleges of Education in Oyo State

ii. attitudes towards Basic General Mathematics in Colleges of Education in Oyo State

Ho3: There is no significant main interaction effects of Cooperative Learning and WhatsApp Use on Pre-service Teachers' Basic General Mathematics

i. achievement in Basic General Mathematics in Colleges of Education in Oyo State

ii. attitudes towards Basic General Mathematics in Colleges of Education in Oyo State

1.6 Significance of the Study

The stakeholders listed below could benefit from this study's findings:

Pre-service teachers would benefit from this study because it would help them improve their pedagogical and professional skills. They will be adequately prepared for the workplace because it will provide them with knowledge of the skills required by the field in which they intend to work. It is anticipated that the various Colleges of Education and other higher educational institutions will receive feedback based on this study's findings.

It aims to provide Pre-service teachers with a useful tool for determining the contributions of Cooperative Strategy to their comprehension of Basic General Mathematics, thereby facilitating comprehension of other courses.

Pre-service teachers at a variety of colleges of education and other higher institutions of learning will be able to have more understanding of WhatsApp Platform's contributions to the effective teaching and learning of Basic General Mathematics.

It would provide educational planners and policymakers with pertinent information for the purpose of formulating policies that will enhance a curriculum that matches the provision of necessary ICT tools to pre-service teachers' understanding of not only Basic General Mathematics but also other mandatory and required courses at various Colleges of Education and other higher educational institutions. It will be used as a starting point and a framework for future policies to improve the training of better-qualified pre-service teachers in each academic

discipline. It will also assist the lecturers in identifying the suitable strategy to be used in teaching a particular content in Basic General Mathematics.

Theoretically, the findings of this study, which focus on the effects of Cooperative Strategy(STAD) and WhatsApp Platform Usage on Pre-service Teachers, are expected to add to the body of knowledge. This will help keep track of how education goals are progressing and show that pre-service teachers' learning and teaching can be improved.

At long last, this study is supposed to be of importance to students and future analysts in any scholastic field who might wish to do explore work on the effects of Cooperative Learning Strategy and WhatsApp Platform Usage on pre-service teachers learning outcome across different disciplines and geological zones not thought about in this work.

1.7. Limitation of the Study

The study focused on effects of Cooperative Strategy and WhatSapp Usage on Pre-service Teachers' Academic Achievement and Attitude towards Basic General Mathematics in a selected Federal and two State Colleges of Education in Oyo State not for the whole Nation. This could limit the generalization of the result from this study since other states were not sampled in the study.

1.8 Scope of the Study

The geographical scope covers three (3) colleges of education in Oyo State. This study's participants were 200 level pre-service teachers from Emmanuel Alayande College of Education,Oyo, Federal College of Education (Special), Akimorin and Oyo State College of Education, Lanlate.

The content scope consists of the first content from Basic General Mathematics III which is Change of subject of the Formula.

Conceptual scope of this study includes Cooperative Strategy [Student Teams Achievement Divisions (STAD)], ICT [What Sapp Platform Usage and Microsoft Form], while pre-service teachers' learning outcome in Basic General Mathematics was estimated by Basic General Mathematics Achievement Test (BGMAT) and Pre-service teachers Attitude Questionnaire (PTAQ).

1.9. Operational Definition of Terms

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

Learning Outcomes in Basic General Mathematics: These are what describing what students must know, be able to do, or be able to demonstrate after completing a course in Basic General Mathematics. It is a student action that must be observable, measurable, and demonstrateable[55]. Students' learning outcomes in this research involve their achievement and their attitude toward Basic General Mathematics.

Achievement in Basic General Mathematics: Is the student ability in understanding and application of knowledge gained in solving Basic General Mathematics problems, which can be measured by written examination. Therefore, it is the student overall performance at the completion of Basic General Mathematics course.

Students' Attitude: Is the measure of students' positive and negative feelings toward Basic General Mathematics in terms of students' self-confidence in their Mathematics ability, Mathematics anxiety, phobia for Mathematics, Mathematics enjoyment, perception about the usefulness of Mathematics and general impression toward the subject.

Cooperative Learning: Students Team Achievement Division as one of Cooperative Learning Strategies was used to measure Pre-Service teachers' Learning Outcomes in Basic General Mathematics for this research work. This strategy involves students working together in a small group on structured activities. The lecturer firstly present the teaching to students using normal

conventional method, then grouped the students and give them structured instruction and activities on which members of the groups will learn to work together to accomplish a common purpose. After which they will be tested individually and the group will be rewarded based on their scores.

WhatsApp Usage: This refers to one of the common social media that is mostly use for Information and Communication worldwide. In this study, a WhatsApp group was created by the researcher and students used in this experimental group were added to the platform, also, lecture time was fixed and communicated to the students via whatsApp. The lesson was taken by a research assistance while video recording of the lesson was made. At the fixed time for the lesson, recorded video clips for the lesson were sent into the platform, students listen to the video clips and sent their response through voice mail and whatsApp message, teacher answered them through voice mail and whatsApp messages. The lesson lasted four an hour per week.

Pre-Service Teachers: Pre-Service Teachers refers to students that are under training in a structured tertiary institution so as to become professional teachers. In this study, students from the three selected colleges of Education in Oyo State were referring to as Pre-service teacher. The colleges of education were Emmanuel Alayande Colleges of Education, Federal College of Education special, Akimorin and Oyo State College of Education, Lanlate.

Basic General Mathematics: Basic General Mathematics is one of general courses offering by students in colleges of education, starting from 100 level to 300 level. All the course contents in this course are the revision of what the students have learnt in their secondary school education. For the purpose of this study, 200 level were used.

Microsoft Form: This is one of Microsoft package, It may be used to design surveys, quizzes, generate responses from the respondents using practically any web browser or mobile device, view real-time results as they submitted, assess responses using built-in analytics, and export data to Excel for further analysis or grading. This form was use for the assessment of WhatsApp

platform Usage group. The link was sent to WhatsApp platform created for the group, each student gained access to the test as they click on the link just like Computer-Based Test.

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Chapter Two

Literature Review

This chapter presents the review of related literature under Effects of Cooperative Strategy and WhatsApp Usage as determinants of Pre-Service Teachers' Basic General Mathematics Learning Outcome in Colleges of Education, Oyo State. It was done under the following sub headings:

2.1 Conceptual Review

2.1.1 Concept of Cooperative Strategy

2.1.2 Concept of WhatsApp Platform Usage

2.1.3. Concept of Students' Learning Outcome

2.1.4. Concept of Basic General Mathematics

2.1.5. Concept of Students 'Attitude

2.2 Theoretical Review

2.2.1 Experiential Learning Theory

2.2.2 Theory of Career Adaptability

2.3 Review of Empirical Studies

2.3.1 Cooperative Learning and Pre-service Teachers' Basic General Mathematics

2.3.2 WhatsApp Usage and Pre-service Teachers' Basic General Mathematics

2.3.3 Students' Attitude and Pre-service Teachers' Basic General Mathematics

2.4 Conceptual Model

2.5 Summary of Gap in Literature Reviewed

2.1 Conceptual Review

2.1.1 Concept of Cooperative Strategy

Cooperative strategy was defined as a kind of learning strategy in which students' study together and complete common goals[1]. "Small groups of learners working together as a team to solve a

problem, complete a task, or accomplish a common goal" is another way to describe it. The fundamental objective of mathematics education is to ensure that every student has a sufficient mathematical foundation to become productive members of a society marked by complex information and technology. They also revealed that there is a lot of evidence to suggest that cooperative learning methods are more effective in achieving the objectives of mathematics instruction[1]. Students will be more cognitively active, better able to solve problems, more confident in their abilities in Basic General Mathematics, less anxious about learning basic general mathematics, more motivated to take additional Basic General Mathematics courses, and better able to apply what they know about Basic General Mathematics to career situations if cooperative strategy is used. In a number of areas, cooperative strategy results are more upbeat attitudes. Acceptance of heterogeneity and group conflicts, improved attitudes toward the teacher, and increased motivation were all promoted by cooperative strategy[2].

Cooperative learning is one of the two different ways of coordinating the learning climate of a study hall, the other being competitive. In cooperative learning environment, the objectives of discrete people become so connected that there is a positive relationship between them; running against the norm, in a competitive traditional climate, the objectives of the students are connected to the point that there is a negative relationship between their objective attainments[3]. In a non-competitive learning environment, cooperative learning creates a community in which students can immediately receive assistance and support from other group members by simply raising their hands and waiting for the appropriate responses. The majority of the mathematics syllabus topics can be learned using the cooperative learning strategy[1].

Cooperative learning, student grouping, academic achievement, and group rewards have all been the subject of numerous studies in recent years. Cooperative learning is a showing approach in which little gatherings, each with students of different degrees of capacity, use scope of instructive exercises to upgrade their understanding of a topic[4]. One of the most recent and

impressive areas of learning research, theory, and practice is cooperative education. It indicates students working together to achieve the goals and the educational occasion that arrange the students' joint effort[5]. The first step in the cooperative learning strategy, which is STAD, is for students of the same grade and age to form groups or teams. The cooperative learning method lets students learn from one another and improve their interpersonal skills[6].

Cooperative learning aims to improve students' learning as well as their social skills, such as decision-making, conflict resolution, and communication[7]. In contrast to passive listening, this teaching method encourages higher-order thinking, reinforces listening to others, and provides opportunities for immediate feedback and thought modification[8]. Students can even broaden their perspectives on issues by working together to comprehend material or content. Frequently, students evaluate the ideas of their peers and determine whether they agree or partially agree, allowing them to better formulate their own ideas. Individuals learn when they view one another as resources rather than rivals in cooperative learning[8,9]. In response to other students' requests for assistance or their perceived need for assistance, members frequently provide information prompts, cues, reminders, and encouragement. In this manner students upgrade their reasonable understanding[10].

There are numerous cooperative learning strategies for achieving various goals. Among the many cooperative learning methods, such as Learning Together (LT); Group Investigation (GI); Jigsaw Procedure (JP); Student Teams Achievement Divisions (STAD); Team Assisted Instruction/Individualization (TAI); and Cooperative Integrated Reading and Composition (CIRC)[11].

Learning Together

The learning together strategy is a method created by D.W. Johnson and R.T. Johnson. The main highlights of this procedure are the presence of the gathering objective and imparting the insight

and materials, division of work and the gathering reward. We find that there are more cooperative learning activities in mathematics education by looking at the literature. Cooperative learning has a great need for research to test its impact on academic success, especially at higher education levels, given the significance of mathematics education[12].

Jigsaw Cooperative Learning Strategy

The jigsaw method is a way to plan activities in the classroom that makes students work together to succeed. It divides classes into groups that, once completed, assemble a portion of an assignment and combine their efforts. Elliot Aronson, a social psychologist, created it to help break down racial cliques in schools that have been forced to integrate people of different races.[13]The strategy divides classes into blended gatherings to take care of on little issues that the gathering groups into an outcome[14]. For instance, an in-class task is partitioned into points. After that, the students are divided into groups, with one member assigned to each subject. Each student learns about their topic individually and presents it to their group. Then, students assemble into bunches partitioned by point. Each participant once more addresses the topic group. In same-theme gatherings, students accommodate perspectives and combine data. They write a report at the end. Finally, the initially formed groups reunite and take in everyone's speeches. The final presentations teach each group member about their own material and the outcomes of the topic - specific group discussion[15].

The jigsaw method is a cooperative learning strategy that encourages individual accountability as well as team success. Because it involves putting the pieces of the assignment together to create a complete picture, the procedure gets its name from the jigsaw puzzle. The assignment is broken up into sections, and the class is also broken up into the same number of groups as the assignment[16]. Each group is given a different topic to study. These groups are shuffled to form new groups with members from each group[17]. History has shown that fights, discrimination, and

hate crimes were common in schools. New students were terrorized by groups of white supremacists and racist white students. All of the learning abilities of students were harmed as a result of this, which made them feel unsafe in their schools. Students frequently could scarcely sit in a similar room together without occurrence, substantially less work together. This made an issue for educators, students, guardians, networks, and the nation the same, as a whole age of students were diverted from advancing by uncontrolled scorn and segregation[18].

It was right now that analysts were pulled in to encourage schools on how to address this issue. Dr. Elliot Aronson used a psychological approach to address classroom issues when he was hired to advise Austin in 1971. The level of competition among students had risen dramatically. It was quickly realized that the classroom's competitive atmosphere encouraged students to ridicule one another and discriminate against those who were different from them in order to advance in status. To counter this issue, students were put in differentiated bunches so they would be expected to cooperate and diminish the cutthroat climate. It was challenging for students to adjust to the classroom's ethnic diversity. An atmosphere was created that encouraged more cooperation and less resistance to working together. An assignment was devised that accorded equal importance to each group member. The students had to pay attention and learn a lot from the other members of the group. Because of this, each group member can contribute a small part to the bigger picture, making them all important to the group. This trains the students to depend on one another and lessens their cutthroat perspectives toward one another on the grounds that they need everybody in their gathering to do well on the grounds that their grade relies upon the other students[19].

Writing surveyed that Students in jigsaw homerooms ("jigsaws") showed a diminishing in bias and generalizing, preferred in-bunch and out-bunch individuals more, showed more elevated levels of confidence, performed better on normalized tests, loved school more, decreased truancy,

and blended in with students of different races in regions other than the homeroom contrasted with students in conventional study halls ("trads"). The analysis additionally expanded compassionate job taking. Students were able to see things through the eyes of another student[22].

Group Investigation Cooperative Learning Strategy

A classroom teaching strategy called group investigation involves students working cooperatively in small groups to explore, experience, and comprehend their subject of study[7]. As a result, GI is a teaching approach that can encourage classroom engagement among the students since they are required to exhibit both positive interdependence and individual accountability. They also need to connect well with one another because they must work in groups. They ought to work together to discuss a variety of subjects with their group. Group Investigation (GI) was reportedly created by Herbert Thelen[23]. Sharan and his associates at Tel Aviv University have more recently expanded and improved this strategy. In contrast to STAD and Jigsaw, GI is undoubtedly the most complicated and challenging cooperative learning strategy. Group inquiry: A Cooperative Learning Method of 59 includes students in planning the themes that will be examined and how the inquiry will be conducted. This calls for more complex norms and class structures than those used in teacher-centered systems. Following is a description of the GI method's six steps[23].

1. Topic Choice. Students select one or more specialized subtopics from a field of typical issues that are typically addressed by the teacher. Then, students are put into task-focused small groups of two to six persons. The diverse group's makeup, both academically and racially.

2. Collaborative education. Following the sub-subtopics chosen in step 1, students and teachers design procedures, tasks, and specific learning objectives.

3. Application. Students put a plan they created in stage 2 into action. Learning should expose kids to a variety of activities and abilities as well as sources both within and outside of the classroom. Each group's progress is continuously monitored by the teacher, who also provides assistance as needed[23].

4. Analysis and Synthesis. Students analyze and evaluate information obtained during step 3 and plan for how this information can be summarized by drawing to be displayed or presented to classmates.

5. Presentation of the completed work. To engage everyone in the class's work and provide a more comprehensive understanding of a subject, some or all of the groups present on engaging themes. The teacher organized the groups' presentations.

6. Assessment. The groups occasionally pursue various facets of the same subject. Each group's overall contribution is evaluated by the students and the teacher. Assessment of the group and individuals was part of the evaluation.

Cooperative Integrated Reading and Composition (CIRC)

CIRC is a procedure where students work in their group in different helpful exercises including understanding couples, distinguishing key story components, jargon and outline exercises, perusing cognizance system rehearses, and experimental writing utilizing the most common way of composing approach. It is believed that group work can boost student motivation. Learning steps for cooperative integrated reading and composition. The learning steps are as the following: (1) Students are divided into diverse groups; (2) Each group reads a book or article; (3) Students rewrite the discussion's outcome on a worksheet; (4) Each group displays or presents its results; and (5) The best group is awarded a prize[24].

Team-Assisted Individualization (TAI)

Team-Assisted Individualization (TAI) is one type of cooperative learning. It is referred to as a group learning strategy in which a more competent student serves as an assistant and is responsible for providing individual assistance to group members who are less advanced. In this instance, the teacher's role in the learning and teaching process is limited to that of a facilitator and mediator. It is enough for them to establish a cooperative learning climate for the students [25]. By prioritizing individual roles without sacrificing cooperative aspects, the TAI learning model encourages learners to assist one another in their groups and generates enthusiasm in the competitive system. The eight stages of this learning model's implementation are as follows: (1) placement test, (2) teams, (3) teaching groups, (4) creative student, (5) team study, (6) fact test, (7) team score and team recognition, and (8) whole-class unit[24]. The lecturer starts by giving the students a placement test to see how well they can start learning. Heterogeneous gatherings comprising of five students each are shaped, and the course material is momentarily conveyed before the students are given tasks. In addition, the lecturer emphasizes that each student's success is dependent on the group. The encouragement of others in the group serves as external motivation. Students study together by completing assignments from their groups' worksheets. In the following stage, the teacher, or those with remarkable scholastic capacities as companion coaches, offers individual help to students who need assistance. At this stage, social union is reinforced, on the grounds that every part effectively assumes a part and needs to be essential for the gathering. As a result, members of the group are dependent on one another. According to the cognitive development of the students, an interactive session can aid in learning[25, 26]. In the experimental class, the teacher and students use the learning model.

This cooperative learning model also has stages that teach all of the students in the class how to solve problems using mathematical reasoning, communication, and self-proficiency skills.

Teachers, students, and the upper and lower groups that collaborate to complete academic tasks all benefit from each component of the TAI type of the cooperative learning model. It is the responsibility of those students whose comprehension of a particular idea is quicker to assist those who are still incorporating the new idea into their existing knowledge base. Every student can learn new skills and abilities as a result of this.

Student Teams-Achievement Divisions (STAD) is a cooperative learning strategy in which students of varying skill levels collaborate in small groups to achieve a common learning objective. STAD is viewed as one of the most explored, least difficult, and generally direct of all agreeable learning. It is used to achieve clearly defined instructional goals[27].

The students will be divided up into teams or small groups. The class completely will be given the illustration and students will be hence tried. People are evaluated in the group's presentation. Albeit the tests are taken independently, students will be urged to cooperate to work on the general execution of the gathering. Although it is primarily a cooperative activity, students will receive individual grades based on the contributions they make to their teams. For the most part in STAD students are bunch into various groups that are blended in execution level, orientation, and nationality. The lesson will be taught by the teacher, and the students will work in teams to make sure they understand it. The material is tested individually by the students, who may not assist one another. Students' scores are compared to their previous averages, and points are given based on how well they meet or exceed their previous performance. It encourages students to assume responsibility for themselves and other group members. Subsequently in this manner it is ensured that all gathering individuals with various levels are similarly persuaded to give their all.

Individual accountability, team rewards, and equal opportunities for success were listed as three main STAD concepts. If a STAD group reaches a higher level than a predetermined level, they receive team rewards in the form of certificates or either of these rewards. All or none of the

groups would be rewarded based on their scores, fostering a spirit of positive competition. The success of the terms is determined by the individual learning of each group member in terms of individual accountability[28].

In STAD, students are assigned into groups. Once these assignments are made, a four-step cycle is initiated, which are: (i) teach, (ii) team study, (iii) test and (iv) recognition.

Teaching: In the teaching stage, the teacher presents materials usually in a lecture-discussion format. Students should be told what it is they are going to learn and why it is important.

Team study: In the team study stage, group members work cooperatively with teacher-provided instruction and exercises to practice

Test: In the testing stage, each student individually takes a test. The teacher grades the test and notes the current scores as well as the improvement over previous test.

Recognition: Each team receives recognition awards depending on the average scores of each team. For example, teams with average of 20 to 25 improvement points receive a GOOD TEAM certificate, teams with average 26 to 30 improvement points receive a VERY GOOD TEAM certificate, and teams with average 31 to 40 improvement points receive a EXCELLENT TEAM certificate[28].

Advantages of Student Team Achievement Test

- Group has greater information resources than individuals do
- Group has to employ a greater number of creative problem-solving methods
- Group members gain a better understanding of themselves as they interact with each other.
- Working in a group foster learning and comprehension of idea discussed[28].

Disadvantages

- An individual group member may dominate the discussion.

- Some group members may rely too much on others to get the job done.
- Group members may pressure others to conform to the majority opinion which may not be the best

For this study, Student Team Achievement Division was used to measure Pre-service teachers' achievement in Basic General Mathematics in the Experimental Group 1.

2.1.2 Concept of ICT (WhatsApp Usage)

ICT is defined as the administration, storage, and transmission of information using a variety of established technological resources and toolkits for information and communication technologies. ICT is become one of the fundamental pillars of our contemporary society. It can be used as a technique to get around impediments to lower-level education, costs, teacher shortages, and issues with time and distance[29].

ICT represents Information Communication and Technology. The terms "information technology" and "communication technology" are combined to create it. Management methods and the scientific, technological, and engineering discipline of information technology are used to manage information; ICTs are networks that offer new opportunities for teaching, learning, and training through the delivery of digital content. It's adding vitality to classroom education environments, through virtual environments, therefore, ICT altering the processes of teaching and learning mathematics[30]. ICTs represent Data and Correspondence Innovations and are marked as a "various arrangement of mechanical instruments and gadgets used to convey, and to make, disseminate, store, and oversee data[30]. Digital ICT of the future is not a single technology; its combines multimedia, software, hardware, and delivery systems. Desktop, notebook, and handheld computers, digital cameras, the Internet, cloud computing, the World Wide Web, spreadsheets, tutorials, simulations, email, local area networking, Bluetooth, streaming, and DVDs are all examples of ICT in education today. Also, applications like virtual environments,

emulators, word processors, digital libraries, computer-mediated conferences, videoconferencing, and other are inclusive. Digital libraries, where professionals, students, and teachers can access course and study materials from any location at any time, are made possible by ICT[31].

The use of technology in teaching, learning, communicating with students, and managing educational programs are all examples of technology in education. The quantity of technological devices supporting traditional educational activities, including anything electronic like CD players and photocopiers, is defined as technology in education. Students can now learn in new ways thanks to technology. When students are able to select technology tools that assist them in obtaining information in a timely manner, analyzing and synthesizing the information, and professionally presenting it, effective technology integration is achieved. The classroom's use of technology should become standard practice. The effect of sight and sound is that students can investigate new ideas that are nearer to their everyday experience and making sense of the idea of good science[32].

This is a great change from the method of common reasoning to a substantial perspective. As a result, this may indirectly boost students' interest in acquiring science process skills and enhance the learning process. Around the world, the use of technology in education has been steadily increasing. Involving Nigeria for instance, innovation has kept on being a pathway for educationists to further develop their instructing strategies, to improve the introduction of materials, to draw in students and to give current and pertinent information[33]. In the middle of the 1980s, there was a significant influx of technology into classrooms; however, this explosive growth did not appear to match the general population's growth in technology. It has for the most part been seen that new innovation goes to military, the confidential area, advanced education, lastly government funded training in that order[34].

This consideration of innovation in the study hall started decisively around the time the primary PCs hit the market. Teachers are designing curriculum with the use of technology as a tool to enhance learning in a content area or in a multidisciplinary setting as they use technology and, more importantly, as strong professional development in the integration of technology in education. Technology has significantly altered the means of communication. Most of the time, anyone who has the right technology can access information. Moment correspondence all over the planet is a reality for individual, business and instructive applications. Students can now learn in new ways thanks to technology. When students are able to select technology tools that assist them in obtaining information in a timely manner, analyzing and synthesizing the information, and professionally presenting it, effective technology integration is achieved. The classroom's use of technology ought to become standard practice[35].

Because of the difficulties students face in learning the subject, teaching and learning science subjects, particularly mathematics, requires more attention. The way that students experience challenges learning Mathematics is well reported[36,37]. Another issue affecting the teaching and learning of mathematics is the teaching methods used by teachers. When new technologies are incorporated into the teaching of mathematics, it is believed that the majority of the issues that are associated with the subject will be resolved. To support and enhance learning, a variety of technologies can be incorporated into teaching and learning.

A portion of the innovations as of now being use in the homerooms incorporate specialized gadgets and applications, for example, cells, PCs, projectors, intuitive whiteboards, different programming applications, and the Web. Learning will be significantly enhanced by having access to some of these technologies at home and in the classroom. It was stated that a favorable reading climate and the availability of computers at school and at home have a positive impact

on science performance. The benefits of using new technologies in mathematics education serve as the foundation for novel teaching strategies. Both theoretically and practically, they help the teacher and the student advance their work[38].

Teachers' awareness of, familiarity with, and proficiency with these brand-new technologies are largely responsible for the successful application of those applications. Teachers of mathematics need to know exactly how these technologies can be used in the classroom to teach and learn mathematics. The Internet, cloud computing, word processing, social media, and other areas are just a few of the many ICT subfields. The researcher is focusing on WhatsApp Platform Use, one of the most popular aspects of social media, for this study.

In Nigeria, virtually all households and young people are glued to social media, particularly WhatsApp, and this consumes more than half of their daily time. Therefore, it is believed that this medium, which students are most accustomed to and addicted to, could be turned into learning tools and environments to properly engage them in academic activities rather than just for social use[40]. The utilization of virtual entertainment, particularly the most well-known one, WhatsApp is so uncontrolled among the age section of adolescents in Schools. In order to accomplish this, the pre-service teachers in the colleges of education with the highest proportions of social media users were the focus of this study.

Since its introduction, social media, particularly WhatsApp, has been well-received by everyone, particularly young people. The majority of students and professors who use mobile phones are engaged in online communication and social interactions, according to various institutions in Nigeria and around the world. Virtual Entertainment has turned into a significant piece of current life. It provides a vastly expanded, non-geographic route for the dissemination, exchange, and

collaborative engagement of information between people and technology[41,42]. Nowadays, people, particularly young people, spend more time online than in the "real world" for the majority of their daily activities. Most of the time, people use these powerful and multifunctional platforms for just audio and video communications to reconnect with friends from high school[43].

There are numerous platforms for social media networking. Facebook, Google+, Linkedin, WhatsApp, Instagram, Reddit, Telegram, Messenger, Twitter, YouTube, Google+, Zoom, and Skype are the most widely used social networking sites in Nigeria[44]. These stages may be transformed into useful learning conditions to further develop student commitment in scholastic exercises to achieve upgraded execution.

Online platforms known as social media network sites enable two-way communication, screen sharing, video and audio conferencing, and manipulation. WhatsApp, Zoom, Google Classroom, Google Docs, Google Forms, AZ Recorder, Cisco Web-Ex, Team Viewer, Join Me, Apache, Open Meeting, Google Hangouts, GoToMeeting, Skype, Mikogo, WeChat, Screenleap, AnyMeeting, Discord, JitsiMeeting, Proficonf, Uber Conference, and a variety of other social media network applications are just a few examples.

The WhatsApp platform has the potential to be transformed into a mobile classroom in which all students can register to participate in learning activities due to its widespread use and popularity among Nigerian youths. Live videos, photo events, files, albums, announcements, and watch parties are just a few of WhatsApp's features that can be used for classroom activities[46].

The use of WhatsApp in recent years has changed communication, which may make activities related to education easier. One of the most important tools for youth communication is the WhatsApp platform. It is a term that is frequently used to describe a strategy that combines learning opportunities in person and online. WhatsApp is a computer or smartphone application

that lets users communicate with one another[47]. Teachers are lately upholding the significance of WhatsApp use in the homeroom. The utilization of WhatsApp works with correspondence, and schooling is just correspondence in its most essential structure.

Educators can utilize WhatsApp to speak with their students all the more quickly and successfully. It can also help students communicate more effectively in any setting[48]. The group chat features can be used to keep in constant contact with students outside of the classroom and to coordinate learning and studies both inside and outside the school. This allows teachers to create lessons that students can listen to whenever they want.

Students may be able to develop skills in teamwork and communication as well as create an environment for self-directed learning when they are encouraged to participate in learning and research through social networks [49]. WhatsApp is a tool for unlimited, free messaging that can be used both inside and outside of the classroom. WhatsApp Web is an online rendition of WhatsApp that permits you to use it straight over the web. With the utilization of WhatsApp gatherings, instructors can easily and actually oversee huge class sizes. It may assist students in developing self-assurance[50].

A website that enables users to engage, communicate, socialize, entertain themselves, and exchange information with others is referred to as a social networking site or social website[51]. If they are not incorporated into meaningful academic pursuits, social networking activities are time-consuming and pointless[51]. Social networking of this kind could jeopardize a nation's ability to achieve its educational objectives[52]. Person to person communication alludes to a bound setting where individuals interface whenever, this setting can be changed into a scholarly learning climate reasonable for remote learning, e-learning, virtual homerooms, and portable classrooms[53,54].

As the world continues to revolve around technology, teachers must continue integrating these new tools into their instruction for the purpose of efficacy and efficiency. Mathematics instruction necessitates a manipulative and constructive approach that makes concepts tangible and applicable[54]. Because of this, innovative approaches like the use of social media and the electronic classroom are gaining ground in Nigerian classrooms[50]. As a result, Experimental Group II measured Pre-service teachers' achievement in Basic General Mathematics using WhatsApp platform devices.s

2.1.3 Concept of Students' Learning Outcome

Statements describing what students must know, be able to do, or be able to demonstrate after completing a course or program are called "Student Learning Outcomes." It is a student action that must be observable, measurable, and demonstrateable[55]. Students' learning outcome involve their accomplishment and their disposition toward the consummation of a course.

In 2009, students' performance in mathematics was determined to be poor, with 27.5% failing. In 2010, the failure rate increased to 49.6%, and in 2011 and 2012, it increased to 46.4% and 60.5%, respectively[56]. According to a study, teachers, students, environmental factors, inadequate service training, few qualified teachers to teach Mathematics and poor working conditions were the causes of students' failure[57].

Scores on mathematics tests, interest in mathematics, and general self-efficacy in mathematics were all found to be significant indicators of students' learning outcomes in a study. The review shows that none of the sorts of showing rehearses straightforwardly affected students' grades, while instructors' informative quality and social-everyday reassurance decidedly affected students' post-guidance arithmetic interest and general mathematics self-adequacy after genuinely controlling for students' very own attributes and their pre-guidance performance[58]. Truth be told, such an effect was likewise detailed in other scientists' work; for example,

scientists tracked down that students' inspiration, mentalities toward school, readiness to do schoolwork, and trust in their learning ways of behaving are undeniably impacted by educators' perspectives toward teaching, while it is justifiable that the most consideration is paid to students accomplishment, this review uncovered that the obligingly sure effect of showing rehearses on students' academic achievements is through their overall self-viability. Subsequently, while focusing on students achievements, it is especially essential to reinforce students' personal encounters in classrooms to upgrade their learning inspiration and other non-mental execution. Students' learning outcomes are positively correlated with their motivation for learning and their failure in mathematics also linked to teachers' teaching methods[59].

Showing rehearses is what educators do in the classroom, how instructors apply educational systems and conventional approaches to teaching to upgrade students' adjustment of conduct. In the learning of mathematics, these methods include lecture, teacher-centered methods, and rote memorization[61,62]. Numerous students are viewed as underachiever in the learning of Mathematics, in which teachers' factors like teaching strategy, dominance of the topic, the utilization of educational strategies, correspondence ability; The underachievement of the students was attributed to factors like their study habits, attitudes, and mathematical interests, as well as environmental factors like parents' values, classroom environment, and peer group[63,64].

2.1.4 Concept of Basic General Mathematics

As a fundamental subject at all educational levels, mathematics is also a significant subject that has played an important role throughout history. Mathematicians use mathematics as both a language and a tool in their research, which enables them to analyze and predict the future as well as the world's overall development[65]. The study of topics like quantity (number theory), structure (algebra), space (geometry), and change (analysis) is included in the máthma

('knowledge, study, and learning'). To come up with new hypotheses, mathematicians look for and use patterns; they use mathematical proof to determine whether these are true or false.

It is possible to make inferences or predictions about nature using mathematics[2]. The study of numbers, their operations, relationships, combinations, generalizations, and spatial abstractions, as well as configurations and their structures, measurements, and transformations, is known as mathematics[66]. Mathematical branches include algebra, arithmetic, calculus, geometry, and trigonometry. Using reflection and rationale, Mathematics created from counting, estimation and the orderly investigation of the shapes and movements of physical objects[66]. Since the ancient Greeks left written records, practical mathematics has been a human endeavor[67].

The application of mathematics to everyday life is common; the group of information and practice is gotten from the commitments of masterminds all through the ages and across the world. He went on to say that mathematics is used all the time. It is the body of knowledge and behavior that has grown over time and all over the world as a result of intellectuals' contributions over time. However basic and huge as mathematics may be to the world's expanded creation, it has not provoked the curiosity of numerous students because of its high conceptual nature and spotlight on associated thoughts and image control. Therefore, teaching mathematics focuses not only on the subject's computing ability but also on the selection of mathematical information and the communication required for comprehension[68]. It is generally acknowledged that mathematics is the foundation upon which science and technology are built. Mathematics is a subject that is required in both elementary and secondary education due to its significance. The Arithmetic prospectus plainly expresses that Mathematics is intended to empower the student to secure perspectives, abilities and information that will be pertinent to their life after school[69]. Obviously existence without Mathematics won't merit living as all different angles that cause everyday routine deserving of experiencing to rely upon Science.

Mathematics is a science that deals with measurements, quantities, and manipulation of number[70]. It also involves doing calculations, doing computations, solving problems, and so on. It is generally accepted that mathematics is a fundamental subject and the foundation upon which science and technology rest, implying that science and technology would not exist without it. Science and technology now serve as a standard by which any nation's economic strength and level of development can be evaluated; a nation with cutting-edge technology is regarded as a developed nation. Mathematics, on the other hand, is necessary to solve problems of sustainability in a variety of human endeavors, and these cannot be accomplished without it[71]. Mathematics enables us to visualize the fundamentals of the investigated phenomenon and the mechanisms of the issue[72]. This word was affirmed in the advanced investigations of the economy, industry, and the social circle. For instance, the authors described an approach to the study of unequal distribution of resources in society by examining the impact of economic growth and financial development on wealth concentration using the vector auto regression model[73]. The classifier for identifying abnormal records in medical data arrays was examined using a sensitivity analysis of neural network models[74]. An answer for the traffic stream improvement issue was introduced utilizing a neuro primary renovating approach. Traffic becomes stable and safe as a result, and exhaust gas pollution is reduced[75]. The characteristics of university students' academic motivation were investigated through mathematical modeling, making it possible to implement principles of student-centered education in the teaching process[76]. Studies by some researchers demonstrate how mathematics can improve production processes at a ferrous metallurgy company. Product quality can be improved, energy and raw material costs can be reduced, production waste that pollutes the environment can be reduced, emergencies can be avoided, and labor safety can be improved[77]. Positive trends were discovered in a socioeconomic analysis of the region: Economic expansion, employment expansion, and a

decrease in the pollution caused by industrial waste can all be regarded as steps in the direction of sustainable development. As a result of the significance of mathematics to all aspects of life, numerous efforts have been made to enhance the teaching and learning of mathematics, particularly at the basic and post-basic levels, in order to lay a solid foundation for future researches[80, 81]. Mathematics educators and researchers have conducted studies on the factors that contribute to poor performance in mathematics at the basic, post-basic, and colleges of Education levels. These factors include, but are not limited to, a lack of qualified mathematics teachers, inadequate facilities and equipment for instructional aids for teaching and learning, lack of innovative in the use of teaching methods, large class sizes, and students' attitudes[83]. Low Mathematics achievement has been linked to a wide range of factors, according to numerous studies[84, 85].

2.1.5 Concept of Students' Attitude

Not just thinking and reasoning are required for mathematics learning. The attitude of the students toward learning mathematics has a great impact. A person's attitude is made up of their cognitive and affective responses to something or their environment based on how they feel or what they are interested in[86].

What a person believes or thinks about mathematics is the cognitive aspect of attitude. The sentiments or emotions that a person has in relation to learning mathematics make up the emotional component of attitude. As a result, the emotive element is what motivates pupils to be interested in mathematics. The belief developed from the cognitive component of attitude also has an impact on the affective side since it shapes students' sentiments toward learning mathematics by forming a mindset that persists over time. As a result, there is a strong interaction between the cognitive and affective aspects of attitude[87].

The propensity to react in a particular way to studying mathematics is the affective side of attitude. Student behavior has an impact on their' affective attitudes as well. It is considered a favorable behaviour if a learner associates their level of confidence with their achievement in mathematics. Students' attitude towards Mathematics influences the efforts they put in understanding and practicing mathematical concepts and skills. Students' beliefs about their competence and their expectation for success in school have been directly linked to their levels of engagement, as well as to emotional states that promote or interfere with their ability to be academically successful[88]. Thus, attitudes determine the effort a student is likely to put in his learning of the subject, that is, Mathematics.

Attitude is a psychological or mental preparation status that was displayed as a result of experiences, that has a leading or dynamics influence on a person's behaviours towards all

objects or situations in which he or she has been involved[86]. Attitudes are intensive feelings, relatively stable which are consequence of positive or negative experiences over time in learning a topic.

Recent research, however, suggests a link between students' attitudes about mathematics and their academic achievement. According to the data, there is a strong association between students' attitudes and performance, and those who had a positive attitude did better. A survey of college students found that those who performed well academically had a more favorable attitude toward mathematics than those who performed poorly. These findings were supported by broader studies on college students' views about mathematics study in nine different nations[87]. Positive attitudes toward mathematics can predict high achievement, but so can good performance predict a positive attitude. However, these authors emphasize the role of lecturers and colleges in affecting attitudes, stating that using better teaching techniques, more motivated

teachers, or better course material could improve mathematics performance, which has a corollary to the improvement of attitudes toward mathematics[88].

2.2 Theoretical Review

This study is anchored on two relevant theories. The first is known as Experiential Learning and the second is Theory of Career Adaptability.

2.2.1 Experiential Learning Theory

Experiential Learning theory was propounded by David Kolb in 1984. According to this theory, learning is the process by which experience is transformed into knowledge. Because it is widely used by educators and health care professionals, Kolb's model has been chosen to illustrate various approaches to critical thinking on role play and career development planning[89].

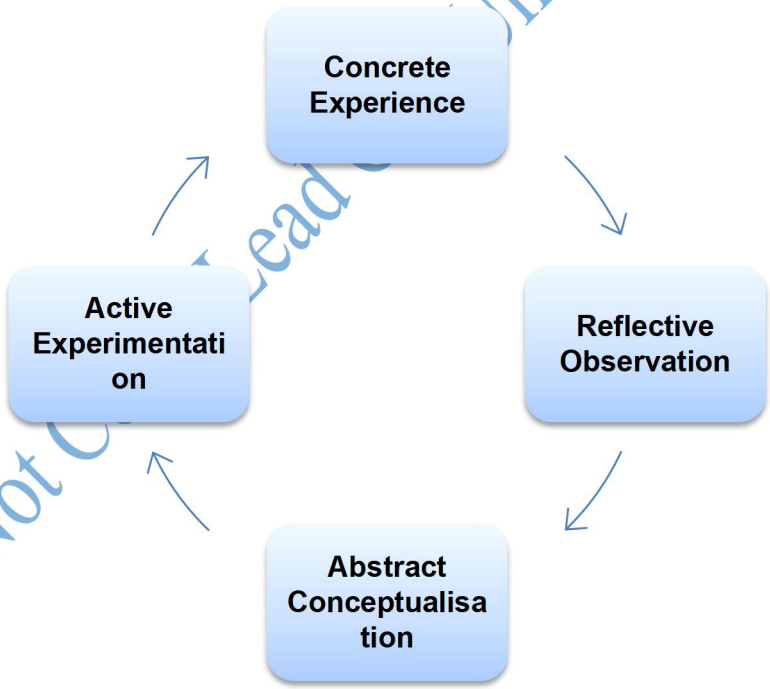

Figure 2.1: The Cycle of Experiential Learning in Kolb's Reflective Model

Source[86]

In 1984, Kolb created the experiential learning cycle, which consists of four stages. Goal-directed and behavior learning theories were combined by Kolb to create a learning cycle that

values the process and ongoing nature of learning[90]. Concrete Experience is the first of the four stages; Observation by Reflection; Abstract Conceptualisation; and Active Experimentation[89]. How Kolb's intelligent model of the pattern of experiential learning helps my profession improvement arranging as an airline steward are introduced beneath under the model's four phases.

The Concrete Experience: The actual event that needs to be achieved is described in Kolb's model's first stage. Kolb features the meaning of the reflection part in the pattern of learning. Students are able to process what happened during the experience in this stage. At this point, the student will consider her objective, make a note of it, and describe what she sees, how she feels and what she believes is her objective[90]. The circumstance necessitates contemplation of your thoughts and emotions. You need to provide a solid foundation for your review here. The student is put in a conscious and physical situation that forces her to think about how she can learn new things and improve her skills and practice. This first concrete experience as a flight attendant has provided me with knowledge and skills that help me understand my strengths and the areas in which I need to grow, like the roles and responsibilities of a flight attendant[89].

The Reflective Observation: This second phase of Kolb's model connect past information and encounters to accomplishing vocation goals. A student describes and evaluates their experiences at this point. Students gather the necessary information for the model's from other locations at this stage. A student asks herself specific questions, such as "What has worked well?" after writing down the goal. What hasn't been going as planned? How would I represent the disappointment or achievement up to this point? What factors have been influencing the experience? The student ponders what has transpired deeply at this point. The second stage of Kolb's model, reflective observation, has provided me with the knowledge and skills necessary to establish my career objective and personal action plan as a flight attendant. I wrote down my

dream job as a flight attendant at this point. I assess the profession's strengths and weaknesses. I put down what I really want to learn in resulting stages[91].

The Abstract Conceptualization: The student is able to consult literature and converse with colleagues who share their perspectives during the third stage of Kolb's model. At this point, the student alters her perspective and reevaluates the situation. By comprehending why the experience went as it did, the student takes her reflection to the next level in this third stage. She gleans some background knowledge by employing some theoretical concepts. Students make a clear connection between her experiences, her expectations, and the outcome of the experience, as well as her preparatory learning. The experience can truly change as a result of this reflection process, which evaluates the knowledge a student brings to a learning activity in light of her own experience. The questions from the previous step serve as the guiding question for the third stage. The student will inquire about herself, such as: What could I have done better or differently? Could I at any point develop what I have done[92]?

In addition, the student endeavors to discover various strategies for coping with the circumstances. In the event that a similar issue arises once more, she develops diverse solutions. As the third stage of Kolb's model, abstract conceptualization, I now has the knowledge and skills necessary to be an effective flight attendant. At this point, I work more and consult on my flight attendant career goal[91].

I learn and relearn the two speculations and practices of the calling. At this point, I am better prepared than I was before.

The Active Experimentation: In the fourth and final stage of Kolb's model, the student is given the opportunity to test out contemporary methods, theories, or solutions in new or similar contexts. As a result, students gain more experience on which to reflect later. She then develops a plan for how things will be done differently as students examine her experience at this stage.

She might get the chance to put her cutting-edge methods, theories, or solutions to the test in a relevant setting. The student makes plans for future learning opportunities through reflection. She puts the new theoretical knowledge she's learned to use by bringing her improvement ideas, reviews, and thoughts back into her practice to try out new strategies[91].

Not every cutting edge approach, hypotheses, or arrangements will work at this last stage. Some will work, while some will not, so this is then naturally the reason for another cycle. During the active experimentation stage, experiences turn into brand-new, concrete experiences as this continues. As the last phase of Kolb's model, dynamic trial and error has improved my abilities and information as a potential airline steward. I now have the new, concrete experiences that I learned about modern approaches, theories, and solutions at this stage. By giving me the knowledge and skills I need to become a professional flight attendant, this stage gets me ready for work. However I have obtained fundamental abilities and information, yet there are a few different abilities and information that might be missing as an airline steward; I believe that on-the-job training will resolve that[90,89].

These boxes can be used to look at and think about a situation, habit, way of doing something, or how a service is provided. At various times, the models can be used for expedient or more in-depth reflection. Both necessitate consulting the literature and having a conversation with others, such as coworkers, service users, managers, or loved ones. The model makes it possible to become more reflective.

Pre-service teachers' participation in an active learning process (known as "do" by Kolb) is the focus of this study, which draws on experiential learning theory. observing the content being learned's relationships and outcomes ('observe'); planning any given mathematics lesson by thinking about the relationships and the results (active experimentation). Three of Kolb's experiential theory's from four learning styles which are convergers, accommodators, and divergers—are supported by learner-centered activities and teacher demonstration are examples

of activity-based learning methodologies. The learning environments that benefit students are emphasized by the styles. These learning styles include:

- Assimilators, who learn best when given strong logical theories to think about;
- Convergers, who learn best when given concrete examples of how concepts and theories are applied.
- Accommodators, who learn best when given "hands-on" experiences;
- Divergers, who learn best when given the freedom to observe and gather a variety of data, in other words, pre-service teachers who prefer learning via hands-on experience, learning through observation, or learning through the collecting of a wide range of information would function at their best in activity-based tactics. These teachers would be able to prepare, deliver, and assess activity-based lessons for students as they were in practice. This theory is related to this study on the use cooperative learning strategy on pre-service teachers learning outcome on General Basic Mathematics because the theory emphasise learning through personal discovery and experience gathered in the process of readiness to learn new things which is attributed to Student team achievement division where students are grouped and student contributed to the achievement of each other in the group.

2.2.2 Theory of Career Adaptability

Adaptability implies that quality can change, ability to easily adjust to new or changed circumstances[91]. The physical, psychological, and social maturity that comes with age and lifelong development is referred to as career maturity. The hypothesis of vocation versatility started from the center idea of Super's profession improvement hypothesis, in a particular profession development, which has been continually refreshed and updated by scientists. It refers to an individual's capacity to smoothly adapt to changes and maintain a balance in their career

roles when coping with the transition of their own career roles as the work world shifts from stable to fluid. It has been investigated how individuals can improve their career resilience to cope with unpredictable situations and make appropriate adjustments[92].

Simply put, career adaptability refers to the resources that are able to effectively manage individuals' anticipated and current career shifts[92]. These resources are psychosocial because they serve as a point of contact between people and their surroundings and are not the core characteristics of an individual. In the meantime, Savickas altered the hypothesis to be the singular's condition of status for unsurprising profession errands, the vocation jobs included, and Professional issues that are erratic in profession changes or profession circumstances, which is likewise a quality that considers change absent a lot of trouble to adjust to the new environment[92]. The state of preparation and resources required to respond to current and anticipated career development tasks, including the attitudes, abilities, and behaviors individuals require to match them with work that suits them—psychological resources for managing career change, new tasks, and job trauma—were later defined and supplemented with a more concise definition[93]. There were four different resources for career adaptability: Concern is the state of worrying about one's future in terms of one's work; Control is the state of trying to plan for one's future in terms of one's career; Exploring one's possible selves and scenarios falls under the category of curiosity, while developing one's confidence is one's capacity to achieve desired objectives and aspirations falls under the category of confidence[92].

Researches on Career Adaptability

Numerous studies have examined the application and practice of career adaptability. These researchers were of the opinion that students' sustainable development education can benefit from career adaptability[94]. Additionally, career adaptability was primarily affected by two

aspects: One was personal variables like gender, grade (age), personality traits, and so on. The second was the factors connected with the climate, like family, social help, etc. An examination of the factors that predict career adaptability skills among Nigerian higher education students has been conducted. It was tracked down that profession self-adequacy; Among Nigerian higher education students, personal goal orientation, career future concern, and perceived social support are predictors of career adaptability skill. In terms of family factors, the impact of parents' and family's socioeconomic status on career adaptability was primarily investigated[95]. Parental support is positively correlated with parents' intrinsic fulfillment values and work–life balance values as career-specific parenting behaviors link parents' vocational characteristics and children's career adaptability[96].

Work was completed on profession versatility: the impact of adaptability and readiness on educational success cannot be underrated. Quality adaptability can easily change to accommodate new or altered circumstances[94]. The hypothesis zeroed in fundamentally on how people utilize their professional characters to change the grouping of occupation changes. The proactive personality and the Big Five personality traits were the primary focus. Examining the factors that influence career ability as well as its impact on power and life satisfaction. He discovered through a longitudinal study that career adaptability has an impact on feelings of power and life satisfaction. He also discovered that men are more confident in their abilities than women. Men are higher in vocation versatility and experience profession fulfillment than women[97].

Proactive care behaviors and career adaptability showed positive correlations between initial individual levels, intraindividual changes in career adaptability, and proactive care behaviors, indicating a parallel development[97]. It is clear from the perspectives of the aforementioned researchers that career adaptability places an emphasis on how people interact with their living environment and on the non-deterministic challenges they faced. Thusly, profession flexibility

can be viewed as a sort of mental capacity for people to keep equilibrium of these components when they change their vocation jobs. The WhatsApp platform's use for teaching and learning is relevant to this theory. The WhatsApp platform is a device that has been discovered as a result of technological advancement. It is quite distinct from the conventional approaches that are taken when instructing students. Ability of teachers to adjust with the current development in technology and be prepared for the challenges in chosen appropriate ICT device that can be used to improve the learning outcomes of pre-service teachers in Basic General Mathematics through the application of theory of carrier adaptability. Pre-service teachers who are preparing to teach in primary and junior secondary schools will also benefit from carrier adaptability because it would enable them to always be prepared to adapt to any change in their profession, particularly in the teaching method chosen at a particular time and for a particular set of students.

2.3 Review of Empirical Studies

2.3.1 Cooperative Strategy and Pre-service Teachers' Basic General Mathematics

In both controlled and unstructured groups, a researcher examined the impact of cooperative learning on 223 students in the ninth grade[8]. Students in the organized group were shown to be more willing than those in the unstructured group to cooperate on group projects and help their peers. The students collaborated in mixed-race, sex, and academic achievement groups of three or four people[8].

Another researcher employed multivariate regression analysis to discover that children who received cooperative learning instruction outperformed their peers academically as seen by their excellent test results. A total of 116 intermediate macroeconomics students, divided into groups of three or four, participated in the study. In seasons of teaching arranged either as cooperative group work or entire class instruction, students aged 11 to 14 were involved. The researcher compared their academic performance and classroom behavior. Three different group projects were involved in their experiment. The design consisted of three parts: cooperative groups

(taking on roles and putting ideas together), sitting groups (checking each other's work), and collaborative work (full interdependence). Pre- and post-test results as well as observations of the classroom were used to collect data[5].

It was shown that classes where collaborative grouping was used to teach students outperformed classes where whole-class instruction predominated. Group instruction seemed to have 5% higher gains in task behavior than whole-class training. Additional research demonstrates that group training performed much better than whole-class instruction in terms of open discussion and sustained interactions[10]. A study that looked at how cooperative learning affected students' academic performance 63 female students enrolling in grade 12 at a public college were divided into experimental and control groups, and a pre-test was administered to each group as part of a quasi-experimental design. The experimental group participated in a variety of cooperative learning activities, such as Jigsaw II and Team Game Tournament (TGT), for eight weeks. Post-test was then conducted. It was concluded that cooperative learning activities had a positive effect on academic achievement of students enrolled in the subject of education[4].

These studies demonstrate that students who participated in cooperative learning environments performed better academically. Students who are working toward a similar objective like the sensation of supporting one another's accomplishment and it seems that the longer the group worked together, the more beneficial this group work became. Cooperative learning has been chosen by educators at the pre-tertiary level as the method that produces the best results out of all the teaching and learning approaches. The ideal classroom environment is one in which students feel free to express their opinions. This will lead to improvement on student achievement. The pupils may, however, need some time to recognize each other's abilities and contributions to the group. There could be three different explanations for why cooperative learning groups did better on tests. Cooperative learning improves student-teacher connection, to start. Second, cooperative learning improved the amount of collective examination preparation. Third, the

novelty of small-group work increases interest in the subject[3]. The group's organizational structure is crucial. Children in the structured group were shown to exhibit fewer antisocial and off-task behaviors than their peers in the unstructured group[98]. They were more open to collaborating on the project with others, hearing what they had to say, and exchanging information and ideas[4]. Working in small groups was innovative, which increased interest in the subject matter[11]. Cooperative learning is acknowledged as a strategy that encourages learning in a variety of curricula, from primary through college[10]. This suggests that when students are actively learning in the classroom, education quality can be improved.

Interdependence is the main goal of cooperative learning. Using Taguchi Quality Indexes, a study was done to compare how well children performed academically in cooperative versus traditional learning. 42 sophomore mechanical engineering students took part in the study. The pupils were split into two classes, each with 21 students, by the researcher. While the second group worked alone, the first group collaborated to complete the task given to them. Using a T-test, the researcher discovered that students who participate in cooperative learning groups performed better academically than those who worked alone[12]. Cooperative also promotes communication. Team members support one another in their efforts to learn alongside one another and instruct other students who might be struggling with the subject or issue. Traditional centered learning, on the other hand, promotes individual learning. Both methods have advantages and disadvantages. Cooperative learning promotes teamwork, provides feedback and support, and enables students to recognize their own learning strengths and weaknesses, reducing their reliance on the teacher.

The drawback of cooperative learning is that it takes more time and requires the cooperation of the students. Traditional learning promotes independence because it is focused solely on student interaction with the topic and teacher feedback.

The use of competition to inspire pupils was cited as one of the contrasts between cooperative learning and more conventional learning strategies. Setting competitive goals enables kids to compete, it was said[3]. Therefore, pupils are forced to work more in an effort to surpass their peers. Cooperative learning, on the other hand, lacks the competitive urge. The ability to achieve personal goals through individual learning is another contrast between cooperative and traditional learning. The effectiveness of college students' cooperative learning experiences was studied in a thorough study of research studies that compared the three paradigms of learning, namely individualistic, competitive, and cooperative learning. 113 participants from four Sections of a psychology course at a college participated in the study there. Data was gathered by the researchers using questionnaires. Two weeks later, the pupils gave feedback. The optimal learning model, according to the experts, is cooperative learning. The researchers made a comparison between group learning experiences and individualistic learning. Students who participated in cooperative learning activities felt more positively about academic learning than students who did not[14].

Additionally, compared to students who did not participate in cooperative learning, they showed greater appreciation for the thoughts and viewpoints of other students. Furthermore, compared to students who learnt in individualistic and competitive situations, those in the cooperative learning group participated in contentious debates about academic subjects, honed their interpersonal skills, and had higher academic expectations. Another study looked at the distinctions between lecture-based learning and the cooperative learning technique, which is problem-based learning. 150 students took part in the study; 67 were in the experimental group and 83 were in the control group. Both groups took a course on the mental hearth. The pupils were split into a control group and an experimental group at random. To determine whether there was a difference between the two groups, the researchers conducted pre- and post-tests as well as a t-test. The findings revealed that individualistic learning (t=0.70) and cooperative learning

(t=0.00) both produced inferior academic results[23]. When they worked together, the students performed well. The researchers found that cooperation helped students become more motivated to learn. Students in the experimental group sought out each other's explanations, justifications, and elaborations[25]. Additionally, it allows them to share conceptual work, procedural expertise, and argument roles. Cooperative learning may be successful in settings that promote passive learning, according to research. The student's part in this type of learning is passive; there are no activities during class; it is dependent on verbal lectures. To determine whether or not cooperative learning enhances student outcomes in a passive learning environment, an empirical study was conducted, 172 students from a Hong Kong University intermediate accounting course made up the study's sample. The students were divided into two groups at random; one group received all of its instruction through lectures, whereas the other group received it entirely through cooperative learning (small groups). The test results for the two groups were compared by the researcher. The outcome indicated that the experimental group's p value was 0.01 in its favor. Additionally, students who participated in group projects performed better than those who were given lectures[14]. A four-week research was conducted on a group of students. The study looked at how standard learning methods and the jigsaw approach affected students' performance. They discovered that students who used jigsaw learning outperformed those who used the conventional technique on the examination given at the end of the semester, demonstrating a 5% improvement in pre-test and post-test results in comparison to those who had only taken lectures. Cooperative learning increases cognitive processes that help students learn and retain information. All of these studies demonstrate that, compared to standard lectures, cooperative learning is the most effective method of learning[26] .In a similar study presented a rationale, “why does cooperative learning deserve a central place in mathematics instruction?” The study of mathematics is often viewed as an isolated, individualistic, or competitive matter. Perhaps it is not surprising that many students and adults are afraid of mathematics and develop Basic

General Mathematics avoidance or Basic General Mathematics anxiety. Students often believe that only a few talented individuals can function successfully in the mathematical realm. Small – group cooperative learning addresses these problems in several ways. Effectiveness of mathematics integrated learning curriculum within the context of cooperative learning motivate students and teachers to involve themselves in the learning activities[17].

In addition, a study on the impact of cooperative learning on the attitude, confidence, and performance of students in undergraduate discrete mathematics courses indicated that cooperative learning group performed better to significant degree and there was a significant increase in attitude and confidence of students to learn mathematics[8].

A similar study was carried on the effects of cooperative learning on the achievement and attitude toward mathematics of a group of 5th grade students from the United States (Bermuda). Students participated for 12 weeks in Student Team Achievement Division method of cooperative learning in Mathematics during the first semester. The analysis of the pretest scores and post-test scores revealed positive change in attitude and achievement. Moreover, the reasons why teachers put students in cooperative learning groups are that all students can achieve higher academic success individually than were they to study alone. Consequently, each student must be held individually responsible and accountable for doing his or her own share of the work and for learning what has been targeted to be learned[19].

Notably, groups cannot function effectively if students do not have and use the needed social skills such as leadership, decision-making, trust-building, communication, and conflict management skills. For the cooperative learning environment to be successful teachers should teach these skills as purposefully and precisely as academic skills and the learner should utilise the skills they have learnt in completing assigned activities[11].

Notwithstanding, students are placed in groups and expected to use appropriate social and group skills does not mean students will automatically use these skills. To work together as a group, students need to engage in such interactive abilities as leadership, trust-building, conflict management, constructive criticism, encouragement, compromise, negotiation, and clarifying. Teachers may need to describe the expected social interaction behaviours and attitudes of students and to assign particular students specific roles to ensure that they consciously work on these behaviours in their groups". Cooperative learning is a viable but underused teaching-learning tool as opined by a researcher who contends that educators can best utilise this teaching strategy in their classrooms more effectively if they themselves were active participants in their teacher education training programme[21]. They asked these three (3) questions.

1. Can we change the post-secondary instructional paradigm from predominantly lecturers to a student participatory teaching and learning style such as cooperative learning?

2. How do teacher education students internalize cooperative learning techniques into their cognitive domain, so that they can use the techniques with their future students?

3. In our merit based American society marked indelibly with the ideals of individualism and competition to favour competition and collaboration?

There have been surveys conducted in Third World cities such as Nigeria to assess student views of cooperative learning strategies. A similar study was conducted on the attitudes of physics students towards the use of cooperative, competitive and individualistic learning strategies in Nigerian Senior High School. The research design for this study was quasi-experimental. There were a total of one-hundred and forty (140) students taking part in the study who were selected by a random sampling technique. A structured questionnaire titled Students' Attitude towards Mathematics Questionnaire (SATMQ) on 4-point scale was used to collect the data. Poor student performance can be attributed to poor teaching methods, unqualified and inexperienced teachers; poor student attitude toward mathematics, poor learning environment and gender effect[10].

Also, in the present Nigerian educational system, competition is valued over cooperative learning strategies[26]. The findings showed that cooperative learning strategy was the most effective in facilitating students' attitude towards mathematics. This was then followed by competitive strategies with the individualistic learning strategies being seen to be the least facilitative[11].

They also discovered that students began selecting group members based upon previous, positive collaborative experiences with them. "Each person tends to focus on gratifying his or her own ends without concern for others. Physical, psychological and material self-indulgence has become a primary concern". As a result, today's youth do not feel connected to the hardships of other individuals. Yet, self-fulfillment does not develop from operating in isolation. True meaning and purpose come from contributing to the welfare of others[15].

2.3.2 WhatsApp Usage and Pre-service Teachers' Basic General Mathematics

Numerous studies have examined the application and practice of career adaptability. These researchers were of the opinion that students' sustainable development education can benefit from career adaptability[94]. Additionally, career adaptability was primarily affected by two aspects: One was personal variables like gender, grade (age), personality traits, and so on. The second was the factors connected with the climate, like family, social help, etc. An examination of the factors that predict career adaptability skills among Nigerian higher education students has been conducted. It was tracked down that profession self-adequacy; Among Nigerian higher education students, personal goal orientation, career future concern, and perceived social support are predictors of career adaptability skill. In terms of family factors, the impact of parents' and family's socioeconomic status on career adaptability was primarily investigated[95]. Parental support is positively correlated with parents' intrinsic fulfillment values and work–life balance values, as career-specific parenting behaviors link parents' vocational characteristics and children's career adaptability[96].

Work was completed on profession versatility: the impact of adaptability and readiness on educational success, quality adaptability can easily change to accommodate new or altered circumstances[94]. The hypothesis zeroed in fundamentally on how people utilize their professional characters to change the grouping of occupation changes. The proactive personality and the Big Five personality traits were the primary focus, examining the factors that influence career ability as well as its impact on power and life satisfaction. He discovered through a longitudinal study that career adaptability has an impact on feelings of power and life satisfaction. He also discovered that men are more confident in their abilities than women. Men are higher in vocation versatility and experience profession fulfillment than women[97].

Proactive care behaviors and career adaptability showed positive correlations between initial individual levels, intraindividual changes in career adaptability, and proactive care behaviors, indicating a parallel development, according to the research[97]. A study looks into how a WhatsApp social media learning group helps teach and learn mathematics to underprepared first-year university students. The research was conducted using a quantitative approach. It used a randomized post-test-only design with non-equivalent groups to see if there was a statistically significant difference between university students who used a blended approach (WhatsApp chat) to learn mathematics and those who used the traditional face-to-face lecturing method. The review populace contained first-year College students enlisted for the college expanded program presented by all colleges in South Africa. 192 students from the experimental groups and 341 students from the control groups were conveniently selected from a South African university for the sample. The review discoveries showed no measurably massive distinction in results between students who concentrated on science through an eye to eye addressing approach and students who concentrated on mathematics through WhatsApp Stage Use learning approach. The review presumed that the students in the trial bunch performed somewhat better compared to students in

the benchmark group, affirming that a WhatsApp learning gathering can be a reasonable option in contrast to the educating and learning at the tertiary establishment when up close and personal learning is unimaginable, with respect to a model in the Coronavirus time. A report was provided on an investigation into effective staff development in ICT for teachers. The study suggests that more in-depth research be conducted to identify and analyze positive indicators when learning is done through social media interaction[46]. A sample of primary school teachers in Scotland was surveyed to find out how different ICT staff development models affect teachers and what teachers learn from staff development: technical; academic/content-related; pedagogy. The findings suggest that the pedagogy of ICT needs to be given much more attention[42]. This ought to be of interest to everyone involved in teacher education and ongoing professional development.

In a study that focused on pedagogy using ICT and primary school teachers who were known to be achieving gains on measures of relative attainment by students that were either average or above average. According to observations, the teachers who used examples and counterexamples and included students in the class's explanation and modeling were the most effective[38]. Instructors who leaned toward ICT were probably going to have advanced ICT abilities and to consider ICT to be a significant apparatus for learning and guidance. Additionally, they were likely to value student decision-making, inquiry, and collaborative work. There are a number of important factors that influence teachers' pedagogical approaches. They are first influenced by their own subject knowledge. There is an unmistakable differentiation between educators who pick ICT assets to fit inside a specific point and the people who pick assets just to introduce students' work in another manner, with no immediate application to the subject. The evidence indicates that when teachers employ ICT, they have a more direct impact on students' attainment when they use their knowledge of the subject as well as how students understand it.

In an American study of how secondary science teachers use ICT that focuses on one aspect of the use of ICT in secondary subject areas and teachers' perceptions of it, The perceptions of science teachers and teachers of other subjects are compared. The study's overall numbers were quite small, so a general view is taken across the three science disciplines of biology, chemistry, and physics despite the fact that teachers' responses could be analyzed. According to the analysis of the data, science teachers performed better than teachers of other subjects when it came to ICT use and confidence[40]. However, despite the fact that the availability of computing resources was said to be quite high, the actual level of use was quite low in absolute terms. Moreover, where level of purpose was higher, it was as to a fairly limited scope of uses, especially word-handling. In addition, little information was provided regarding the use of ICT by students in science classes. Although teachers indicated that they did not anticipate the introduction of ICT radically altering the teaching method or the relationship between teachers and students, there appeared to be awareness of the potential of ICT in science. Although science teachers felt they could make good use of ICT in the classroom, they felt they needed much more support and professional development to do so[44].

According to the findings of a Scotland-based study on teachers' ICT skills and knowledge needs, only a small percentage of students use ICT[54]. In primary and secondary schools, word processing is the most common use of ICT. Both sectors make use of educational software that is made by someone else. Secondary teachers, on the other hand, tend to use a wider variety of generic packages like spread sheets than primary teachers do. Despite the fact that the majority of secondary schools have Internet access, primary and secondary teachers use the Internet, WWW, and email very little. Assets, for example, video conferencing and network PC conferencing are seldom utilized. The study also showed that primary teachers primarily use ICT to help with classroom practice; It is used by secondary educators equally or more for personal and professional growth than in the classroom. Educators are utilizing ICT all through the

educational plan however use and demeanor shifts in auxiliary schools between branches of knowledge. The skills of teachers that influenced the process of adoption and use of ICT were investigated in public secondary schools in many counties[46]. While teachers of business and management subjects are the non-computing teachers who use ICT the most, teachers of mathematics and science teachers use ICT the least. The review took on a clear overview research plan. From a target population of 350, stratified sampling was used to select 105 (30%) schools for the study. Simple random sampling was used to select 315 respondents for the sample. 220 questionnaires were completed and returned correctly, or 69.8%. Descriptive and inferential statistical methods were used to analyze the collected data, and then the results were presented in tables. According to the findings of the study, there was a shortage of qualified ICT teachers in Kenya. In order to ensure that ICT-based curriculum is effectively delivered by ICT teachers, more ICT teachers should be employed in public secondary schools and trained in ICT skills. Teachers should be able to learn ICT skills through in-service courses. Proceeded with proficient advancement of educators is key to fruitful execution of ICT in schools. Teachers generally viewed the adoption and utilization of ICT in schools favorably.

Teachers must be knowledgeable and competent in ICT in order to use technology in the classroom, integrate it into the curriculum, align it with student learning objectives, and use it to engage students in meaningful academic development[49]. The purpose of this survey was to have postgraduate in-service teachers from a few Nigerian universities self-evaluate their core technology competence. A 61-item Likert-type questionnaire was filled out by 238 people, 108 male teachers and 130 female teachers. Additionally, the purpose of the study was to ascertain the in-service teachers' requirements for professional development and their preferred method. Results uncovered that most of the in-administration educators needed abilities in center innovation regions, and they generally declared that they need broad expert advancement in 17 expertise regions in ICT and preparing in 10 skill regions. The in help educators favored

participation at gatherings/classes, college courses, and coaching as the significant methods of preparing in ICT skills[46].

Educators' capability and certainty level with respect to the utilization of ICT was analyzed in Greece, Italy, Spain, and the Netherlands through a quantitative multipurpose case study[47]. The study, which looked at primary school teachers in those countries, found that ICT "assumed a supplementary role in the primary teachers' practice, being used as a complement to other materials." They also said that, with the exception of projects in Greece and Portugal, there aren't many concrete examples of long-lasting and meaningful learning activities supported by ICT. Most of experienced educators in those nations, as per Peralta and Costa, said that ICT had never been an object of their preservice preparing, while starting instructors demonstrated they were not as expected ready for ICT despite the fact that a few educators in Portugal and Spain had a few credits in new advances. The study came to the conclusion that not many primary school teachers are skilled at incorporating ICT into instruction. The Information Development Programme, which stated that teacher inexperience and skill shortages are significant factors preventing the effectiveness of ICT use in education in Organization for Economic Cooperation and Development (OECD) countries, supports these findings[41].

Classroom communication technologies give students and teachers' useful feedback on how well they understand the material being covered and whether or not they can apply it in new ways[42]. In a review charged by the Product and Data Industry Affiliation, that surveyed 311 exploration concentrates on the viability of innovation on student accomplishment, discoveries uncovered positive and predictable examples when students were taken part in innovation rich conditions, remembering huge additions and accomplishment for every single branch of knowledge, expanded accomplishment in preschool through secondary school for both ordinary and students with unique necessities, and further developed mentalities toward learning and expanded confidence. It has been discovered that aligned with constructivist pedagogy, the incorporation of

technology into educational environments, particularly those for the social studies, has the potential to inspire novel approaches to teaching and learning[50].

The incorporation of video clips based on standards into lessons that have been created by classroom teachers has been found to increase student achievement[52]. According to a recent study, the prevalence of online e-teaching has made a flipped classroom the new trend in digital learning. The study examined the relationship between computer use and students' science achievement using data from a standardized assessment. It found that the way computers are used, not the use of computers themselves, has a positive or negative effect on students' achievement[51]. Multimedia digital teaching is constantly influencing original teaching methods as information technology evolves; Texts, images, and clear audio with sound and light effects convey multiple knowledge; In addition, students' learning interests are piqued and the teaching effect is enhanced by simulating learning environments and materials[52].

It has been demonstrated that there is a strong correlation between attitudes regarding ICT and its use in the classroom for educational purposes [53]. Teachers' acceptance of the usefulness of ICTs in the classroom and their decision to incorporate ICTs into their classrooms are both influenced by their attitudes toward ICTs, according to a number of studies in the field of ICT in education. Trusted in the mathematics training local area proper combination of ICT will affect each part of arithmetic schooling: what sort of arithmetic is to be introduced and the way in which science is educated and learned[54]. Powerful utilization of ICT in science training could prompt a more student focused showing practice, since the combination of ICT in a general sense changes the educator student collaboration and the manners in which math content is being introduced to students. It has long been accepted that these adjustments will benefit mathematics instruction and learning. For instance, the utilization of ICT can advance students' arithmetic growth opportunity, work on students' inclinations in learning math, and change their perspectives towards mathematics[43,54].

Although it is generally accepted that information and communication technology (ICT) has positive effects on mathematics education, there are actually instances in which teachers either do not use ICT at all or use it in a very conventional manner, such as by using ICT to support direct instruction. It has been argued that teachers' beliefs and attitudes about how to use ICT are a major obstacle to their adoption and effective use[98]. All the more critically, the viable mix of ICT can make science (e.g., unique ideas) more open to students and further work with how students might interpret arithmetic ideas, foster students' critical thinking abilities, work on students' more elevated levels of numerical reasoning, and try and by and large further develop students' math achievement[48].

Teachers' attitudes toward ICT were found to be a better predictor of their intention to use technology than teachers' beliefs, such as self-efficacy beliefs[98]. Positive attitudes toward ICT will generally encourage greater classroom ICT integration, whereas negative attitudes will discourage its use. In mathematics education, it was discovered that teachers will only consider using technology if they believe it will improve students' mathematics learning or increase students' motivation, enjoyment, and confidence in comparison to other methods[45]. If teachers believe that a student must be able to solve problems without the assistance of ICT in order to demonstrate understanding of mathematics, or even if they believe that the use of ICT will hinder the development of students' abilities, such as the ability to calculate, they will either not integrate ICT into mathematics education or use it in a very traditional way to transmit knowledge[52].

The role of gender in the ICT-mathematics performance relationship, Technological Pedagogical Content Knowledge (TPACK) and ICT use based on gender, resistance to digital means of communication, frequency of ICT use and types of activities using ICT by gender, and working experience of lecturers working at higher education institutions in Malaysia have all been areas of focus for researchers studying the differences between male and female students' ICT use[99,100].

2.3.3 Students' Attitude and Pre-service Teachers' Basic General Mathematics

51 pre-service teachers were used in a study to see if there was a connection between students' attitudes toward mathematics and their ability to solve problems. The study found a strong positive correlation between students' attitudes toward mathematics and their ability to solve problems. Higher levels of problem-solving ability are found in students who enjoy mathematics, enjoy explaining their solutions to others, and detest solving more problems of the same type. Pre-service primary school teachers must cultivate a positive attitude toward mathematics, according to the findings. In addition, it is essential to employ instructional strategies that demand creativity from students, foster collaboration, and place students in the position of explaining their solutions.

We can deduce from the results that three quarters of respondents view Mathematics as beneficial to their future, despite the fact that one third of respondents enjoy it. Only one tenth of students enjoy writing mathematical problems and less than half enjoy explaining mathematics. These two percentages are extremely low when one considers that these students will be teaching mathematics to primary school students. As a result, they will need to have strong explanation skills and be able to create engaging lessons[98].

2. 4 Conceptual Framework

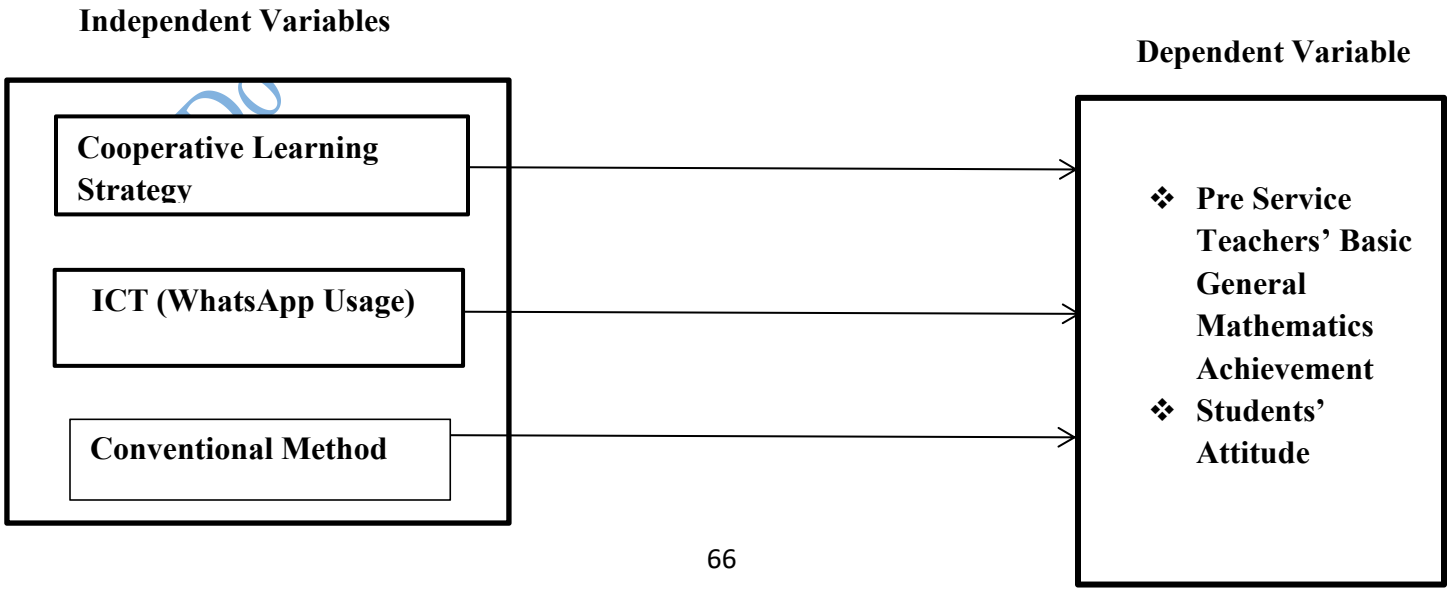

Figure 2.2: Conceptual Framework

Source: Researcher, 2023

Conceptual Framework portrays the relationship that exists among the variables and marks of the review. The framework above shows that Cooperative Learning (Students Team Achievement Division) and ICT (WhatsApp Platform Usage) strategies are the independent variable in measurement of the College Students' Learning Outcomes. The dependent variable is the measurable outcome of this manipulation, the results of the experimental design and this is the Students' Learning Outcomes.

In this study, there are two groups: (i) Control group (ii) Experimental groups. The Experimental groups were taught by Students Team Achievements Division and WhatsApp Platform Usage while the control group was taught by Traditional method.

2.5 Summary of Gap in Literature Reviewed

Related Literature under effects of Cooperative Strategy and WhatsApp Usage was reviewed based on the following sub- heading; Conceptual Review on Cooperative Strategy , WhatsApp Platform Usage, Students' Learning Outcome and Basic General Mathematics;

Theoretical Review in which two theories were adopted, which are Experiential Theory and Theory of Career Adaptability.

Experiential Theory related to this study on the use cooperative learning strategy on pre-service teachers learning outcome on General Basic Mathematics because the theory emphasise learning through personal discovery and experience gathered in the process of readiness to learn new things which is attributed to Student Team Achievement Division.

Ability of teachers to adjust with the current development in technology and be prepared for the challenges in chosen appropriate ICT device that can be used to improve the learning outcomes of pre-service teachers in Basic General Mathematics through the application of theory of carrier

adaptability. Lastly Empirical studies on Cooperative Strategy and Pre-service teachers' Basic General Mathematics, also on ICT (WhatsApp Platform Usage) and Pre-service teachers' Basic General Mathematics, was reviewed.

In the conceptual framework, the researcher has given out assumptions on factors that have influences on students' learning outcomes in Basic General Mathematics. It was noticed that students' learning outcome are function of learning strategy.

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Chapter Three

Methodology

The strategies for data collection and analysis for this study are described in this chapter. It includes the research design, the population of the study, the sample and sampling methods, the description of the research instruments, their validity and reliability, data collection and analysis.

3.1. Research Design

This study employed the use of a pretest, posttest, non-equivalent control group quasi-experimental research design to examine the effects of cooperative learning through Student Teams Achievement Divisions (STAD) and WhatsApp Usage on Pre-service Teachers' Academic Achievement and Attitude toward Basic General Mathematics in Colleges of Education, Oyo in Oyo State.

A pre-test, post-test control group quasi experimental design was used which was explained below:

O1 X1 O2 (E1)

O3 X2 O4 (E2)

O5 X3 O6(C)

Where O1, O3, O5 are pretest for the two experimental and control groups respectively.

O2, O4, O6 are post-test for experimental and control groups respectively.

O1 =Pre-test for Experimental group 1

O2 =Post-test for Experimental group 1

O3 = Pre-est for Experimental group 2

O4 = Post-test for Experimental group 2

O5= Pre-test for Control group

O6= Post-test for Contro group

X1 = STAD

X2 = WhatsApp Usage

X3 = Conventional Method

Variables in the study

(a) Independent variable

(i) Cooperative Strategy (Student Teams - Achievement Divisions)

(ii) ICT (WhatsApp Usage)

(iii) Conventional lecture method (control)

(b) Dependent variables: Learning Outcomes which comprise of -

(i) Students' Academic Achievement

(ii) Students' Attitude

3.2 Population of the Study

The population of this study comprises all 1,200 year two pre-service teachers in Emmanuel Alayande Colleges of Education, Oyo, 2,056 in Federal College of Education special, Akimorin, Oyo and 401 from Oyo State College of Education, Lanlate.

3.3 Sample and Sampling Techniques

There are seven Colleges of Education in Oyo State, which are Murtadha College of Educationn,Olodo, Al-Ibadan College of Education, Oyo State College of Education, Lanlate, Emmano College of Education, Federal College of Education (Special), Oyo, Delar College of Education and Emmanuel Alayande College of Education, Oyo.[1]

Multistage sampling procedure was used to select sample for the study.

At the first stage, stratified sampling technique was used to select the three colleges of education which are Emmanuel Alayande College of Education, Oyo, Oyo State College of Education, Lanlate and Federal College of Education (Special), Oyo, from seven colleges of Education that we have in Oyo State.The technique is appropriate because it enhances the selection of a true representation (sample) of the target population.

At the second stage, purposive sampling technique was used to select pre-service year two teachers who had offered some courses in Basic General Mathematics in year one. The technique was appropriate because it focuses on relevant respondents of the study.

At the third stage and last stage, purposive sampling technique was used to select all students from the school of Languages out of five schools in each College of Education chosen for this study. Students from school of languages was chosen because they believe that since their disciplines are not Mathematically based, learning of Mathematics is of no use and this have been affecting their achievement and attitude towards the course negatively. The three colleges consist of five different schools which are School of Arts and Social sciences, School of Early Childhood Care, School of Education, School of Languages, School of Science and School of Vocational and Technical. The total numbers of pre-service year two teachers from school of Languages in the three colleges of education are 420. 130 pre-service year two teachers from Emmanuel Alayande Colleges of Education, Oyo and 230 from Federal College of Education special, Akinmorin, Oyo and 60 from Oyo State College of Education, Lanlate.

3.4 Description of the Research Instruments

The instruments used for this study were the following:

a. Lesson Plan prepared by the researcher
b. Basic General Mathematics Achievement Test (BGMAT) adopted from immediate past examination of pre-service year two teachers in the Basic General Mathematics III.
c. Pre-service Teachers' Attitude Questionnaire (PTAQ) adapted from Fennema-Sherman Attitude Scale.

3.4.1. **Lesson Plan:** It was prepared by the researcher; the first course content in Basic General Mathematics IV, first semester course outline for 200level was selected by the researcher. The topic is Change of the Subject of the formula in which three (3) lesson plans was prepared; one for Experimental group I, second one for the Experimental group II and the third one for the

control group. Each lesson plan was used for the treatment of each group. The lesson plans are in Appendix I,II and III.

3.4.2. Basic General Mathematics Achievement Test (BGMAT)

The test was adapted from the immediate past examination question of the pre-service NCE II teachers Basic General Mathematics IV. It covers the first topic in the course content for first semester of year two students. It consists of 20 items multiple choice question with 4 options A to D and was based on four cognitive levels – "knowledge", "comprehension," and "application". This measured the dependent variable which is pre-service teachers' academic achievements in Basic General Mathematics. The table of specification for the construction of BGMAT is presented in the table below.

Table 3.2 Table of Specification for MAT

S/N	Topics	Knowledge	Comprehension	Application	Total No. of Items
1.	Change of Subject of the Formula through operation of Addition and Subtraction	1,5	12	16, 19	05
2.	Change the subject of the formula by operation of multiplication and division	6,9,10	3, 17	2	06
3	Change the subject of the formula by operation of Square and square root	8	18	7,4	04
4	Application of Change the subject of the formula in Problem solving	15, 13	20	14, 11	05
	Total	08	05	07	20

Source: Extracted by the researcher from the adopted BGMAT used.

Each question was allotted 2marks, the total obtainable score was 40 and whatever each respondent scored out 40 marks was recorded for data analysis. The Basic General Mathematics Achievement Test was conducted virtually with the use Microsoft Form and onsite using paper and pencil.

3.4.3. Pre-service Teachers' Attitude Questionnaire (PTAQ)

This was adapted from the modified Fennema-sherman Mathematics Attitude scale which consists of four(4) subscales, in which each designed to measure confidence, Mathematics as a male domain, teachers perception and usefulness[2]. For this PTAQ, it was designed to measure students' confidence, students' perception and usefulness. The questionnaire is of two sections: Section A consists of student's name of institution, subject combination while Section B consists of 20 items which are positively worded in which the students were expected to respond to by expressing their level of agreement or otherwise on a four point likerts scale of strongly Agree (SA)(4), Agree(A)(3), Disagree(D)(2)and strongly disagree(SD)(1).Responses to PTAQ was scored using 4,3,2,1 for Strongly agree (SA),Agree (A), disagree(D),strongly disagree(SD) all the responses are positive. This is to measure students' attitudes in relation to their level of confidence, perception and usefulness towards Basic General Mathematics.

3.5. Validity of Research Instruments

3.5.1. Validity of BGMAT

The Basic General Mathematics Achievement Test was subjected to proper validation by given it to the researcher project supervisor and also to two senior lecturers in the field of Mathematics Education to ascertain the content and face validity.

3.5.2. Validity of PTAQ

Copies of this instrument were given to the researcher supervisor and a lecturer from Science Education Department in Emmanuel Alayande College of Education so as to increase its credibility. All correction made was effected before administration of the instrument.

3.6. Reliability of the Instruments

3.6.1. Reliability of BGMAT

A pilot survey of 40 (forty) NCE II students from the School of Education at Emmanuel Alayande College of Education which was different from the sample used in this research. This was used to determine the reliability of the instrument, the split-half reliability method was used in which the scores of the 40 respondents was randomly splited into two set and the reliability coefficient was calculated to be 0.76.

3.6.2. Reliability of PTAQ

In order to determine the reliability of the instrument, the instrument was trial-test on the same 40 NCE II students that was use in pilot survey to determine reliability of BGMAT . The internal consistency of the instrument was calculated using Cronbach alpha and reliability coefficient was calculated to be 0.88

3.7 Methods of Data Collection

To obtain the approval of the heads of the various institutions used for this study, a letter of introduction was collected from the Head of Department,Mathematics Education Department, Faculty of Education, Lead City University, Ibadan. First week, the researcher went to seek the approval from the authority of each colleges used for this research work. Second week, the research assistants who were part of lecturers taking the course in the selected colleges of education were contacted, the material

was given to them as part of training for treatment of each group and the procedure for the treatment was discussed, especially for the two experimental groups (Cooperative Strategy and

WhatsApp Use), also the pre-test instrument was given to them which was administered the following week. For the Cooperative Strategy, the pre-test was done in the third week, the Questionnaire(PTAQ) was firstly administered to the whole class and then the achievement test(BGMAT). Fourth week, the material used for the treatment was presented to the whole class using traditional method by a research assistant and the second research assistant help in controlling the class. At the end of the lecture, the students were grouped into fifteen groups, they were 8 students in each of thirteen (13) groups, the remaining two (2) groups consist of seven (7) students each. The tutorial questions were given to each group leader so as to assist them to understand the content by solving it together and share knowledge within themselves. They were given three (3) weeks to learn together. The post-test was conducted in the last two weeks, questionnaire (PTAQ) was firstly administered and followed by the achievement test. There supposed to be a reward for each team based on their performance which researcher was unable to do due to time constraints because as at the time rounding up the treatment, the student were about starting examination. For the experimental group II that made use of WhatsApp Platform, a whatsApp platform was created by the researcher, the 200 level students from the school of languages and the research assistant was added and the time was fixed for the lecture. Third week, the pre-test was conducted online using Microsoft Form for both the questionnaires (PTAQ) and the achievement test (BGMAT). The link that gave student access to the questionnaire was sent to the platform, students were instructed to click on the link and answer the questionnaire. The following day, the link for Basic General Mathematics achievement test (BGMAT) was sent to the platform, they were given forty (40) minutes to do the test, after forty (40) minutes if a student failed to submit, the access to the test was denied. As each student submitted, their scores were displayed to them and also to the researcher that created the form. Fouth week, a convenient time and place were chosen by the research assistant for the presentation of the lesson in which video record of the lesson was made.

Fifth week, video clip for the first lesson was sent to the platform at the fixed time, students played the video clip and responded through voice mail and whatsApp messages, answer to their responses was also sent via voice mail and whatsApp messages. The same process was repeated in the sixth and seveenth week but different video clip since lesson was broken into three.

Eight and nineth week was used for Post-test which was conducted online. For the control group, two research assistants was used, no treatment was applied, that is, the normal conventional method was used to taught the student. Pre-test was conducted within the first three(3) weeks, teaching took place by the lecturer taking the course who was one of the research assistant for three(3) weeks and the post-test was conducted within the last three (3) weeks. All the field work was carried out for nine weeks.

3.8 Method of Data Analysis

Analysis of Covariance (ANCOVA) was used to analyze the hypotheses at 0.05 level of significance.

Endnotes

1. List of Colleges of Education in Oyo State- https:// nursinghealth.org

2. Modified Fennema-sherman Mathematics Attitude scale- STELAR, https://stelar.edu.org

Chapter Four

Results and Discussion of Findings

This chapter centers on presentation and analysis of data colllected. It also includes discussion of findings. The data were analysed with different descriptive and inferential statistical method using the Statistical Package for Social Science (SPSS) IBM version 20.0 in order to analyse data collected and test the hypotheses.

4.1 Data Presentation

Research Questions

1. What are the frequency distribution of pre-service teachers' pretest and posttest mean scores in BGMAT?

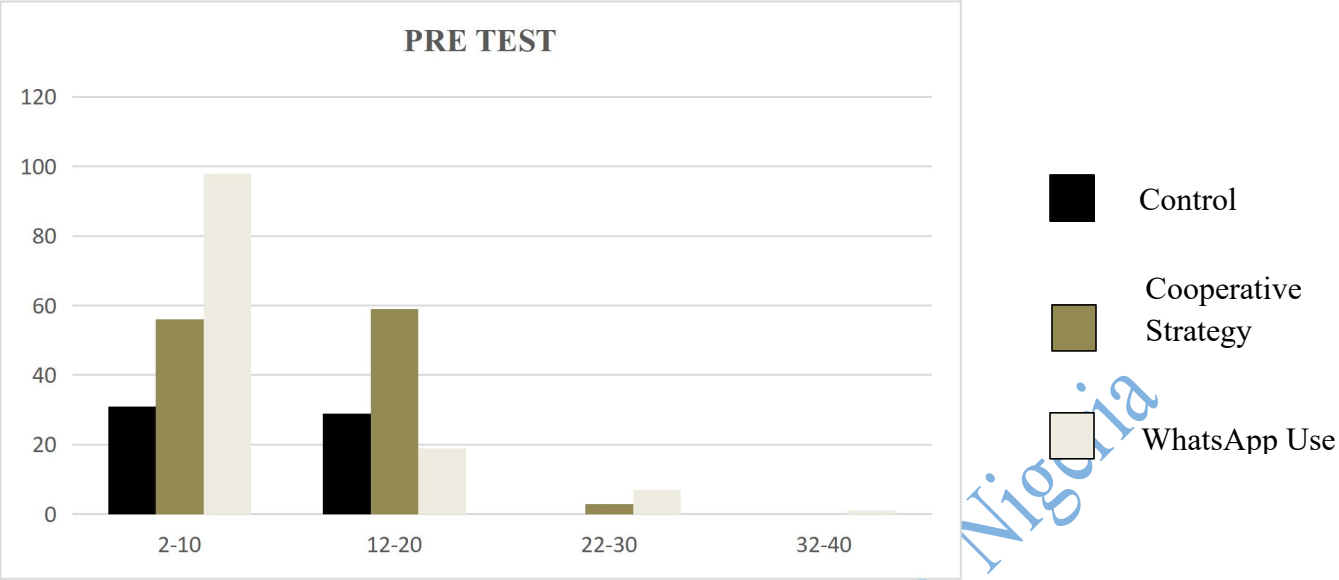
The frequency distribution of the Pre- Service Teachers' Basic General Mathematics Achievement Test for Pretest and Posttest are presented below:

Table 4.1.1.: Frequency distribution of Pre- Service Basic General Mathematics Achievement Test (Pre-test Score)

Pretest Score	Control	Cooperative Strategy	WhatsApp Use
2-10	31	56	98
12-20	29	59	19
22-30	0	3	7
32-40	0	0	1

Source: Author's Compilation from E-view Output

Figure 4.1.1: Bar Chart of Pre-Service Teachers' Basic General Mathematics Achievement Test (Pretest score) in Colleges of Education in Oyo State.



Source: Researcher's Fieldwork 2023

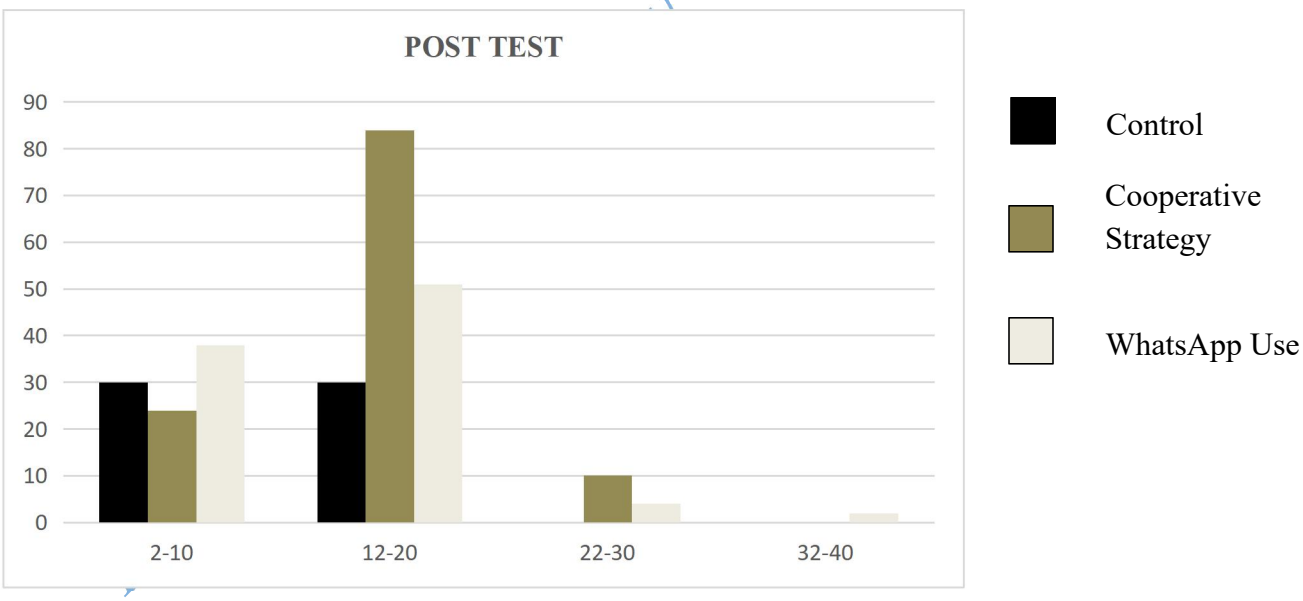
The result revealed the pre-test score of Basic General Mathematics Achievement Test of 200 level students in the control group. The total number of students in the control group were sixty (60), total number of students that scored from 2-10 marks were thirty-one (31) which is 51% and twenty-nine (29) students scored from 12-20, representing 49%, none of the student score between 22-30 and 32-40. For the Cooperative Strategy group, the total number of students that supposed to attempt the Basic General Mathematics Achievement Test were two hundred and thirty (230), but only 118 were available for the test, fifty-six (56) students scored from 2-10marks, which 47.5%, fifty nine (59) scored from 12-20marks, that is50.0%, three (3) scored from 22-30marks which represent 2-5% and none of the student scored Zero(0). Also, for WhatsApp Use, One hundred and thirty (130) students was the sample that supposed to attempt the Basic General Mathematics Achievement Test but one hundred and twenty-five submitted, ninety-eight (98) students scored from 2-10marks which represent 78.4%, nineteen (19) scored from12-20marks representing 15.2%, seven (7) students scored from 22-30marks which is 5.6%, lastly, one(1) student scored from 32-40marks which is 0.8%. This implies that students achievement in Basic General Mathematics were low.

Table 4.1.2: Frequency distribution of Pre- Service Basic General Mathematics Achievement Test (Posttest Score)

Post-test Scores	Control Group	Cooperatice Strategy	WhatsApp Use
2-10	30	24	38
12-20	30	84	51
22-30	0	10	4
32-40	0	0	2

Source: Author's Compilation from E-view Output

Figure 4.1.2: Bar chart of Basic General Mathematics Achievement Test (Post-test score) in Colleges of Education in Oyo State.



Source: The Researcher's Fieldwork 2023

The result revealed the post-test score of Basic General Mathematics Achievement Test of 200 level pre-service teachers in colleges of Education, Oyo State. The total number of students in the control group were sixty (60), total number of students that scored from 2-10 marks were

thirty (30) which is 50% and thirty (30) students scored from 12-20, representing 50%, none of the student score between 22-30 and 32-40. For the students in the Cooperative Strategy group, the total number of students that supposed to attempt the Basic General Mathematics Achievement Test were two hundred and thirty (230), but only 118 were available for the test, twenty-four (24) students scored from 2-10marks, which 20.3%, eighty-four (84) scored from 12-20 marks, that is74.3%, ten (10) scored from 22-30 marks which represent 8.5% and none of the student scored Zero(0). InWhatsApp Use group, Ninety-five (95) students submitted the test , thirty-eight (38) students scored from 2-10marks which represent 40.0%, fifty-one(51) scored from12-20 marks representing 53.7%, four (4) students scored from 22-30 marks which is 4.2% and two(2) students scored from 32-40 marks which is 2.1%.

Table 4.1.3: Descriptive Statistics of Basic General Mathematics Achievement Test

	Pretest Control	Pretest Cooperative Strategy	Pretest WhatsApp Use	Posttest Control	Posttest Cooperative Strategy	Posttest WhatsApp Use
Students	60	118	122	60	118	95
Minimum	2.0	2.0	2.0	4.0	8.0	2.0
Maximum	20.0	28.0	40.0	20.0	28.0	36.0
Mean	10.5	11.2	8.9	11.3	15.2	12.8
Std. Dev.	4.7	5.1	5.9	4.2	4.5	5.7
Skewness	0.1	0.4	2.0	0.1	0.3	1.4
Kurtosis	-0.8	0.3	6.3	-0.5	-0.3	4.0

Source: Author's Compilation from E-view Output

The table above shows the preliminary analysis which was conducted with the aim to determine the normality of the data, measures of central tendency and measures of dispersion. The mean is a measure of central tendency and it indicates the average value of the score. Standard deviation

is the positive square root of variance. It is a measure of dispersion, that is, it shows the extent of the deviation from the mean score. Skewness and kurtosis show the normality of the distribution. A distribution is said to be normal when skewness is approximately zero. The descriptive statistics from above table shows that over the period, all the variabls under consideration have positive mean value while their standard deviation support this positive mean value. The minimum score was 2 for Cooperative Strategy and Control Group in the pre-test of Basic General Mathematics. The maximum score was 20 for students in both pre-test and post-test of the control group. The maximum score was 28 for students in both pre-test and post-test of Cooperative Strategy. The maximum score was 40 for students in pre-test of WhatsApp Use.

4.2. Hypotheses Testing

$H0_1$: there is no significant main effect of Cooperative Strategy on Pre-Service teachers'

(i) Academic Achievement in Basic General Mathematics in Colleges of Education,Oyo, Oyo State.

Table 4.2.1. Analysis of Covariance Statistics of the main effect of Cooperative Strategy on Pre-Service Teachers' Academic Achievement in Basic General Mathematics Model Summary

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	621.368[a]	2	310.684	15.068	.000	.147
Intercept	3971.186	1	3971.186	192.595	.000	.524
treatmet_groups	581.289	1	581.289	28.191	.000	.139
pre_ach_score	46.158	1	46.158	2.239	.136	.013
Error	3608.385	175	20.619			
Total	38560.000	178				
Corrected Total	4229.753	177				

The result in Table above revealed that there is a significant main effect of the Cooperative Strategy(STAD) on pre-service teachers' academics achievement in Basic General Mathematics in Colleges of Education in Oyo State ($F_{(1, 175)} = 28.191$, $p < 0.05$), that is,F-value of 28.191 is obtained with a p-value of 0.000 computed at 0.05 alpha level. Since p-value (0.00) is less than alpha level (0.05), therefore null hypothesis one was rejected.

To know the direction of the differences, the estimated marginal means of the ancova shows the differences in the post achievement score in the table below:

Table 4.2.2: Estimated Marginal Means of effect of Cooperative Strategy on Pre-service Teachers' Academic Achievement in Basic General Mathematics in Colleges of Education, Oyo State

Treatment groups	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Cooperative strategy	15.176[a]	.418	14.351	16.002
Control	11.353[a]	.586	10.196	12.510

It was revealed from the above table that the pre-service teachers that used Cooperative Strategy has higher mean score,compare to mean score of the control group.Therefore, the significant main effect is as a result of the differences in the post achievement mean score of the Cooperative Strategy that is higher than that of the control group.

$H0_1$: there is no significant main effect of Cooperative Strategy on Pre-Service teachers'

(ii) Attitude towards Basic General Mathematics in Colleges of Education in Oyo State.

Table 4.2.3: Analysis of Covariance Statistics of the main effect of Cooperative Strategy on Pre-Service Teachers' Attitude towards Basic General Mathematics Model Summary

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1738.485[a]	2	869.243	70.742	.000	.450

Intercept	1034.091	1	1034.091	84.158	.000	.327
treatmet_groups	1236.068	1	1236.068	100.596	.000	.368
pre_att_scores	246.680	1	246.680	20.076	.000	.104
Error	2125.732	173	12.287			
Total	143477.108	176				
Corrected Total	3864.217	175				

a. R Squared = .450 (Adjusted R Squared = .444)

From the Table above, the result of the analysis reveals that there is significant main effect of the Cooperative Strategy(STAD) on pre-service teachers' attitudes toward Basic General Mathematics in Colleges of Education in Oyo State ($F_{(1, 173)} = 100.596$, $p < 0.05$), therefore null hypothesis one which stated that there is no significant main effect of Cooperative Strategy(STAD) on Pre-service teachers' attitude towards BBasic General Mathematics was rejected.

The estimated marginal means of the ancova in the table below shows the differences in the post achievement score which shows that cooperative strategy has significant main effect on pre-service teachers' attitude towards Basic General Mathematics in Colleges of Education in Oyo State.

Table 4.2.4: Estimated Marginal Mean Score of the effect of Cooperative Strategy on Pre-service Teachers Attitudes towards Basic General Mathematics

Treatment groups	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Cooperative Strategy	30.103[a]	.327	29.456	30.749
Control	24.419+[a]	.458	23.515	25.322

The mean score of Cooperative Strategy was higher (30.103) than the mean score of the control group (24.419).Therefore, the significant main effect was as a result of the differences in the post attitude mean score of the Cooperative Strategy that was higher than that of the control group.

$H0_2$: there is no significant main effect of Whatsapp Use on Pre-Service teachers'
(i) Academic Achievement in Basic General Mathematics in Colleges of Education,Oyo

Table 4.2.5: Analysis of Covariance Statistics of the main effect of WhatsApp Use on Pre-Service Teachers' Academic Achievement in Basic General Mathematics Model Summary

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	256.250[a]	2	128.125	3.802	.024	.048
Intercept	5451.805	1	5451.805	161.788	.000	.516
treatmet_groups	187.511	1	187.511	5.565	.020	.035
pre_ach_score	17.290	1	17.290	.513	.475	.003
Error	5121.970	152	33.697			
Total	31288.000	155				
Corrected Total	5378.219	154				

a. R Squared = .048 (Adjusted R Squared = .035)

The result in Table above reveals that there is significant main effect of WhatsApp Use on pre-service teachers' academics achievement in Basic General Mathematics in Colleges of Education in Oyo State ($F_{(1, 152)} = 5.565$, $p < 0.05$), therefore null hypothesis that stated that, there is no significant main effect of WhatsApp Use on Pre-service teachers academic achievement in Basic General Mathematic in Colleges of Education in Oy State was rejected.

Table 4.2.6:The Estimated Maginal Score of the effect of WhatsApp Use on Pre-Service Academic Achievement in Basic General Mathematics

treatmet groups	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
WhatsApp	13.839[a]	.605	12.643	15.035
Control	11.488[a]	.768	9.970	13.006

a. Covariates appearing in the model are evaluated at the following values: pre_ach_score = 9.5613.

The mean score of WhatsApp group was higher (13.839) than the mean score of the control group (11.488).Therefore, the significant main effect was as a result of the differences in the post achievement mean score of WhatsApp Use that was higher than that of the control group.

$H0_2$: there is no significant main effect of WhatsApp Use on Pre-Service teachers'

(ii) Attitude towards Basic General Mathematics in Colleges of Education in Oyo State.

Table 4.2.7: Analysis of Covariance Statistics of the main effect of WhatsApp Use on Pre-Service Teachers' Attitude in Basic General Mathematics Model Summary

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	39632.126[a]	2	19816.063	161.785	.000	.680
Intercept	4250.857	1	4250.857	34.706	.000	.186
treatmet_groups	38624.291	1	38624.291	315.342	.000	.675
pre_att_scores	20.292	1	20.292	.166	.685	.001
Error	18617.513	152	122.484			
Total	361506.000	155				
Corrected Total	58249.639	154				

a. R Squared = .680 (Adjusted R Squared = .676)

The result in Table above reveals that there is significant main effect of WhatsApp Use on pre-service teachers' attitude towards Basic General Mathematics in Colleges of Education in Oyo State ($F_{(1, 152)} = 315.342$, $p < 0.05$), therefore null hypothesis that stated that, there is no significant main effect of WhatsApp Use on Pre-service teachers attitude towards Basic General Mathematic in Colleges of Education in Oyo State was rejected.

Table 4.2.8: The Estimated Maginal Score of the effect of WhatsApp on Pre-service Teacher Attitude towards Basic General Mathematics in Colleges of Education in Oyo State.

Treatment groups	Mean	Std. Error	95% Confidence Interval	
			LowerBound	Upper Bound
WhatsApp	56.897[a]	1.140	54.645	59.149
Control	24.180[a]	1.437	21.340	27.019

a. Covariates appearing in the model are evaluated at the following values: pre_att_scores = 24.7484.

The mean score of WhatsApp group was higher (56.897) than the mean score of the control group (24.180).Therefore, the significant main effect was as a result of the differences in the post attitude mean score of WhatsApp Use that was higher than that of the control group.

Hypothesis: $H0_3$: There is no significant main interaction effects of Cooperative Strategy and WhatsApp Use on Pre-service Teachers'

(i.) Academic Achievement in Basic General Mathematics in Colleges of Education in Oyo State

Table 4.2.9: Analysis of Covariance Statistics of the main interaction effect of Cooperative Strategy and WhatsApp Use on Pre-Service Teachers' Academic Achievement in Basic General Mathematics Model Summary

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	575.263[a]	3	191.754	6.677	.000
Intercept	9372.466	1	9372.466	326.332	.000
treatment_groups	575.151	2	287.576	10.013	.000
pre_ach_score	.005	1	.005	.000	.989
Error	7725.865	269	28.721		
Total	61028.000	273			
Corrected Total	8301.128	272			

The result in Table 4.8 reveals that there is significant main interaction effect of Cooperative Strategy and WhatsApp Use on pre-service teachers' academics achievement in Basic General Mathematics in Colleges of Education in Oyo State ($F_{(2, 269)} = 10.013$, $p < 0.05$), therefore null hypothesis one is rejected.

To know the direction of the differences, the estimated marginal means of the ancova below shows the differences in the post achievement score

Table 4.2.10:Estimated Marginal Means of the main interaction effects of Cooperative Strategy and WhatsApp Use on Pre-service Teachers' Academic Achievement in Basic General Mathematics in Colleges of Education in Oyo State.

Treatment groups	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Cooperative strategy	15.169[a]	.497	14.190	16.147
WhatsApp usage	13.917[a]	.562	12.810	15.025
Control	11.366[a]	.696	9.996	12.735

a. Covariates appearing in the model are evaluated at the following values: pre_ach_score = 10.2564.

From table above, it was revealed that the mean score of the Cooperative Strategy is the highest(15.169), followed by the mean score of WhatsApp Use (13.917) while the control group has the least mean score (11.366).Therefore, the significant effect of the Cooperative Strategy and WhatsApp Use was as a result of the differences in the post achievement mean score of the treatment groups.

Hypothesis: Ho_3: There is no significant main interaction effects of WhatsApp Use and Cooperative Strategy on Pre-service Teachers'

(ii) Attitudes towards Basic General Mathematics in Colleges of Education in Oyo State

Table 4.2.11: Analysis of Covariance Statistics of the interaction effect of WhatsApp Platform Use and Cooperative Strategy on Pre-service Teachers' Attitudes towards Basic General Mathematics Model Summary

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	52820.814[a]	3	17606.938	233.094	.000
Intercept	4630.790	1	4630.790	61.306	.000
treatmet_groups	52181.940	2	26090.970	345.412	.000
pre_att_scores	253.954	1	253.954	3.362	.068
Error	20168.079	267	75.536		
Total	469498.108	271			
Corrected Total	72988.892	270			

The result in Table above revealed that, there is a significant main interaction effect of the WhatsApp Use and Cooperative Strategy on pre-service teachers' attitudes in Basic General Mathematics in colleges of education in Oyo State ($F_{(2, 267)} = 345.412$, $p < 0.05$).

The direction of the differences was revealed in the table below that shows the estimated marginal means of the treatment groups

Table 4.2.12: Estimated Marginal Means of the main interaction effects of Cooperative Strategy and WhatsApp Use on Pre-service Teachers' Attitude in Basic General Mathematics in Colleges of Education in Oyo State.

Treatment groups	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
cooperative strategy	30.149[a]	.809	28.556	31.742
whatsApp usage	56.913[a]	.892	55.157	58.669
Control	24.366[a]	1.130	22.141	26.592

a. Covariates appearing in the model are evaluated at the following values:

pre_att_scores = 25.0406.

The table above shows the mean of post attitude score of each treatment group. It was revealed that the WhatsApp Use group has highest mean score(56.913), followed by Cooperative Strategy group(30.149) while the control group (24.366) has the least post attitude mean score.Therefore, the significant main interaction effect of cooperative strategy and whatsApp use on pre-service teachers attitude towards Basic General Mathematicsis was as a result of the differences in the post attitude mean score of the treatment groups.

4.3 Discussion of Findings

Regarding research hypothesis one which stated that "There is no significant main effect of Cooperative Strategy (STAD) on Pre-service Teachers'

(i) Achievement in Basic General Mathematics in Colleges of Education in Oyo State

(ii) Attitude towards Basic General Mathematics in Colleges of Education in Oyo State

The result from the analysis revealed that there is significant main effect of the Cooperative Strategy (STAD) on pre-service teachers' academics achievement in Basic General Mathematics in Colleges of Education in Oyo State ($F_{(1, 175)} = 28.191$, $p < 0.05$) with the estimated marginal mean score of Cooperative Strategy (15.176) which is higher than the mean score of the control group(11.353). Also, it was revealed that,there is significant main effect of the Cooperative Strategy(STAD) on pre-service teachers' attitudes toward Basic General Mathematics in

Colleges of Education in Oyo State ($F_{(1, 173)} = 100.596$, $p < 0.05$) with the estimated marginal mean score of Cooperative Strategy (30.103) which is higher than the mean score of the control group(24.419). This is in agreement with a findings on Preservice Teachers' Implementation of Cooperative Learning in Chinese Physical Education[1]. According to the findings, cooperative learning is a powerful instrument for inspiring college students to create academic objectives that will drive them to fully engage with the tasks assigned to them in order to gain information and skills (learning objectives)[2]. This study is also in support with a finding on a comparison of students' academic performance in both cooperative and traditional learning by using Taguchi Quality Indexes[3]. The study is also in line with a finding that concluded that Cooperative Learning approach was very effective in teaching Science concepts and theories as it rejected the null hypothesis. Therefore, Cooperative Learning was highly encouraged to be used as approach in teaching particularly in Science Education[4]. Finally, it was recommended in this study that cooperative learning, must be utilized by all teachers, to allow learners improves attitude towards participation and that would have greatly effect on the performance of the Senior High School student.

Going by research hypothesis two which stated that, "There is no significant main effect of the WhatsApp Platform Use on Pre-service Teachers'

(i)Academic Achievement in Basic General Mathematics in Colleges of Education in Oyo State.

(ii) Attitude towards Basic General Mathematics in Colleges of Education in Oyo State

It was revealed that there is significant main effect of WhatsApp Use on pre-service teachers' academics achievement in Basic General Mathematics in Colleges of Education in Oyo State ($F_{(1, 152)} = 5.565$, $p < 0.05$) with the estimated marginal mean of WhatsApp group (13.839) higher than the estimated marginal mean of the Control goup (11.488). Also, it was revealed that there is significant main effect of WhatsApp Use on pre-service teachers' attitude towards Basic

General Mathematics in Colleges of Education in Oyo State ($F_{(1, 152)} = 315.342$, $p < 0.05$) with the estimated marginal mean(x) of the WhatsApp group (56.897) higher than the estimated marginal mean(x) score of the Control group(24.180).

This is consistent with a study on the Impact of Social Media on Students' Academic Performance". who reported that integration of social media into teaching and learning process enhance student academic performance[5]. This study is also in agreement with a finding, which recommended that the WhatsApp Group Learning Platform should be used to improve students' performance in STM based on the result of the findings[6]. In addition, a research found that virtual learning boosts students' performance in applied mathematics and suggested using it to raise students' academic accomplishment, particularly in situations when physical classroom space is limited[7]. According to research findings, using WhatsApp as a treatment has a good impact on pupils' mathematics skills. In order to improve performance, it was advised that WhatsApp be used as a social media communication tool in mathematics teaching and learning[8].

Going by the last hypothesis, Hypothesis three stated that, there is no significant main interaction effect of Cooperative Strategy and WhatsApp Use on Pre-service Teachers'

(i.) Academic Achievement in Basic General Mathematics in Colleges of Education in Oyo State

(ii) Attitude towards Basic General Mathematics in Colleges of Education in Oyo State.

The result from the analysis revealed that there is a significant main interaction effect of the WhatsApp Platform Use and Cooperative Strategy on Pre-service Teachers' Academic Achievement in Basic General Mathematics in Colleges of Education in Oyo State

($F_{(2, 267)} = 10.013$, $p < 0.05$). Also, there is a significant main interaction effect of Cooperative Strategy and WhatsApp Use on pre-service teachers' attitudes in Basic General Mathematics in colleges of education in Oyo State ($F_{(2, 267)} = 345.412$, $p < 0.05$). This is in support with a study,

after data were analyzed through statistical methods that determined the positive impact of cooperative learning on the academic achievement of mathematics students. It was found that the involved students found it pleasant and enjoyed the learning environment. And it was recommended that teaching through cooperative learning as designing activities that promote group work which can help students for better academic achievement[9].

Likewise, a study came to the conclusion that in order to improve learning in higher education institutions, WhatsApp's potential must be fully utilized[10].

Endnotes

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Chapter Five

Conclusion

This chapter deals with the summary of findings, conclusions, recommendations based on the findings of the study, contribution to knowledge and suggestion for further research.

5.1 Summary of Findings

The findings showed the frequency distribution of pre-service teachers' Basic General Mathematics achievement scores for both pretest and posttest. It was revealed that, there are low performances of Pre-service teachers' on Basic General Mathematics in Colleges of Education, in Oyo state, Nigeria.

There was a significant main effect of the Cooperative Strategy (STAD) on pre-service teachers' academics achievement in Basic General Mathematics in Colleges of Education in Oyo State ($F_{(1, 175)} = 28.191$, $p < 0.05$) with the estimated marginal mean score of Cooperative Strategy (15.176) which is higher than the mean score of the control group(11.353). Also, it was revealed that,there was a significant main effect of the Cooperative Strategy(STAD) on pre-service teachers' attitudes toward Basic General Mathematics in Colleges of Education in Oyo State ($F_{(1, 175)} = 28.191$, $p < 0.05$) with the estimated marginal mean score of Cooperative Strategy (30.103) which is higher than the mean score of the control group(24.419).

Furthermore, It was revealed that there was a significant main effect of WhatsApp Use on pre-service teachers' academics achievement in Basic General Mathematics in Colleges of Education in Oyo State ($F_{(1, 152)} = 5.565$, $p < 0.05$) with the estimated marginal mean score of WhatsApp group (13.839) higher than the estimated marginal mean score of the Control goup (11.488). Also, it was revealed that there is significant main effect of WhatsApp Use on pre-service teachers' attitude towards Basic General Mathematics in Colleges of Education in Oyo State ($F_{(1, 152)} = 315.342$, $p < 0.05$) with the estimated marginal mean(x) of the WhatsApp group (56.897) higher than the estimated marginal mean(x) score of the Control group(24.180).

Finally, there was a significant main interaction effect of the WhatsApp Platform Use and Cooperative Strategy on Pre-service Teachers' Academic Achievement in Basic General Mathematics in Colleges of Education in Oyo State ($F_{(2, 267)} = 10.013$, $p < 0.05$). Also, there was a significant main interaction effect of Cooperative Strategy and WhatsApp Use on pre-service

teachers' attitudes in Basic General Mathematics in colleges of education in Oyo State ($F_{(2, 267)} = 345.412$, $p < 0.05$).

5.2 Conclusion

The researcher reached the following conclusions about the study based on the collected and analyzed data, discussions, literature review, and findings.

Pre-service teachers in Oyo State Colleges of Education performed poorly on Basic General Mathematics, according to this study. Cooperative strategy and WhatsApp Use has significant effect on Students' Academic Achievement and Attitude in Basic General Mathematics in Oyo State Colleges of Education. Achievement and attitude of pre-service teachers towards Basic General Mathematics was improved with the use of Cooperative strategy and WhatsApp Platform Use. Therefore, Cooperative Strategy and WhatsApp Platform Use strengthened Achievement and attitude of pre-service teachers toward Basic General Mathematics in Colleges of Education in Oyo State, Nigeria,

5.3 Recommendations

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

i. Pre-service teachers should work together to discuss many topics within themselves or in any of their groups on Basic General Mathematics in Colleges of Education, so as to share knowledge and improve their learning ability

ii. Pre-service teachers should make judicious use of their various WhatsApp Platforms to discuss related and useful topics rather than mere fun on social media, so as improve their their Achievement and attitude in Basic General Mathematics.

iii. Teachers are to employ the use Cooperative Strategy together with WhatsApp Platform to enhancing students' achievement and attitudes towards the learning of Basic General Mathematics

5.4 Contributions to Knowledge

1. Theoretical Contribution

In contrast to previous studies that support the linkage between the independent variable (Cooperative Learning Strategy and WhatsApp platform Use) and the dependent variable (Pre-service teachers' learning outcome in Basic General Mathematics), this study theoretically contributed to the discovery of additional theories, Experiential theory and Career adaptability.

2. Empirical Contribution

This study adds to the pool of previous researches by showing the significant main effect of Cooperative Learning Strategy and WhatsApp Platform Usage on pre-service teachers' Learning Outcome in Basic General Mathematic as a search of existing literatures that might not have or less researches carried out that combine Cooperative Strategy which is a teaching method with WhatsApp Platform Usage which is a device to enhance teaching and learning in colleges of education. This study therefore closes the gap in empirical literature.

4. This thesis could contribute to knowledge when it is published into journals.

5.5 Suggested Areas for Further Study

There is no doubt that this study is only a minimal contribution towards a larger goal attainment of the society and the body of knowledge. By the nature of its limitations, its findings may be regarded as restricted and tentative which is subject to change over a period of time. The researcher therefore strongly suggests that more studies be carried out on the effects of other

variables along with cooperative strategy and WhatsApp Use Platform on Pre-service teachers' Basic General Mathematics Learning Outcome, this will make for the deficiencies of this study, and more importantly, to validate the findings of this study.

1. **Study Population**

   Two state Colleges of Education and one Federal College of Education students in Oyo state made up the population of this study. However, other students in tertiary institution such as private Colleges of Education, Polytechnics, Mono-technics and University could be used for further researches.

2. **Demographic Characteristics**

   Demographic characteristics or bio-data of students was not examined in this study, it could be examined and the likely moderating influence of any demographic characteristics of the students could be explored on other studies

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Appendix I

Lesson Plan for WhatsApp Platform Use Group

Course Title: Basic General Mathematics IV

Level: 200

Duration: 1hr

Content: Change of Subject of Formulae

Previous Knowledge: Students have been taught how to differentiate equation (i.e. formula) from expression in their 100 level Basic General Mathematics

Instructional Objectives: At the end of the lesson, students should be able to;

i. explain the concept subject of formulae
ii. make a given element of an equation its subject
iii. substitute values correctly in a given equation
iv. calculate the unknown value in a given equation

Reference: Raimi S.O. et al (2011); Basic General Mathematics IV, Odumatt Press & Publisher, Oyo. page 27-36;

Introduction: Change of Subject of formulae involves making a variable to stand in terms of others. E.g.

D = bx + c ---------- (i)

$Y = ax^2$ ----------(ii)

A = ½ b x hb ----------(iii)

From the examples above, D,Y and A are the subject of the formulae in equation (i), (ii) and (iii) respectively. So, to change the subject of the formulae in any of the above equation, it entails making any other variables in the equation the subject in place of the previous ones. From equation (i), we can make any of variables b, x or c to replace the position of D to become:

b = D-c/x

x = D-c/b

c == D-bx

All these operation can be perform by different methods such as addition, subtraction, multiplication, division, squaring and finding the square root depending on the equation given.

Presentation
Step 1:

A. Using addition and subtraction operation

Example: d = 2c – p, make 'p' the subject of the formula

Solution: subtract 2c from both sides
d -2c =2c -2c –p, it gives
-p =d-2c=, multiply both sides by -1
P=2c-d
Step 2:

B. Multiplication and Division operation

Example: m = IR/E-Ir, make 'r' the subject of the formular

Solution:

Multiply both sides by E-Ir, we have

M(E-Ir) = IR

ME –MIr = IR

Subtract ME from both sides

-MIr = IR-ME

Divide both by –MI

r = ME –Ir/MI

Step 3:

C. Squaring and finding square root operation

Example: l =$\sqrt{a^2 + b^2}$ make 'a'the subject of the formula

Solution:

Square both sides

$I^2 = a^2 + b^2$

Subtract b^2 from both side

$I^2 - b^2 = a^2$

Find the square root of both sides

$a = \sqrt{I^2 - b^2}$

Application in solving mathematical problem

Example:

T =$Fd^3/16$ make "F" the subject of the formulae and find the value of F when T=2, d=4

Solution:

T = $Fd^3/16$ multiply both sides by 16

16T =Fd^3 divide both sides d^3

F = $16T/d^3$

Substitute the values of T and d

F = $16x2/4^3$

F = 32/64

F =1/2 or 0.5

Evaluation:

The formula $V=a^2h/3$ gives the volume of a square base pyramid of height h and length of one side of the base edges a

(i) obtain a formula for 'a' in terms of V and h

(ii) Find 'a' when V=48cm^3 and h =8c

Appendix II

Lesson Plan for Cooperative Strategy

(Use of Students Team Achievement Division in Teaching Change of Subject of the formula)

Course Title: Basic General Mathematics IV

Level: 200

Duration: 1hr

Content: Change of Subject of Formulae

Previous Knowledge: Students have been taught how to differentiate equation (i.e. formula) from expression in their 100 level Basic General Mathematics

Instructional Objectives: At the end of the lesson, students should be able to;

i. explain the concept subject of formulae
ii. make a given element of an equation its subject
iii. substitute values correctly in a given equation
iv. calculate the unknown value in a given equation

Reference: Raimi S.O. et al (2011); Basic General Mathematics IV, Odumatt Press & Publisher, Oyo. page 27-36;

Introduction: Change of Subject of formulae involves making a variable to stand in terms of others. E.g.

D = bx + c ---------- (i)

$Y = ax^2$ ----------(ii)

A = ½ b x hb ----------(iii)

From the examples above, D,Y and A are the subject of the formulae in equation (i), (ii) and (iii) respectively. So, to change the subject of the formulae in any of the above equation, it entails making any other variables in the equation the subject in place of the previous ones. From equation (i), we can make any of variables b, x or c to replace the position of D to become:

b = D-c/x

x = D-c/b

c == D-bx

All these operation can be perform by different methods such as addition, subtraction, multiplication, division, squaring and finding the square root depending on the equation given.

Mathematical operations in changing the subject of the formula

Step 1:

A. Using addition and subtraction operation

Example: d = 2c – p, make 'p' the subject of the formula

Solution: subtract 2c from both sides

d -2c =2c -2c –p, it gives

-p =d-2c=, multiply both sides by -1

-1x-p =-1(d-2c)

P=2c-d

Step 2:

B. Multiplication and Division operation

Example: m = IR/(E-Ir), make ‘r’ the subject of the formula

Solution:

Multiply both sides by E-Ir, we have

i.e. mx(E-Ir) =IR/(E-Ir) x (E-Ir)

M(E-Ir) = IR

ME –MIr = IR

Subtract ME from both sides

ME-MIr-ME =IR-ME

It gives

-MIr = IR-ME

-MIr/-MI =(IR-ME)/-MI

Divide both by –MI

r = (ME –IR)/MI

Step 3:

C. Squaring and finding square root operation

Example: L =$\sqrt{a^2 + b^2}$ make ‘a’the subject of the formula

Solution:

Square both sides

$L^2 = (\sqrt{a^2 + b^2})^2$

$L^2 = a^2 + b^2$

Subtract b^2 from both side

$L^2 - b^2 = a^2 + b^2 - b^2$

$L^2 - b^2 = a^2$

Find the square root of both sides

$a = \sqrt{L^2 - b^2}$

Substitution of value in subject of the formula

Example:

T =$Fd^3/16$ make “F” the subject of the formulae and find the value of F when T=2, d=4

Solution:

T =$Fd^3/16$, multiply both sides by 16

We have Tx16=$(Fd^3)/16$ x16

It gives 16T=Fd^3

Divide both sides by d^3

$16T/d^3=Fd^3/d^3$

$F=16T/d^3$

To get the value of F, substitute for the value of T and d in equation $F=16T/d^3$

Therefore, $F=16x2/4^3$

Solution:

T = $Fd^3/16$ multiply both sides by 16

16T =Fd^3 divide both sides d^3

F = $16T/d^3$

Substitute the values of T and d

F = $16x2/4^3$

F = 32/64

F =1/2 or 0.5

Practice Questions for the groups

1. Make y the subject of the formula in a= b(1+y)
2. Express 'x' in terms of c, h,in h=(c-x)/(c+x)
3. Express 'u' in terms of other letters in the formula $P=q+u^2$ s
4. The perimeter P of a rectangle with length l and width w is given by the formula P=2(l+w); i. make l the subject of the formula, ii. Find l if P=28 and w=6
5. The Formula V= $(a^2h)/h$ gives the volume of a square based pyramid of height h and length of one side of the base edges a. i. obtain a formula for 'a' in terms of V and h, ii. Find 'a' when V=$48cm^3$ and h=8cm
6. In the formula V=u+at, make t the subject of the formula
7. In the formula A=P+(PRT)/100, make P the subject of the formula
8. In equation ax+bx+c=0, make x the subject of the formula
9. The surface area A of a closed cone of height h and base radius r is given by the formula $A=\pi r^2+\pi r\sqrt{h^2+r^2}$, make h the subject of the formula, hence calculate the height of a cone of surface area 157(1/7)cm^2 and base radius=3 (takeπ =22/7)

10. In an equation A=px+q, make x the subject of the formula

Appendix III

Lesson Plan for Control Group

Course Title: Basic General Mathematics IV

Level: 200

Duration: 1hr

Content: Change of Subject of Formulae

Previous Knowledge: Students have been taught how to differentiate equation (i.e. formula) from expression in their 100 level Basic General Mathematics

Instructional Objectives: At the end of the lesson, students should be able to;

i. explain the concept subject of formulae
ii. make a given element of an equation its subject
iii. substitute values correctly in a given equation

iv. calculate the unknown value in a given equation

Reference: Raimi S.O. et al (2011); Basic General Mathematics IV, Odumatt Press & Publisher, oyo. page 27-36;

Introduction: Change of Subject of formulae involves making a variable to stand in terms of others. E.g.

$D = bx + c$ ---------- (i)

$Y = ax^2$ ----------(ii)

$A = ½ b \times hb$ ----------(iii)

From the examples above, D,Y and A are the subject of the formulae in equation (i), (ii) and (iii) respectively. So, to change the subject of the formulae in any of the above equation, it entails making any other variables in the equation the subject in place of the previous ones. From equation (i), we can make any of variables b, x or c to replace the position of D to become:

$b = D-c/x$

$x = D-c/b$

$c == D-bx$

All these operation can be perform by different methods such as addition, subtraction, multiplication, division, squaring and finding the square root depending on the equation given.

Presentation

Step 1:

B. Using addition and subtraction operation

Example: $d = 2c – p$, make 'p' the subject of the formula

Solution: subtract 2c from both sides

$d -2c =2c -2c –p$, it gives

$-p =d-2c=$, multiply both sides by -1

$P=2c-d$

Step 2:

B. Multiplication and Division operation

Example: $m = IR/E-Ir$, make 'r' the subject of the formular

Solution:

Multiply both sides by E-Ir, we have

$M(E-Ir) = IR$

$ME –MIr = IR$

Subtract ME from both sides

-MIr = IR-ME

Divide both by –MI

r = ME –Ir/MI

Step 3:

C. Squaring and finding square root operation

Example: l =$\sqrt{a^2 + b^2}$ make 'a'the subject of the formula

Solution:

Square both sides

$I^2 = a^2 + b^2$

Subtract b^2 from both side

$I^2 - b^2 = a^2$

Find the square root of both sides

a = $\sqrt{\ }$ $I^2 - b^2$

Application in solving mathematical problem

Example:

T =$Fd^3/16$ make "F" the subject of the formulae and find the value of F when T=2, d=4

Solution:

T = $Fd^3/16$ multiply both sides by 16

16T =Fd^3 divide both sides d^3

F = $16T/d^3$

Substitute the values of T and d

F = $16x2/4^3$

F = 32/64

F =1/2 or 0.5

Evaluation:

The formula $V=a^2h/3$ gives the volume of a square base pyramid of height h and length of one side of the base edges a

(i) obtain a formular for 'a' in terms of V and h

(ii) Find ‘a’ when V=48cm^3 and h =8c

Appendix IV

LEAD CITY UNIVERSITY

FACULTY OF ARTS AND EDUCATION

DEPARTMENT OF SCIENCE EDUCATION

Pre-Service Teachers’ Attitude Questionnaire (PTAQ)

Dear Respondents.

This questionnaire is meant for collection of data on Pre-Service Teachers’ Attitude towards learning of Basic General Mathematics. All information generated shall be solely used for the purpose of this research.

Thanks for your cooperation.

Section A: Demographic Variables

Please fill these appropriately

Name of your institution:……

…….

Course Combination: ……

Level:……

Section B

Instruction: You are required to mark only ONE out of the four options to each statement in this questionnaire. The options are Strongly Agree (SA), Agree(A), Disagree (D) and Strongly Disagree (SD). Your personal opinion to each item is needed, kindly fill it with sincerity.

S\N	Statements	SA	A	D	SD
1.	I always like attending Basic General Mathematics lecture				
2.	I get a great deal of satisfaction out of solving a mathematics problem				
3.	Basic General Mathematics helps develop my mind and thinking ability.				
4.	Basic General Mathematics is one of the most dreadful course to me				
5.	My mind goes blank and I am unable to think clearly when working mathematics problem.				
6.	6. Studying Basic General Mathematics makes me feel nervous.				
7.	I see Basic General Mathematics as a valuable course				
8.	Learning Basic General Mathematics is dull and boring to me				
9.	Group discussions makes learning of Basic General Mathematics to be more interesting to me				
10.	Group discussions relief the fear of learning of basic general mathematics				
11.	I usually enjoy Basic General Mathematics class				
12.	Basic General Mathematics will not be useful for me in future				
13.	I don't think I can perform better in Basic General Mathematic				
14.	Basic General Mathematics is important in everyday life				
15.	Basic General Mathematics suppose not to be a compulsory course				
16	Basic General Mathematics will be useful for me in future				
17	Basic General Mathematics would be very helpful in other courses				
18.	I am able to solve Basic General Mathematics problems without too much difficulty.				
19.	I like to explain my solution to other				
20.	Basic General Mathematics is not relevant to my course				

Appendix V

Basic General Mathematics Achievement Test (BGMAT)

Course Title: Basic General Mathematics III

Topic: Change of the Subject of the Formula

Duration: 40mins

Level: 200

Instruction: Answer all questions by ticking a correct option from A-D

1. The equation of a straight line is given by y=mx+c, Express x in terms of y,m and c

(A) x=(y+c)/m

(B) x=(y-m)/c

(C) x= mc/y

(D) x= (y-c)/m

2. Find the value of m from the formula T=1/2 (mv^2); when v=20, T =2000

(A) 10

(B) 25

(C) 1.0

(D) 20

3. If F = (9/5C) + 32, find C when F =98.6

(a) 30

(b) 37

(c) 39

(d) -1

4. From the equation r =$\sqrt{x^2 + y^2}$, make x, the subject of the formula

(A) x = r+y

(B) x = $\sqrt{r^2 - y^2}$

(C) $x = \sqrt{r^2 + y^2}$

(D) $x = \sqrt{r^2 - y^2}$

5. Find x in an equation x-8=3x+1.

(A) x= 9

(B) x=-4.5

(C) x=20

(D) x=8

6.Make x the subject of the formula, if h=(c-x)/(c+x)

(A) x= c(1-h)/(h+1)

(B) x= (c-h)/(h+1)

(C)x= c(h+1)/(1-h)

(D) x = (1-h)/(c+h)

7. The curve surface area A of a cone of height h and base radius r is given by the formula A=P$\sqrt{h^2 + r^2}$, make h the subject of the formula.

(A) h=$\sqrt{A - Pr^2}$

(B) $h = \sqrt{r^2 + AP}$

(C) $h = \sqrt{r^2 - AP}$

(D)h =$\sqrt{Ar^2 - P}$

8. In a right angled triangle, the hypotenuse h is given by the formula h $\sqrt{a^2 + b^2}$, find b if h =15 and a=9

A) 12

(B) 24

(C) 9

(D) 14

9.Make w the subject of the relation1/y = a/x + b/w

(A)(a/x) + by

(B) (by/a) +ay

(C) (bxy/x)-ay

(D) (bxy/x) +ay

10. Make r the subject of the formula in equation S=2w(r+v)

(A) v= (S-2wr)/2w

(B) v= (S-wr)/2w

(C) v=(S+wr)/2w

(D) v= (S-2w)/2wr

11. Given that 9+x=xy+5, find x, when y =4

(A) x=1/2

(B) x=4/3

(C) x=3/4

(D) x=4

12. The perimeter P of a rectangle with length l and width w is given y the formula P=2(l +w), make l the subject of the formula.

(A) l=Pw/2

(B) l=(W-P)/2

(C) l =(P/2)-W

(D) W+(2/P)

13. Make x the subject of the formula in equation y = 10- x^2

(A) x=y-10

(B) x=y^2-10

(C) x=$\sqrt{10-y}$

(D) x =$\sqrt{y-10}$

14. The volume V of cone of height h and base radius r is 1/3($\pi r^2 h$), obtain a formula for r

(A) r = $\sqrt{3V/\pi h}$

(B) r = $\sqrt{V/3\pi h}$

(C) r = $\sqrt{3\pi h/V}$

(D) r = $3V^2/\pi$

15. $T^2 = 4\pi^2 L/g$, Calculate the value of L when g=9.8, T=1.4, π =3.142 leave your answer in 2 decimal places

(A) 5.21

(B) 0.49

(C) 0.45

(D) 0.95

16. Given that $V^2 = U^2 - 2as$ express 'a' in term of U,V and s

(a) a =$(U^2=V^2)/2s$)

(b) a =$(U^2-2U)/s$

(c) a=$(V^2-U^2)/2s$

(d) a=$(U^2-2s)/V^2$

17. Given that a=5/ (7-b) make 'b' the subject of the formula

(a) b=(7a-5)/a

(b) b=(7a+5)/a

(c) b=(a+5)/7a

(d) b=7a-5

18. Make b the subject of the formula if A =h/2(m+b)

(a) b= (2A-hm)/h

(b) b= (A-hm)/2

(c) b= h(2-m)/A

(d) b= h(2-m)/A

19. If V = U +at make 't' the subject of the formula

(a) t =U-v)/a

(b) t =(V –u)/a

(c) t= v-(u/a)

(d) t= (U – v)/a

20. Given that T= a+(-1)d, make ‘n’ the subject of the formula

(A) n = (T-a+d)/d

(B) n = T-a+d

© n = (T+a-d)/d

(D) n =T-a+2d

Appendix VI

40 minutes

Basic General Mathematics Achievement Test Conducted Online for WhatsApp Platform Usage

Course Title: Basic General Mathematics III
Topic: Change of the Subject of the Formula
Level: 200
Instruction: Solve the following questions and pick the correct option from option A-D

* Required

1. Matric Number *

2. The equation of a straight line is given by y=mx+c. Express x in terms of y, m and c (2 Points)

- ◯ x=(y+c)/m
- ◯ x=(y-m)/c
- ◯ x=mc/y
- ◯ x=(y-c)/m

3. Find the value of M from the formular T=1/2 (MV^2), when V=20, T=2000 (2 Points)

- ◯ 10
- ◯ 25
- ◯ 1.0
- ◯ 20

4. If F = (9C/5) + 32, find C when F =98.6 (2 Points)

- ◯ 30
- ◯ 37
- ◯ 39
- ◯ -1

5. From the equation r= √(x^2. +x^2), make x the subject of the formula. (2 Points)

- ◯ x=r+y
- ◯ x=√(r^2 -y^2)
- ◯ x=√(r^2 +y^2)
- ◯ x=√(r^2 -y)

6. In an equation x-8=3x+1, find the value of x (2 Points)

- ◯ x=9
- ◯ x = 4.5
- ◯ x=20
- ◯ x=8

7. Make x the subject of the formula, if h= (c-x)/ (c+x) (2 Points)

- ◯ x= c(1-h)/(h+1)
- ◯ x= (c-h)/(h+1)
- ◯ x=(1-h)/(c+h)
- ◯ x=c(h+1)/(1-h)

8. The curved surface area A of a cone of height h and base radius r is given by the formula A= P(h^2+r^2), make h the subject of the formula. (2 Points)

- ◯ h=√(A-Pr^2)
- ◯ h=√(r^2-AP)
- ◯ h=√(A+Pr^2)
- ◯ h=√(Ar^2-P)

9. In a right angled triangle, the hypotenuse h is given by the formula h = √(a^2 +b^2) , find b if h =15 and a=9 (2 Points)

- ◯ 12
- ◯ 24
- ◯ 9
- ◯ 14

10. Make w the subject of the relation1/y = a/x + b/w (2 Points)

- ◯ a/x + by
- ◯ y/a+ay
- ◯ xy/x-ay
- ◯ bxy/x-ay

11. Make v the subject of the formula in equation S=2w (r+v) (2 Points)

- ◯ v=(S-2wr)/2w
- ◯ v=(S-wr)/2w
- ◯ v=(S+wr)/2w
- ◯ v=(S-2w)/2wr

12. Given that 9+x=xy+5, find x, when y=4 (2 Points)

- ◯ x = 1/2
- ◯ x=4/3
- ◯ x=3/4
- ◯ x=4

13. The perimeter P of a rectangle with length l and width w is given by the formula P=2(l +w), make l the subject of the formula. (2 Points)

- ◯ l=Pw/2
- ◯ l=W-P/2
- ◯ l =(P/2)-W
- ◯ l=W+2/P

14. Make x the subject of the formula in equation y=10-x^2 (2 Points)

- ◯ x=y-10
- ◯ x=y^2-10
- ◯ x=√(10-y)
- ◯ x=√(y-10)

15. The volume V of cone of height h and base radius r is (1/3) πr^2h, obtain a formula for r (2 Points)

- ◯ r = √(3V/πh)
- ◯ r = √(V/3πh)
- ◯ r = √(3πh/V)
- ◯ r = (3V^2)/ π

16. T^2= (4Lπ^2)/g, Calculate the value of L when g=9.8, T=1.4, π =3.142 leave your answer in 2 decimal places (2 Points)

- ◯ 5.21
- ◯ 0.49
- ◯ 0.45
- ◯ 0.95

17. Given that V^2 =U^2-2as express 'a' in term of U,V and s (2 Points)

- ◯ a=(U^2-V^2)/2s
- ◯ a=(U^2-2V)/s
- ◯ a=(V^2-U^2)/2s
- ◯ a=(U^2-2s)/V^2

18. Given that a= 5/(7-b) make b the subject of the formula (2 Points)

- ◯ b=(7a-5)/a
- ◯ b=(7a+5)/a
- ◯ b=(a+5)/7a
- ◯ b=(7a-5)

19. Make b the subject of the formula if A =h(m+b)/2 (2 Points)

- ◯ b= (2A-hm)/h
- ◯ b= (A-hm)/2
- ◯ b= h(2-m)/A
- ◯ b= h(2-m)/A

20. If V = U +at make t the subject of the formular (2 Points)

- ◯ t =(U-v)/a
- ◯ t = (V –U)/a
- ◯ t= (v-u)/a
- ◯ t= (U – v)/a

21. Given that T=a +(n-1)d, make n the subject of the formula (2 Points)

- ◯ n=(T-a+d)/d
- ◯ n= T-a+d
- ◯ n=(T+a-d)/d
- ◯ n=T-a+2d

Pre-Service Teachers' Attitude Questionnaire (PTAQ) for WhatsApp Platform Usage

This questionnaire is meant for collection of data on Pre-service Teachers' Attitude towards learning of Basic General Mathematics. Your personal opinion to each item is needed, which shall solely used for the purpose of this research. Kindly pick the option with sincerity.
Thanks for your cooperation.

1. I always like attending Basic General Mathematics lecture

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly Disagree

2. I am able to solve Basic General Mathematics problems without too much difficulty

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly disagree

3. I like to explain my solution to other

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly disagree

4. Basic General Mathematics is not relevant to my course

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly disagree

5. I get a great deal of satisfaction out of solving a Mathematics problem

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly Disagree

6. Basic General Mathematics helps develop my mind and thinking ability

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly disagree

7. Basic General Mathematics is one of the most dreadful course to me

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly disagree

8. My mind goes blank and I am unable to think clearly when working mathematics problem

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly Disagree

9. Studying Basic General Mathematics makes me feel nervous

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly disagree

10. I see Basic General Mathematics as a valuable course

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly disagree

11. Learning Basic General Mathematics is dull and boring to me

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly disagree

12. Group discussion makes learning of Basic General Mathematics to be more interesting to me

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly disagree

13. Group discussion relief the fear of learning Basic General Mathematics

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly disagree

14. Basic General Mathematics will not be useful for me in the future

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly disagree

15. I usually enjoy Basic General Mathematics class

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly disagree

16. I don't think I can perform better in Basic General Mathematics

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly disagree

17. Basic General Mathematics is important in everyday life

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly disagree

18. Basic General Mathematics suppose not to be compulsory course

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly disagree

19. Basic General Mathematics will be useful for me in future

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly disagree

20. Basic General Mathematics would be very helpful in other courses

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly disagree

Appendix VII

Distribution of Students' Academic Achievement Score for three Sessions Between 2019 -2022

		Session					
S/N	Colleges	2019/2020		2020/2021		2021/2022	
		% passed	% failed	% passed	% failed	% passed	% failed
1	Emmanuel Alayande College of Education, Oyo	92.06%	7.94%	90.02%	9.98%	88.01%	11.99%
2	Federal College of Education (Special), Oyo	94.0%	6%	91.99%	8.01%	89%	11%
3	Oyo State College of Education, Lanlate	95.02%	4.98%	92%	8%	88.96%	11.04%

Source: H.O.Ds GS

Table 3.1: Sample of Pre-service Year Two Teachers

S/N	College of Education	Level	Population	Sample
1	Emmanuel Alayande Colleges of Education, Oyo, Oyo State	200	1,200	130
2	Federal College of Education special, Akimorin, Oyo, Oyo State	200	2,056	230
3.	Oyo State College of Education, Lanlate, Oyo State	200	401	60
	Total		3,657	420

Source: From the H.O.Ds (GSE) in the Colleges used for this research

Bio- data

A. Personal Data

1. Name in Full:	Florence Abidemi ODELEYE
2. Address:	Ayetooro Scheme, Oyo.
4. Nationality:	Nigerian
5. Marital Status:	Married
6. Email Address:	odeleyeflorence@gmail.com
7. Phone Number:	07061158010
8. Date and Place of Birth:	17 August, 1978/Osun State
9. Name and Address of Next of Kin:	Dn. Odeleye Olubayo Damilare
10. Address:	Ayetoro Scheme, Oyo.

B. Educational Background

Educational Institutions Attended	**Qualifications with Dates:**	
(i)St. Michael's Ang. Primary School, Esiele, Oyo	Leaving Certificate	1984
(ii) Alaafin High School, Oyo	SSCE	1995
(iii)St. Andrew's College of Education, Oyo	NCE	1999
(iv)University of Ado-Ekiti, Ado-Ekiti	BSc(Ed.) Maths	2003

C. **Work Experience with Dates**

i. Emmanuel Alayande College Of Education, Oyo (Non-Teaching) - 2002- Sept.2021

ii. Emmanuel Alayande College Of Education, Oyo (Lecturer III) - Sept.2021

D. **Conference Paper:**

Odeleye, F.A. & Iyanda, F.O.(2022, May). *Revitalizing Mathematics Education for higher productivity in the new normal world*. Paper presented at the 6th National Conference of the School of Education, Emmanuel Alayande College of Education, Oyo. *(Internal)*

E. **Chapters In Edited Book:**

Odeleye, F.A., Iyanda, F.O., Gabriel, E.T., Wahab, R.A. & Adesina, A.E. (2021). *Enhancing science education with learning management systems: The views of lecturers in colleges of education in Oyo township*. "Accepted for Publication". *(Internal, Empirical)*

F. Attendance At Learned Conferences

1. A- Day E-Learning/IT Education Forum.

   Theme: Advancing Technology - Based Learning in Nigeria: Prospects, Challenges and Strategies. Held online, on 19 of January, 2022.

2. 12th National Conference of the Colleges of Education Academic Staff Union, Southwest Zone.

   Theme: Educational Delivery System Amidst Dwindling Economy and National Insecurity. Held at Emmanuel Alayande College of Education, Oyo, between 28 of March and 1 of April, 2022

3. A 2- Day Hands – On Training Workshop.

   Theme: Delivery of an Effective Academic Lecture with Power Point. Held at Microteaching Laboratory, Federal College of Education (Special), Oyo, between 12 and 13 of April, 2022.

4. 6 th National Conference of the School of Education.

   Theme: Revitalizing Teacher Education for Higher Productivity in the New Normal. Held at Emmanuel Alayande College of Education, Oyo, between 9 and 12 of May, 2022.

5. 5th Faculty of Arts and Education International Conference on Sustainable Development.

   Theme: Pragmatic Human Capital for Sustainable Development. Held at Lead City University, Ibadan, between 6 and 8 of June, 2022.

G. Academic Distinction/Award: **Nil**

H. Other Relevant Information:

a. Member, College of Education Academics Staff Union (COEASU), EACOED Chapter.
b. Member, Women in Colleges of Education (WICE), EACOED Chapter

I. References

1. Prof. P.O. Yara
Science Education Department
Faculty of Education,
Lead City University, Ibadan

2. Dr. S.O. Raimi
General Studies Department,
Emmanuel Alayande College of Education, Oyo

3. Dr. A.O. Ojebisi
Curriculum & Instruction Department,
Federal College of Education, Akinmorin, Oyo.

…… ……...
Signature **Date**

The University Compliance Certification

This is to certify that the thesis by, Florence Abidemi ODELEYE in the Department of Science Education, Faculty of Arts and Education, Lead City University, Ibadan, Oyo State is in full compliance with the approved University Format and Style.

…….. ……

Signature **Date**