TEAM TEACHING MODELS AND PRIMARY SCHOOL PUPILS' LEARNING OUTCOMES IN MATHEMATICS IN OYO, NIGERIA

By

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ABSTRACT

Mathematics is taught at the primary schools to enable pupils apply its skills to solve daily problems. There is evidence that pupils have phobia for and poor performance in Mathematics. This has been attributed to teachers' non-use of effective teaching methods such as the team teaching models. Previous studies have focused largely on individual teaching methods with little attention paid to the use of Collaborative Team Teaching (CTT) and Alternative Team Teaching (ATT) models in improving pupils' learning outcomes in Mathematics. The study, therefore, was designed to investigate the effects of CTT and ATT on pupils' Achievement in Mathematics (AM), Interest in Mathematics (IM) and Dexterity in Mathematics (DM). The moderation effects of Pupils' Learning Styles (PLS) and Pupils' Self-efficacy (PS) were also examined.

Tuckman's Team and Activity Learning theories served as the framework. Explanatory sequential mixed methods design (QUAN ⟶ qual) with dominant quantitative component (QUAN-dominant) was adopted in the study, while the quantitative aspect used 3x3x3 factorial matrix. Both simple random and homogenous purposive sampling techniques were used. Simple random sampling technique was used to select three Local Government Areas (LGAs) in Oyo. From each LGA, three public primary schools were randomly selected and an intact class of primary V pupils was adopted from each school. The classes were assigned to CTT (143), ATT (129) and control (129) groups, while treatment lasted for five weeks. Homogenous purposive sampling method was used to select 72 pupils, 12 primary five Mathematics teachers and 6 head teachers. Instruments used were AM (r=0.78) and DM (r=0.82) tests; IM (α=0.87), PLS (α=0.84) and Mathematics Self-efficacy (α=0.82) scales and instructional guides. These were complemented with 12 focus group discussions with pupils and 18 in-depth interview sessions with six headmasters and 12 Primary V Mathematics teachers. Data were analysed using Analysis of covariance, Sidak post-hoc test at 0.05 level of significance, while qualitative data were content-analysed.

There were significant main effects of treatment on AM ($F_{(2,374)}$=62.85, partial η^2=0.25) and IM ($F_{(2,374)}$=29.86, partial η^2=0.14) but none on DM. Pupils in the ATT (21.09) had the highest mean score in AM, followed by pupils in CTT (12.13) and control (9.84) groups. Pupils in ATT (42.82) had the highest mean score in IM, followed by pupils in control (28.15) and CTT (27.83). There was no significant main effect of PLS on AM, IM and DM. The PS had no significant main effect on AM, IM and DM. The two-way and three-way interaction effects were not significant. Collaborative and alternative team teaching models made learning easier; provided clear understanding of the content; enhanced close interaction between pupils and teachers; and engendered innovation and creativity. Challenges associated with collaborative and alternative team teaching models included inferiority or superiority complex and conflicts among teachers. Solutions to the challenges were planning, monitoring, supervision, communication and mutual understanding.

Both collaborative and alternative team teaching models improved pupils' achievement in mathematics, while only alternative team teaching model aroused pupils' interest in Mathematics. Primary school teachers should employ these models in teaching mathematics.

Keywords: Collaborative team teaching, Alternative team teaching, Mathematics learning outcomes

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CERTIFICATION

I certify that this research work was carried out by Deborah Adepeju OYEGOKE in the International Centre for Educational Evaluation (ICEE), Institute of Education, University of Ibadan, Ibadan, Nigeria under my supervision.

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SUPERVISOR **DATE**

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DEDICATION

This research work is dedicated to God the Father, God the Son and God the Holy Spirit. It is also dedicated to my husband – Rev. Jeremiah Akinwumi Oyegoke and my children – Irebami, Irenitemi and Irenimi.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Problem

Education remains the key factor to scientific, economic, social and cultural development in the world. Any nation that aspires to develop and advance cannot afford to toy with the education of her citizens. Nigerian educational system ranges from pre-primary to tertiary levels. Primary education serves as the basis upon which other levels of education are built. Mathematics is one of the core subjects at this level. Importance of Mathematics at primary level of education includes: inculcating necessary basic numeracy skills in pupils, applying basic skills to solve daily problems, promoting scientific and technological advancement (Nnaji, 2005). Primary Mathematics also helps in developing creativity and innovation in pupils, promoting logical and critical thinking in pupils, developing necessary manipulative skills useful for daily living and inculcating basic knowledge of spatial relationship. Hence, the knowledge of Mathematics is central to daily living and permeates almost all spheres of human endeavours. Chirume and Chikasha (2014) described Mathematics as a subject with important elements for solving daily problems, a language for measurement, means of getting employment / further studies and a drive for innovative and critical thinking. It is not an over-statement that the knowledge of Mathematics is required for a person to have a meaningful life and plays an effective and efficient role in the society.

As important as Mathematics is, it is generally perceived by most pupils as one of the most dreaded subjects if not the most dreaded. People view Mathematics as a subject to be taken by pupils who have innate ability for and talents in the subject. Furthermore, there has been consistent poor performance of primary pupils in Mathematics in majority of the states of the nation in National Assessment of Universal Basic Education Commission (UBEC, 2013). This is shown in Table 1.1 and Figure 1.1 below:

Table 1.1: Mean Performances in 2011 National Assessment of Learning Achievements in Basic Education (NALABE) of Primary Five Pupils by States and FCT

S/N	STATE	PRIMARY V
1	Abia	46.36
2	Adamawa	47.74
3	Akwa Ibom	46.76
4	Anambra	52.15
5	Bauchi	49.55
6	Bayelsa	47.52
7	Benue	52.92
8	Borno	54.12
9	Cross river	45.62
10	Delta	48.71
11	Ebonyi	47.78
12	Edo	60.39
13	Ekiti	52.12
14	Enugu	44.52
15	Gombe	44.66
16	Imo	43.13
17	Jigawa	50.69
18	Kaduna	42.52
19	Kano	50.28
20	Katsina	60.86
21	Kebbi	49.24
22	Kogi	46.38
23	Kwara	45.80
24	Lagos	54.87
25	Nasarawa	47.50
26	Niger	54.53
27	Ogun	56.77
28	Ondo	48.88
29	Osun	56.15
30	Oyo	52.71
31	Plateau	49.76
32	Rivers	54.79
33	Sokoto	47.17
34	Taraba	46.99
35	Yobe	46.61
36	Zamfara	59.39
37	FCT	47.97
	National Mean	**50.36**

Source: Universal Basic Education Commission (UBEC, 2013)

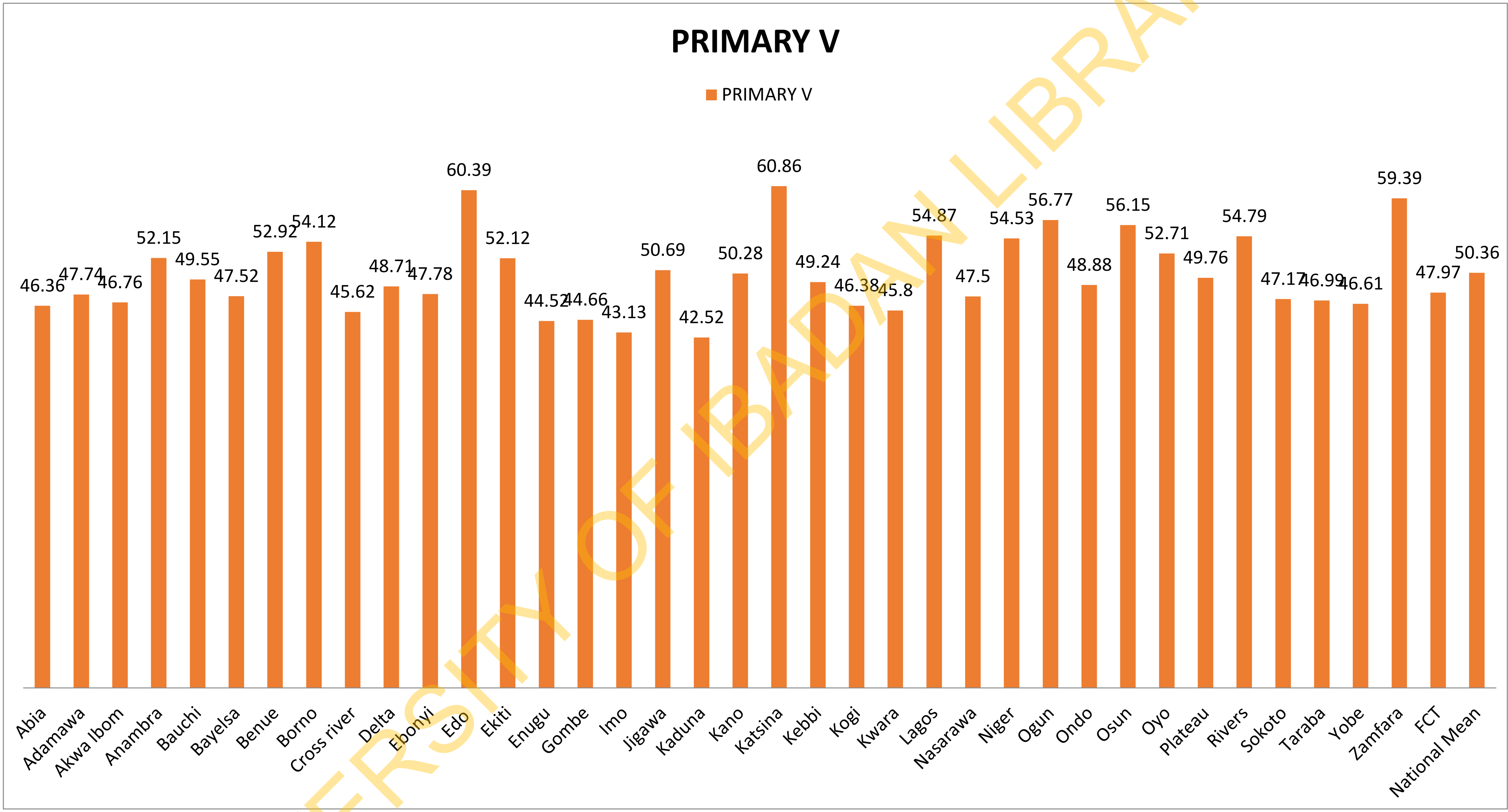

Figure 1.1: Chart showing Mean Performances in 2011 National Assessment of Learning Achievements in Basic Education (NALABE) of Primary Five Pupils by States and FCT

The mean performances of primary five pupils in National Assessment of Learning Achievements in Basic Education (NALABE) by States and FCT as contained in the final report of 2011 NALABE (UBEC, 2013) is shown in Table 1.1 and Figure 1.1. The 2011 NALABE employed both narrative and numerical techniques to assess and determine the effectiveness and value relating to performance of primary and junior secondary schools in Nigeria. Table 1.1 indicated that the pupils' mean performance across states ranges from 42.52% to 60.86%. Also, Table 1.1 showed that 23 states representing 63.89% scored below the national mean mark of 50.36 at primary five level. Also, the table indicated that primary five pupils in Katsina State had the highest mean score of 60.86%, while primary five pupils in Kaduna State had the lowest mean score 42.52%. The mean performance of the primary five pupils in Oyo state was 52.71%, which was just a little above average. The table indicated the need for improvement in primary five pupils' achievement in Mathematics in this era of scientific and technological advancement.

In the light of the above, the researcher sampled eight public primary schools within Oyo metropolis to find out the trend of pupils' academic performance in Mathematics in the mock examinations conducted by the schools over a period of 5 years. The analysis of the mean performance of pupils in the sampled schools between 2014 and 2018 was presented in Table 1.2

Table 1.2: Analysis of Mean Performances of Primary Pupils in Mathematics in the Mock Examinations by Eight Public Primary Schools in Oyo from 2014 to 2018

	SCHOOLS								
YEAR	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**MEAN**
2014	49.72	50.92	43.26	49.64	45.38	39.88	44.78	39.50	45.39
2015	35.82	46.51	54.28	46.17	45.82	44.75	40.72	40.75	44.35
2016	50.65	38.89	45.13	50.81	33.56	50.29	41.91	47.86	44.89
2017	52.42	57.31	42.61	47.40	48.35	56.74	49.39	49.56	50.47
2018	53.33	57.24	42.67	48.59	48.20	49.53	56.81	55.25	50.45

Source: Oyegoke, D. A. (2018)

It could be deduced from Table 1.2 that the mean performances of pupils in Mathematics in the eight schools on school base ranges from 39.50% to 50.92% in 2014; 35.82 to 54.28% in 2015; 33.56% to 50.81% in 2016; 42.61% to 57.31% in 2017 and 48.20% to 57.24% in 2018. Also, the general mean performance was 45.39% in 2014; 44.35% in 2015; 44.89% in 2016; 50.47% in 2017 and 50.45% in 2018. Table 1.2 indicated that in 2017, primary pupils in the eight schools had the highest mean performance of 50.47%, which was just a little above the average, and the lowest mean performance in 2015 which was 44.35. This showed the need for improvement in pupils' academic performance in the subject in Oyo town.

Learning outcomes describe the knowledge or skills students should acquire by the end of a particular assignment, class, course, or program, and help students understand why that knowledge and those skills will be useful to them (Battersby, 1999). Learning outcomes focus on the context and potential applications of knowledge and skills, help students to connect learning in various contexts, and assist in guiding assessment and evaluation. Good learning outcomes emphasise the application and integration of knowledge. Instead of focusing on coverage of material, learning outcomes articulate how students will be able to employ the material, both in the context of the class and more broadly. Learning outcomes focus not only on the cognitive domain of learning but also include the affective and psychomotor domains. The distinction between learning outcomes and learning objectives is not universally recognised, they are interwoven. Some instructors submitted that learning outcomes described what they have already been understood by the term learning objectives (Battersby, 1999; Ronberg, 1993), while some scholars make no distinction between the two terms (Sannino, Engerstron and Lenmos, 2016).

There is serious concern about factors that inhibit pupils' learning outcomes in Mathematics. Various factors have been discussed as responsible for poor learning outcomes in Mathematics by different researchers. Adeleke (2007) indicated learners' factors, Nolting (2006) attributed it to study habit, while school factors were identified by Bature (2006). Also, the reason for poor learning outcomes in Mathematics in terms of erroneous conception (affective) and poor performance (cognitive) was based on the wrong and inappropriate instructional methods employed by Mathematics teachers during classroom interactions (Oyeniran, 2015; Farayola, 2014; Oyeniran, 2010). It had been discovered that majority of the Mathematics teachers still depends solely on some of the methods adopted for other subjects which may not be appropriate for teaching Mathematics most especially at primary school level (Adeteju, 2014). This may result to poor performance of pupils, lack of interest and inability to carry out some manipulative skills in the subject.

Teaching and learning of Mathematics at the primary level should deviate from using just any method to the adoption of methods that cater for the individual uniqueness of learners and involves pupils' active participation through activities. A Mathematics classroom consists of learners with different learning styles and rates. This requires using an instructional method that allows more than one qualified teachers to use their knowledge to design learning experiences to cater for various learning needs of students. A method that gives opportunities to students to achieve success in classroom conditions that typifies collaboration, gives reverence for diverse opinions or views as well as offers teachers the opportunities to build on each other's strengths to meet instructional objectives is inevitable. Team teaching method enables teachers present supportive expertise that creates collective learning environments that are results-based and standards-driven (Texas Education Agency, n.d).

Team teaching approach is a participatory method with two or more professionals coming together to share responsibility, expertise and provide greater opportunity for pupils' attention. It also provides social interaction for instruction, greater opportunity to differentiate pupils' needs as well as improving pupils' achievements (Cohen and Hoffman, 2014). According to Peeler (2010), team teaching is a delivery of lesson by more than one teacher with equal ability sharing a classroom with both teachers actively engaged in purposeful instruction in the general education classroom which provides opportunities for differentiated instruction. Team teaching is a strategy which involves more than a teacher working as a team to co-plan, co-conduct, co-teach and co-evaluate classroom instructional activities for similar set of students.

Quinn and Kanter (1984) viewed team teaching as working together of more than one professional teacher called instructors who teach subject content to a class of pupils or students. These teachers are addressed as instructors while their students are called the audience. In a typical team teaching class, team teachers' names are written on the board and report cards. Both teachers in the team teaching setting have space for personal belongings and have similar furniture. Any of the teachers can take a principal part in the course of lesson delivery. Both teachers communicate during lessons and provide direction to students. Teachers in team teaching interact with all students and they are considered as equal by students (Peeler, 2010). Also, specially designed instruction, strategies being implemented and the level of students' engagement are evident in a team teaching instructional setting.

In team teaching, teachers believe that each has distinct knowledge, skills and view that enhance class instruction. Thus, team teaching offers students the opportunity to acquire knowledge from two or more teachers who may possess different thinking abilities and styles of teaching. They share space within the classroom, take mutual decision concerning classroom instructional activities, and take responsibility for students' learning. Furthermore, they put concerted effort to attain previously stated instructional objectives of instructions. In a team teaching classroom, teachers play different roles as they employ various team teaching models to meet specified learning objectives and students' needs efficiently. However, some misinterpreted and practised team teaching as teaching alternate courses in which one person teaches a group of learners at a time while the other marks learners' books. One of the teachers teaches a lesson, and the other sits, stands, and observes without input or ideas in the teaching. That is, one teacher determines the activities of the instruction in the classroom setting (Villa, Thousand, and Nevin, 2004).

Six team teaching models as outlined by Maroney (1995) and Robinson and Schaible (1995) are:

1. Traditional Team Teaching
2. Parallel Team Teaching
3. Collaborative Teaching
4. Alternative Team Teaching (Differentiated Split Class)
5. Complimentary/Supportive Team Teaching
6. Monitoring Teacher

Goetz (2000) further gave two categories of team teaching as A and B. In category A, more than one teacher interacts with a set of students in the classroom setting within the specified period while in category B, the teachers co-plan and co- teach the same groups of pupils but they do not carry out the instructional activities at the same time. It implies that the team teachers in category A co-plan, co-teach, co-conduct and co-evaluate the pupils together within the same class setting; but in category B, they co-plan but do not co-teach at the same time. Also, they emphasised that the aforementioned six models are usually involved in category A team teaching.

In traditional model, a teacher presents subject content to the pupils, while the other teacher takes note of the situations going on in the classroom. One teacher provides instruction to entire students, while the other systematically collects information which both teachers have identified to be used to improve students' learning. Traditional team teaching is also identified as one teaches and the other observes method of team teaching by researchers like Friend, Cook, Hurley-Chamberlain and Shamberger (2010) and Scruggs, Mastropieri, and Mcduffie (2007). In implementing traditional team teaching in a typical Mathematics class setting, it is the responsibilities of the teachers to review curriculum content, have good mastery of concepts to be taught, examine pupils' records of behaviour for better instructional plan and better evaluation of the effectiveness and delivery of instructional strategies. Applying traditional team teaching in a Mathematics class helps to focus explicitly, affords the team teachers opportunity to monitor and improve their teaching skills as well as collecting data for

Individualised Education Program (IEP) planning. However, the team teachers must possess adequate skills for collecting and analysing data for successful implementation of the method.

In parallel team teaching, the teachers instruct, facilitate, and supervise the work of identical groups of pupils at the same time in the classroom by dividing the class into equal groups based on number of teachers in the team. The teachers teach the groups simultaneously using the same amount of instructional time (Scruggs et al, 2007). The team teachers may decide to be flexible in their choice of instructional methods. This instructional strategy decreases the pupil-teacher ratio and gives room for more pupils' individualised support, more supervision and greater responses and participation from pupils. It also allows the teachers to be actively involved in instructional activities. There is also less teacher talk and greater pupil-to-pupil interactions. For successful implementation of parallel teaching in a Mathematics class, effective planning, identification of appropriate classroom or physical space, avoidance of distraction and noise during the teaching learning process are required (Friend, Cook, Hurley-Chamberlain and Shamberger, 2010).

Teachers deliver the same instruction at the same time in a collaborative team teaching. The team teachers work together to prepare lesson and present the lesson by exchanging, explaining and discussing the topic of the lesson to students instead of employing monologue style of lesson presentation by a single teacher. This type of team teaching is usually called having "one brain in two bodies" (Goetz, 2000). In this type, teachers are actively involved in lesson presentation. They also take responsibility for class control and monitor students' behaviour. This instructional strategy gives opportunities to students to have full understanding of the contents of instruction through various teaching styles used by individual teacher during class interaction.

In alternative team teaching or differentiated split class model of team teaching, the class is divided into two groups according to the students' learning needs (Shumway, Gallo, Dickson and Gibbs, 2011; Villa, Thousand and Nevin, 2004). In alternative teaching, a teacher teaches a set of students while the other teacher engages other students for more explanation, remediation, enrichment and re-teaching of the concept as the case may be. Each teacher structures his/her instruction to cater for the required learning needs of the group. Differentiated split class requires the team teachers to predetermine teaching strategy and remediation mode of class. This includes putting students in groups for each day, management of each group and determining the instructional needs of each group.

Alternative team teaching model as used in this study involved class interactions which a teacher presented contents of instruction to the pupils, while the other observed the teacher teaching to take note of the aspect of the lesson that needs more clarifications. Also, assessment was carried out at the end of the first teaching to determine areas of the contents that need emphasis. Thereafter, other teacher re-teaches the same content focusing on the areas that need more clarification and explanation based on the observation and class assessment. For instance, after teaching types of plane shapes by one of the teachers, the pupils were evaluated to measure how much they have gained from the lesson and the aspect of the lesson that needed more clarification. In addition, while the first teacher was teaching, the other teacher observed the aspect of the lesson that the first teacher did not explain well. The second teacher carried out the re-teaching, focusing on aspects that needed more explanation as a result of the assessment and observation conducted in the first teaching.

Complimentary/supportive team teaching model allows a teacher to teach the content of a lesson, while the other provides unobtrusive assistance and follow-up activities related to the topic of the instruction by moving round the class. This model of team teaching is called one teaches and the other assists model of team teaching (Friend, Hurley-Chamberlain and Shamberger, 2010; Mastropieri, Thomas, Scruggs, Graetz, Norland, Gardizi and Mcduffiek, 2005). Monitoring team teaching is a strategy in which one of the team teachers takes the responsibility for teaching the entire class, while the other teacher(s) monitor pupils' understanding and behaviour (Maroney, 1995).

Category B team teaching consists of five forms such as

(i) A form in which a team of teachers come together to exchange knowledge, views and teaching and learning resources but function individually.

(ii) A form in which a team of teachers shares a common learning materials or resource center. In this form, independent class instruction is carried out by the teachers, however, learning resources or materials such as lesson plans, supplementary textbooks and exercises are shared.

(iii) A form in which students and instructional planning are shared but members teach various sub-sets to the same set of students.

(iv) A form in which a teacher single-handedly plans the teaching activities for a team of teachers. This form lacks full benefits of the team teaching as only one individual ideas are adopted by other team members. Where there is time or financial constraint, there may be no alternative than to adopt this form of team teaching.

(v) A form in which a team of teachers co-plans but each of the teachers teaches his/her own specialised area to the entire students. For instance, five instructors may decide to teach five Mathematics topics to two hundred and fifty students. The instructors may share the students into five classes (50 students per class) and rotate throughout the duration of the course.

Studies of Parka (2010) and Syn-Jong (2006) looked into how co-teaching affects pupils' performance. The studies were conducted on inclusive aspect of special needs education areas. The result of the study of Syn-Jong revealed that team teaching improved achievement, while that of Parka showed no significant different between the experimental and control group. Other studies like that of Uwameiye and Ojikutu (2014), Achor, Imoko and Jimin (2012) and Haselden (2012) were carried out on how team teaching affects students' performance in general education. These studies were carried out using quantitative approach. However, Mastropieri, Thomas, Scruggs, Norland, Gardini and Mcduffiek, (2005) and Yanamandram and Noble (2006) in their studies adopted qualitative approach like interviews, observation, videotapes, field notes and artifacts. The studies discovered that team teachers had excellent work relationship, used their strength as motivator and had effective instructional skills. However, the studies reported team teaching could hinder students' learning if the team refuses work as a cohesive entity to effectively co-ordinate learning concepts.

Moreover, Friend et al (2010), Mastroprieri et al (2005) and Goetz (2000) examined the perception of stakeholders (team teachers and students) on various issues pertinent to team teaching using qualitative approach. Issues identified in their studies were: beliefs and perception of students on team teaching, perception of teachers on team teaching, working relationship between team teachers, planning and allocation of planning time. Other issues are roles and responsibilities of teachers, merits of team teaching with respect to students and teachers as well as selection of teachers for team teaching. The results of the finding of Mastropieri et al (2005) revealed that team teaching greatly showed its efficacy in promoting performance of disabled students in the primary and secondary classes in inclusive arms in that these students benefited immensely. The team teachers indicated that they had good relationships and used their strengths as motivators. They claimed they had time for co-planning which was judiciously used to promote effective instructional skills.

Based on the six models of category A team teaching, this study focused on two models which are collaborative team teaching and differentiated split class teaching (alternative teaching). Implementing category A team teaching instructional approaches in a Mathematics class as identified by Hanover (2012), Peeler (2010) and Mastropieri et al, (2005) requires:

1. Time for co-planning
2. consideration of pupils' needs and characteristics
3. consideration of team teachers' characteristics
4. expertise in the content area of the curriculum
5. outstanding working relationship
6. effective instructional skills

Furthermore, researchers like Salami (2014), Maat, Zakaria, Nordin and Meerah (2011), Oyeniran (2010) and Akinsola (1999) had attributed challenges in teaching and learning of Mathematics at higher level of education to the inappropriate and ineffective methods used for teaching of the subject at foundation level (primary level). They emphasised that irrespective of the methods of teaching employed by teachers of Mathematics at this level, the teaching should be enhanced with activities in order to demystify the misconception about the subject. In this regards, teaching Mathematics at the primary level should be done through various class and out of class activities that would allow pupils' active involvement. Through activities, pupils can learn Mathematics concepts by manipulating learning resources. This will make the concept real, concrete, interesting and meaningful. This is also supported by evidences like Marley, Levin and Glenberg (2010), Epstein (2007), Reshetova (2004) and Fuson (1992) who stated that teaching Mathematics at all levels should give opportunities for adequate interaction between the teacher and pupils on one hand and among the pupils themselves on the other. According to the authors, this should be through appropriate practical activities, building on fundamental skills of pupils, applying Mathematics to everyday situations and investigatory work.

Loeffler (2010) identified two types of activities as pupils' based activities and teacher demonstration activities. Both activities can be used to enhance other instructional strategies in a Mathematics classroom. The usage of any of the two types of activities depends on the class size and the availability of learning resources for the contents of instruction (Salami, 2014). Pupils' activity based is better used with relatively small class size where enough learning resources are available for pupils to explore during the class interactions. However, teacher demonstration activities based is better adopted in a class with large pupils where there are no adequate learning resources for all pupils (Rodriquez, 2010). In this case, the teacher demonstrates with the available learning materials for pupils to observe.

There are some psychological constructs that are germane to the team teaching and are capable of determining students' performance in any academic pursuit. These constructs are concepts used to describe various activities or pattern of activities that are believed to occur but that cannot be directly observed or measured. Examples of some of these constructs are emotional intelligence, attitude, self-concepts, anxiety, self-esteem, academic self-efficacy and learning styles. The psychological constructs built into this study were learning styles and self-efficacy.

Learning styles, a variable of interest in this study. Evidences abound in the literature on how students' academic achievement is influenced by their learning styles. Learning styles refer to diverse approaches to acquiring knowledge or understanding new information. Also, it is the way a person assimilates, understands, articulates and remembers information. Other terms used interchangeably with learning styles are styles of thinking, learning preferences, cognitive styles and learning modalities. Harold, Mark, Doug and Robert (2009) referred to learning styles as the concept that individuals differ in regard to what mode of instruction or study is most effective for them. Harold et al (2009) further stated that how a person would benefit from a content of instruction is determined by diagnosis of his/her learning preferences and this requires designing instructions in accordance to such preference.

In assessing learning style, people are requested to identify their preference for information presentation which may be words, pictures or speech and/or mental activity (analysing or listening) they find most engaging or congenial. Based on his, Wilfrid (2008) identified four major learning styles as visual, auditory, read/write, and kinesthetic. Pupils with visual learning styles learn through seeing. Things such as pictures, symbols, diagrams and flowcharts are pertinent to them in learning a new concept. Learning to a pupil with auditory style is through listening. Such pupil does not play with class attendance, tutorials, and discussions for better learning. An auditory pupil focuses on text book readings by reading them out loud, so he/she can hear how the words sound. Pupils with read/write style acquire knowledge through reading and writing. Kinesthetic pupils acquire knowledge through doing. According to Dipa (2015), learning styles are classified into visual, auditory, kinesthetic, interpersonal and intrapersonal styles.

Studies like that of Mazlini, Nizam, Lee, Che, Che, Marzita, Yeniqand Siti (2013), Alireza, Mahyuddin, Elias and Daud (2011) and Meryem and Buket (2002) had shown the relationship between learning styles and learning outcomes. Mazlini et al (2013) carried out a study to determine the relationship between learning style and Mathematics achievement among High Performance School (HPS) pupils using 362 form four pupils as sample. The study found that active and reflective learning style positively related to performance in Mathematics.

Self-efficacy, another variable of concern in the study, has been found to affect students' achievement. Self-efficacy has to do with the individual's belief in his/her ability to accomplish tasks and attain goals (Bandura, 2001). Ormrod (2006) defined self-efficacy as the belief that a person is capable of achieving task in a way that is specific to achieve certain objectives. Self-efficacy affects all areas of human activity. Self-efficacy is a construction that deals with the perception of people that he or she is willing to do whatever is required to achieve the objectives, in terms of knowing what to do as well as being emotionally capable of doing so. Self-efficacy as it relates to Mathematics implies pupils' self-belief in their capabilities to solve difficult Mathematics concepts. Such a belief is a strong indicator of accomplishment in one's life. According to Pajares in Oshin (2014), people with high self-efficacy believe that no task is too hard to accomplish. They create conducive atmosphere of accomplishing tough tasks. In contrast, people with low self-efficacy are parochial in solving a problem. They have a belief that problems are tougher than they really are; hence, they always feel stressed and frustrated when faced with a problem.

Studies on how self-efficacy relates to academic achievement had been conducted. Odedele (2000) submitted that self-efficacy positively correlated with performance. The study investigated test anxiety (that is, phobia for test) and self-efficacy as determinants of students' academic achievement among secondary school (SS II) students in Ibadan and discovered that self-efficacy and students' academic performance were significantly related. Jegede (2007) observed that the higher the self-efficacy of students, the greater their achievement.

Interest in Mathematics is a condition of being keen, desire and eagerness to know or learn Mathematics concepts of concern or curiosity. Krapp and Prenzel cited in Uysal (2012) stated that interest as a concept is a function of the relationship between the pupil and the instructional content. Kpolovie (2010a) submitted that interest in learning is a very important affective psychological trait. It is a very strong knowledge which involves emotional and overwhelming magnetic positive feelings. It is a sense of being eager, fascinated, thrilled, enthralled, zealous, rejuvenated and energised to cognitively process information much faster and more accurately in addition to most effective application of psychomotor traits like self-regulatory skills, self-discipline, working harder and smarter with optimum persistence (Kpolovie (2010a). Pupils' interest in Mathematics increases their performance in the subject. Pupils who like or find Mathematics interesting have tendency to achieve success in the subject (Deci and Ryan cited in Uysal, 2012). Interest is a key factor in determining the success of students' performance at various levels of education. Isangedighi cited in Kpolovie, Joe and Okoto (2014) discovered that interest in learning, study habits and academic achievement of high school students were strongly related. According to the study, the more the time a child is allowed to be involved in learning, the higher the degree of his/her learning. This helps the child in retaining the content thereby increasing the child's performance or outcomes during tests or examinations. The study also noted that for a pupil to spend a very long time in studying a content of instruction, such content must have captured his/her interest and attention.

It is not an unknown fact that the students' interest in Mathematics is low at various levels of education (Abubakar, 2011). This assertion is further explained that some of the reasons attributed to low interest in Mathematics are the nature of the subject, teachers' factor, teaching methods used in Mathematics class, lack of Mathematics laboratory and poor pupils' background among others. To be interested in science and Mathematics requires showing adequate zeal, desire and curiosity in the subject by active participation in all activities related to the subject. This implied doing science and Mathematics in all their reifications (Ivowi, 2001). Abubakar (2011) stated that pupils' interest in Mathematics could be aroused through teacher's interest in the subjects, use of appropriate instructional strategies, motivation, effective use of relevant learning resources, consideration for pupils' individual differences among others.

Moreover, dexterity is not an easy concept to define due its application in diverse aspects such as robotics, physiotherapy, hand surgery, physiology and education. According to Oxford Dictionary (2010), dexterity is defined as the skill in performing tasks, especially with the hands. The concept of dexterity involves the ability to carry out a comprehensive potential, harmonic action, to find an effective motor solution, and to properly solve motor problems in any situation (Kimmerle, Mainwaring and Borenstein, 2003). Although, these attempts had led to conceptual definitions of dexterity skill, the basic components or dimensions of the skill are not clear. In relation to Mathematics, the dexterity is the ability to perform psychomotor tasks such as hand-drawing, labeling and modeling.

In a typical Mathematics class, pupils with good dexterity will be able to use their hands in performing Mathematics skills such as drawing, labeling and modeling accurately than their counterparts with bad dexterity. Fine motor skills in Mathematics are the collective skills and activities that involve using the hands and fingers (Case-Smith and Shortridge, 2006; Amundson and Weil, 2001).

To ensure all round development of pupils through Mathematics education, it is essential for the teachers of Mathematics at the foundation level of education (primary) to adopt effective methods that employ sharing of expertise of professional and qualifies teachers (team teaching) coupled with the use of hand-on, mind-on, activity-based, learn-to-do-it-by-doing-it strategies. It was based on this premise that this study investigated effects of team teaching models and primary school pupils' learning outcomes in Mathematics in Oyo, Nigeria. The interaction effects of learning styles and self-efficacy were also examined in the study. In addition, study examined the perception of pupils, teachers and head teachers on issues related to team teaching.

1.2 Statement of the Problem

There is an erroneous belief that Mathematics is a subject designed for gifted and talented pupils. Other problems found to be associated with the subject are pupils' aversion, lack of or low interest, negative attitude and consistent low performance at all levels of Nigerian education system. These challenges had been attributed to the adoption of poor and ineffective teaching methods by Mathematics teachers at the primary school level. The methods used by most Mathematics teachers in teaching the subject make the subject boring, abstract, uninteresting and meaningless to the pupils. Mathematics is an important subject, such that its teaching calls for the use of strategies that will improve pupils' performance, stimulate their interest and develop their manipulative skills, leading to the achievement of objectives of learning Mathematics.

Besides, available literature revealed that studies on the effect of team teaching models on pupils' academic achievements were carried out on inclusive Special Needs Education (SNE) and regular education programmes at the secondary and tertiary levels of education. Much had not been done at the primary level of regular education using Mathematics as a subject. Almost all the researchers used one model of team teaching in their studies and focused mainly on the cognitive domain of learning. None of the studies reviewed examined the effect of more than one model of team teaching. Review of relevant literature showed that there seemed to be dearth of studies that examined affective and psychomotor domains of the pupils' learning outcomes. Also, empirical evidences have shown that some studies investigated stakeholders' perception on issues related to team teaching, but the stakeholders used in the studies were limited to team teachers and students. There seemed to be no known study that investigated the perception of stakeholders like head teachers on team teaching.

Consequently, this study was designed to investigate the effects of collaborative and alternative team teaching models on pupils' learning outcomes (achievement, interest and dexterity) in Mathematics. Furthermore, the study examined the moderation effect of learning styles and self-efficacy. Also, perception of pupils, Primary V Mathematics teachers and head teachers on issues related to team teaching, and challenges associated with team teaching and how the challenges can be overcome were examined.

1.3 Hypotheses

The study tested the following seven hypotheses at 0.05- level of significance

1. There is no significant main effect of treatment on primary school pupils'
   (a) achievement in Mathematics
   (b) interest in Mathematics
   (c) dexterity in drawing and labeling of Mathematics concepts
2. There is no significant main effect of learning styles on primary school pupils'
   (a) achievement in Mathematics
   (b) interest in Mathematics
   (c) dexterity in drawing and labeling of Mathematics concepts
3. There is no significant main effect of self-efficacy on primary school pupils'
   (a) achievement in Mathematics
   (b) interest in Mathematics
   (c) dexterity in drawing and labeling of Mathematics concepts
4. There is no significant interaction effect of treatment and learning styles on primary school pupils'
   (a) achievement in Mathematics
   (b) interest in Mathematics
   (c) dexterity in drawing and labeling of Mathematics concepts
5. There is no significant interaction effect of treatment and self-efficacy on primary school pupils'
   (a) achievement in Mathematics
   (b) interest in Mathematics

(c) dexterity in drawing and labeling of Mathematics concepts

6. There is no significant interaction effect of learning styles and self-efficacy on primary school pupils'
   (a) achievement in Mathematics
   (b) interest in Mathematics
   (c) dexterity in drawing and labeling of Mathematics concepts
7. There is no significant interaction effect of treatment, learning styles and self-efficacy on primary school pupils'
   (a) achievement in Mathematics
   (b) interest in Mathematics
   (c) dexterity in drawing and labeling of Mathematics concepts

1.4 Research Questions

1. What are stakeholders' (pupils, teachers, head teachers) perception of team teaching in terms of
   (a) its benefits to (i) pupils (ii) teachers;
   (b) its introduction at primary education level;
   (c) taking responsibilities for putting teachers in team;
   (d) factors to be considered before putting teachers in team;
   (e) preparation time/co-planning time;
   (f) time management in class; and
   (g) work relationship between the teachers.
2. What are other challenges associated with team teaching?
3. How can the challenges of team teaching be overcome?

1.5 Scope of the Study

This study was limited to primary five pupils in the public primary schools in Oyo, Nigeria. The variables of interest covered team teaching models. Two models of team teaching models were adopted in the study. These were collaborative team and alternative team teaching. The moderator variables of the study were learning styles and self-efficacy, while the dependent variables were learning outcomes in terms of achievement, interest and dexterity in Mathematics.

1.6 Significance of the Study

The study investigated team teaching models and primary pupils' learning outcomes in Mathematics. The results of this study revealed the effectiveness of the team teaching models in helping pupils acquire cognitive knowledge and develop positive interest required to their development. The study will help professional Mathematics teachers to collaborate in teaching pupils through active involvement of pupils in teaching and learning activities. Instead of a teacher teaching a class, the Mathematics professionals in a particular school can co-teach to improve pupils' performance. Also, the findings of the study will provide relevant information for curriculum planners in Mathematics education on the interplay between team teaching models, pupils' learning styles and self-efficacy and how these affect learning outcomes.

The study will contribute significantly towards curriculum planning, development, training and re-training of teachers of Mathematics for improved instructional effectiveness which could results in the development of all domains of learning in pupils (cognitive- pupils' academic achievement; affective – interest and psychomotor – dexterity). Through the findings of the study, stakeholders in Mathematics education could organise workshops, conferences and seminars in which effectiveness of models of team teaching in Mathematics would be discussed in enhancing the teaching and learning of the subject. Findings of the study will also sensitise government on the benefits of team teaching to the teaching and learning of Mathematics. Government can recommend the strategy in teaching Mathematics at primary level. Furthermore, the findings of the study will reveal the view of stakeholders (pupils, teachers, head teachers and Local Inspectors of Education) of primary education on the perception and adoption of team teaching at primary level of Nigeria education viz-a-viz the challenges associated with the methods. Suggestions on how to overcome the challenges will be of immense benefits to the stakeholders.

1.7 Definition of Terms:

1.7.1 Conceptual Definition of Terms

Collaborative Team Teaching: This is a model of team teaching in which two teachers work together in designing Mathematics contents and teach the content not by the usual monologue, rather by exchanging the teaching of the content of the subject in the presence of the pupils.

Alternative Team Teaching: A team teaching model in which one teacher presents content of instruction to the pupils, while the other teacher re-teaches the same content focusing on the areas that need more clarification and explanation based on the observation and class assessment.

Stakeholders: These are pupils, teachers and head teachers.

1.7.2 Operational Definition of Terms

Learning Outcomes: These are achievements in Mathematics, interest in Mathematics and dexterity in drawing and labeling some Mathematics concepts as reflected in the scores obtained from AMT, IMS and DMT.

Achievement in Mathematics: This is the outcome of teaching and learning activities in Mathematics class as measured by the scores obtained by the pupils in AMT.

Interest in Mathematics: This is a condition of pupils' concern and curiosity to know or learn Mathematics concepts as measured by pupils' scores in IMS.

Dexterity in Mathematics: This is the pupils' skill in tasks like drawing and labeling of Mathematics concepts as obtained in the pupils' scores in DMT.

Learning Styles: These are three ways (visual, auditory and kinesthetic) in which pupils take in, understand, express and remember information as measured in three levels (visual, auditory and kinesthetic) as reflected in scores obtained in pupils' learning style scale (PLSS).

Mathematics Self-efficacy: This is pupils' self-belief in their ability to overcome difficulties or obstacles to solving Mathematics problems as measured at three levels which are low (1 – 20), moderate (21 – 40) and high (41 – 60) as obtained in pupils' scores in MSS.

1.8 Acronyms

CTT: Collaborative Team Teaching

ATT: Alternative Team Teaching

PS: Pupils' Self-efficacy

PLS: Pupils' Learning Styles

AM: Achievement in Mathematics

IM: Interest in Mathematics

DM: Dexterity in Mathematics

AMT: Achievement in Mathematics Test

IMS: Interest in Mathematics Scale

DMT: Dexterity in Mathematics Test

PLSS: Pupils' Learning Styles Scale

MSS: Mathematics Self-efficacy Scale

CTTP: Collaborative Team Teaching Package

ATTP: Alternative Team Teaching Package

CTP: Conventional Teaching Package

FGDG: Focus Group Discussion Guide

IG: Interview Guide

FGD: Focus Group Discussion

TEA: Texas Education Agency

NALABE: National Assessment of Learning Achievement in Basic Education

UBEC: Universal Basic Education Commission

ANCOVA: Analysis of Covariance

ICEE: International Centre for Educational Evaluation

CVI: Content Validity Ratio

LGA: Local Government Areas

FCT: Federal Capital Territory

IEP: Individualised Education Programme

SSII: Senior Secondary School II

MBTI: Myers Briggs Type Indicators

HPS: High Performance Schools

LSS: Learning Styles Survey

LSI: Learning Styles Inventory

BLSI: Barsch Learning Styles Inventory

VARK: Visual Aural Read/Write Kinesthetic

QAT: Qualitative Ability Scale

MAT: Mathematics Achievement Test

UAE: United Arab Emirates

MAS: Mathematics Attitude Scale

MAQ: Mathematics Anxiety Scale

NCF: National Curriculum Framework

ACI: Analytical Chemistry I

DMCTE: Debre Markos College of Teacher Education

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical Background

The theory of learning is a collection of research aimed at describing, explaining and predicting learning (Smith and Ragan, 1993). Learning theories are an organised set of principles that explain how individuals acquire, retain, and recover knowledge. They help to understand how learning takes place. They serve as principles that can serve as guidelines for the selection of teaching tools, techniques and strategies for learning. There are many learning theories. Most theories are classified as the theory of constructivism (Krause, Bochner and Duchesne, 2003; Vygotsky, 1978); the Theory of Multiple Intelligence (Turkichm, Greive and Cozens, 2014); Experiential Learning Theory; Humanism/emotional Learning Theory; Theory of Cooperative Learning; Theory Behavior and Activity Theory. The theories of teamwork are numerous. Some these theories are Bruce Tuckman's Model of Team Stages (Tuckman, 1965); Belbin's Theory of Team Roles (Belsan, 2014); Myers-Briggs Type Indicator (MBTI) Theory; Social Identity Theory; Strength Theory; Team Analysis Theory.

2.1.1 Theories used in the study

This study is based on two theories which are Tuckman's team theory and Activity learning theory

2.1.1.1 Tuckman's Team Theory

Bruce Tuckman (1965), a psychology professor, identified five stages in team process. The first four stages are called the initial stages which every team experiences during the development. These are forming, storming, norming and performing. The last stage is called adjourning stage which Tuckman came up with through further research in 1977. Tuckman described the initial stage as somewhat fruitless until the team becomes a self-sufficient unit. Working together as a team with time enhances growth and development. The stages of team development are represented in the Figure 2.1

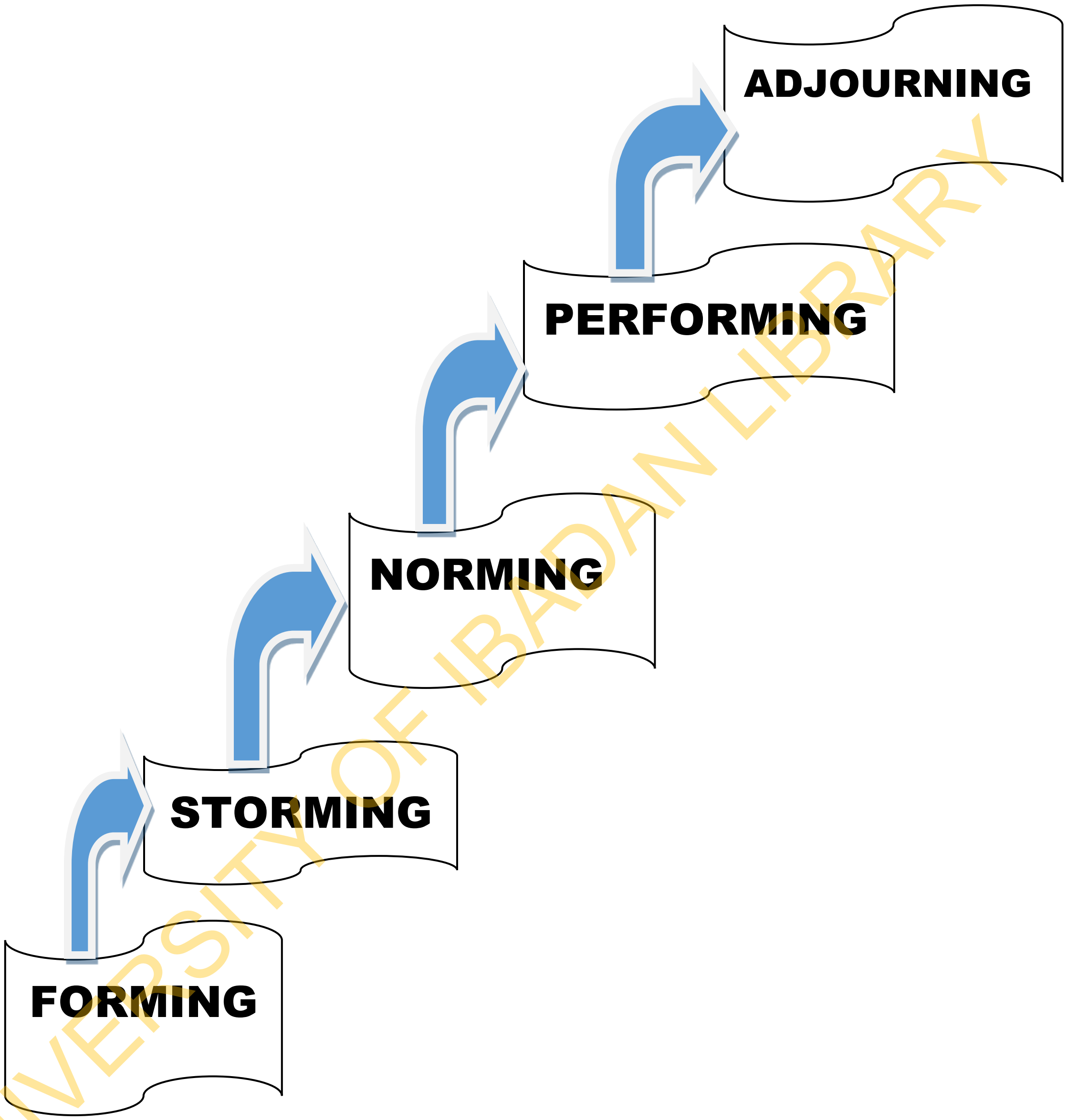

Fig. 2.1: Stages of Team Development

Source: Tuckman, 1977

Forming:

Forming stage is the initial stage of team development during which individuals have not yet settled together. Everybody is busy finding their place in the team, sizing each other up, and asking themselves why they are here.

Storming:

At this stage, individuals begin to see themselves as part of a team. However, they may challenge each other including the team leader, about such things as what the team is doing, and how things should be done. As the stage title suggests, conflict and confrontation typify this stage, as differences surface. This may result in some loss of performance or focus on the task if care is not taken.

Norming:

This is the phase where team members start to come together, developing processes, establishing ground rules, clarifying who does what, and how things will be done. This phase is characterized by a growing sense of togetherness.

Performing:

This is the stage where there is an increased focus on both the task, and on team relationships, combines to provide synergy. Performance is delivered through people working effectively together.

Adjourning:

The adjourning stage which is the final stage involves the disengagement of relationships between team members and a short period of recognition for the team's achievements.

The value of Tuckman's model is that it helps us to understand that teams evolve. It also helps us to consider how they may encounter different problems at different stages of their development. One limitation of the model may be that it makes team building appear too linear and sequential. Although, it is a useful analytical tool, we must remember that some teams may loop around in their development. For example, not all teams evolve smoothly through Tuckman's stages but may go through the norming and storming until they either begin to function, or are disbanded! Regardless of limitations, all well-conceived models can be useful in helping us to understand and better manage our circumstances.

Tuckman asserted that any team that stays together over a period of time will change and develop. Tuckman noted that there are three issues which determine how well teams perform:

- content
- process
- feelings

Content relates to what the team does, process relates to how the team works towards its objectives and feelings applies to how team members relate to one another. Tuckman and Jensen (1977) research suggests that most teams concentrate almost exclusively on content, to the detriment of process and feelings, which explains why teams which are strong on paper can under-perform.

Tuckman's four stages of team development model were first developed in 1965, Tuckman's model is widely known as a basis for effective team building. Tuckman's model recognises the fact that groups do not start off fully-formed and functioning. He suggests that teams grow through clearly defined stages, from their creation as groups of individuals, to cohesive, task-focused teams. Tuckman describes working with a team of social psychologists, on behalf of the U.S. navy. The team studied small group behaviour, from several perspectives. In doing so, Tuckman reviewed 50 articles on group development and noticed that there were two features common to these small groups: the interpersonal or group structure, and the task activity. From this, Tuckman identified that groups evolved into teams via four common stages.

This is an orientation, testing phase which is often led to a period characterized by a degree of conflict. This then generally resolved itself, leading to a more socially cohesive phase. Finally, groups settled to a functional phase, during which they focused on role-relatedness. To summarise these four phases, Tuckman coined the oft-quoted terms: forming, storming, norming and performing. These changes are summarised in the following Table 2.1

Table 2.1: Tuckman's Stages of Team Development and the issues associated with them

	Forming	**Storming**	**Norming**	**Performing**
General Observations	Members are unsure of their roles, they look up for direction	Confidence in team is increased, jettison of guidance from outside	Members are eager to be part of team.	Keen in getting the task accompli shed.
Content issues	Members try task definition.	Team members repel the task demands.	Members exchange idea on the problems confronting the team	Resources are effectively and judiciously allotted to engender attainment of goal of the team..
Process issues	Team members look forward for guidance and direction.	members present excuses for not accomplish a task	Member initiate setting up the processes to accomplish the task	The team employ processed and procedures to achieve task
Feeling issues	Feeling of anxiety and unclear roles by members They expect the leader to provide direction.	People still feel ambiguity and show their differences. Concerns about the hierarchy of the team is evident.	Readily acceptance of team member; individual differences are ignored	Sharing of common vision, effective communication. The team become more effective, proficient and flexible.

Implications of Tuckman's Four Stages of Team Development

Tuckman highlighted a number of important observations from his research on teams and teamwork which still have resonance today:

- A team will not be fully effective unless it reaches the stage of performing/interdependence.
- Many teams accept storming as a normal way of operating, while a number of teams may never get beyond forming.
- Unless the process of norming is fully completed, teams may degenerate into storming.
- The amount of time taken to complete the cycle will vary tremendously between teams.

Many factors determine how quickly a team will evolve towards effectiveness including: its size, geographical spread, frequency and duration of meetings, synergy of team types, stability of team membership, external influences and time pressures and the nature of its activities. The leader's role is also important.

Based on this theory, Mathematics teachers in the team should not display uncertainty about the tasks or goals of the team. They should have confidence in the ability of the team to succeed, ready to contribute their quota to the success of the team and have great concern about getting the goals of the team achievement. They must work hard to move from forming, storming, norming stages to the performing stage in order to achieve their goals. Therefore,

1. Mathematics team teachers must be fully effective until they reach the stage of performing
2. They must not accept storming stage as normal way of operating
3. They must work to get to performing stage in no time

Abudi (2010) suggested that in forming the teams of Mathematics teachers, factors like the size, geographical spread, frequency and duration of meetings, synergy of team types, stability of team membership, external influences and time pressures and the nature of its activities should be critically considered.

2.1.1.2 Activity Learning Theory

Activity learning theory helps to understand how people learn in social contexts (learn from each other) and informs us on how we, as teachers, construct active learning communities. Lev Vygotsky (1962), a Russian teacher and psychologist, first stated that we learn through our interactions and communications with others. Vygotsky (1962) examined how our social environments influence the learning process. He suggested that learning takes place through the interactions students have with their peers, teachers, and other experts. Consequently, teachers can create a learning environment that maximises the learner's ability to interact with each other through discussion, collaboration, and feedback. Moreover, Vygotsky (1962) argues that culture is the primary determining factor for knowledge construction. We learn through this cultural lens by interacting with others and following the rules, skills, and abilities shaped by our culture

Activity Theory emanated from Vygotsky’s earlier concept of mediation, which encompassed learning alongside others (Zone of Proximal Development) and through interaction with artifacts, was the basis for Engeström’s version of Activity Theory (known as Scandinavian Activity Theory). Engeström’s approach was to explain human thoughts processes not simply on the basis of the individual, but in the wider context of the individual’s interactions within the social world through artifacts, and specifically in situations where activities were being produced.

In Activity Theory, Engeström, Mietinnen and Punamäki (1999) explained that people (actors) use external tools (e.g. hammer, computer, car) and internal tools (e.g. plans, cognitive maps) to achieve their goals. In the social world, there are many artifacts, which are seen not only as objects, but also as things that are embedded within culture, with the result that every object has cultural and/or social significance. Tools (which can limit or enable) can also be brought to bear on the mediation of social interaction, and they influence both the behavior of the actors (those who use the tools) and also the social structure within which the actors exist (the environment, tools, artifacts).

Activity theory is probably most commonly used in educational investigations as a conceptual lens through which data are interpreted. The well-known triangular model of an activity system according to Engeström (2015) is frequently applied as a graphic model and lens for such interpretive data analyses. In such analyses, the model of an activity system makes visible the context of the educational processes under investigation. Context is represented as a systemic formation within which specific components and their relations can be identified and examined in detail. Extending the unit of analysis beyond a single activity system to encompass multiple interconnected activities – i.e., third generation Activity Theory – will become a challenge as educational processes become increasingly distributed and networked.

The goal of activity theory is to understanding the mental capabilities of a single individual. However, it rejects the isolated individuals as insufficient unit of analysis, analyzing the cultural and technical aspects of human actions (*Bertelsen and Bødker, 2003)*. Activity theory is most often used to describe actions in a socio-technical system through six related elements (Engeström, 1987) of a conceptual system expanded by more nuanced theories:

- Object-orientedness – the objective of the activity system. Object refers to the objectiveness of the reality; items are considered objective according to natural sciences but also have social and cultural properties.
- Subject or internalization – actors engaged in the activities; the traditional notion of mental processes
- Community or externalisation – social context; all actors involved in the activity system
- Tools or tool mediation – the artifacts (or concepts) used by actors in the system. Tools influence actor-structure interactions, they change with accumulating experience. In addition to physical shape, the knowledge also evolves. Tools are influenced by culture, and their use is a way for the accumulation and transmission of social knowledge. Tools influence both the agents and the structure.

- Division of labour – social strata, hierarchical structure of activity, the division of activities among actors in the system
- Rules – conventions, guidelines and rules regulating activities in the system

Activity theory helps to explain how social artifacts and social organization mediate social action (Bryant, Andrea, and Amy, 2005). Table 2.2 depicts activity as hierarchically organized system, showing the relationship among the three levels.

Table 2.2 Three Levels Depicting Activity as Hierarchically Organised System

Levels of Activity	Mental Representation	Realizes	Level of Description	Analytical Question
Activity	Motive (need) not necessarily conscious, but may become conscious.	Personality	The social and personal meaning of activity; its relation to motives and needs	Why?
Action	Goal conscious	Activities (systems of actions organized to achieve goals)	Possible goals, critical goals, particularly relevant sub-goals	What?
Operation	Condition of actions (structure of activity) normally not conscious; only limited possibilities of consciousness.	Actions (chains of operations organized by goals and concrete conditions)	The concrete way of executing an action in accordance with the specific conditions surrounding the goal.	How?

Figure 2.2 indicated that the three levels of activity are not fixed as an action can become an operation through automation/ internalisation, and an operation can become an action through conceptualisation in breakdown situations (Bødker, 1991). A separately motivated activity in one context can be an operation in another. The focus of activity theory is on how human acts are transfer between the different levels of activity which is an important feature that distinguishes this framework from the mainstream of cognitive theories. Activity theory is further illustrated in Figure 2.2

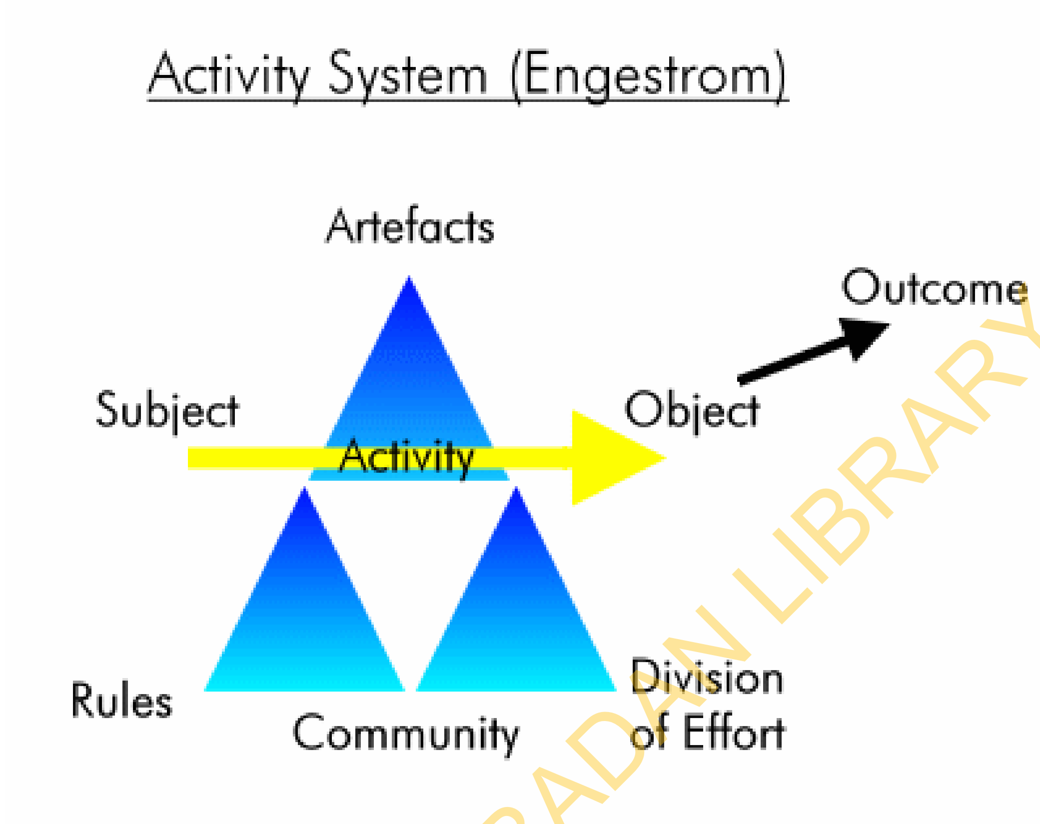

Figure 2.2: Activity System Chart

Source: Learning Theories.com: Knowledge base and Webliography

Engestrom's model of activity theory above is useful for understanding how a wide range factors work together to impact an activity. In order to reach an *outcome*, it is necessary to produce certain *objects* (e.g. experiences, knowledge, and physical products) Human activity is mediated by artefacts (e.g. tools used, documents, recipes, etc.) Activity is also mediated by an organisation or community. Also, the community may impose rules that affect activity. The subject works as part of the community to achieve the object. An activity normally also features a division of labour.

There are three levels of activity in activity theory

1. Activity towards an objective (goal) carried out by a community. This level answers why an activity should be carried. That is a motive that produces social and personal meaning of activity.
2. Action towards a specific goal (conscious). This level answers what activity to be done by an individual or a group to perform jobs and attain goals or sub-goals.
3. The third level of activity theory answers how an activity is to be done to attain a task. This has to do with the operation structure of automated activity to carried out an action in accordance with the specific conditions surrounding the goal.

According to Engestrom, activity theory has four major principles which are principles of object-orientedness, principle of internalization/externalization, principle of mediation and principle of development.

In this study, subject (actors) were team teachers and pupils. Community was the classroom setting, tools were instructional mathematics, note books, textbooks, blackboards, pencil, eraser e.t.c. Object in this study were the behaviour objectives of lesson, that is, what the pupils were expected to achieved at the end of the teaching and learning process. In this case, increase achievement, interest and dexterity in Mathematics. Division of effort was the division of roles, within-class and out-of-class activities between the team teachers; between the team teachers and pupils and among pupils while rules were guidelines and rules regulating activities in the system.

Also, application of activity theory in this study emphasised that Mathematics teachers should be aware that everything in the classroom has a cultural and social meaning. The way pupils interact with each other and with the teachers is mediated (influenced) by objects such as the whiteboard, furniture, technology, and even the shape, size and configuration of the room. Learning occurs within these contexts, and usually through specific activities.

Mathematics teachers should ensure that those activities are relevant and iterative, providing students with incremental challenges that they can engage with at a social level, so that the entire community of learners extends its collective knowledge through the construction of meaning. Mathematics teachers should also be aware that tools can limit as well as enable social interaction, so must be applied wisely and appropriately to promote the most effective learning.

In line with the activity theory model, the study considers team teaching with activities strategy as a process of blending the materials, learners, classroom interaction together including rules and principles guiding the activity and the interaction among the learners and the teachers with the aim of achieving the pre-specified behavioural objectives. Pupils' understanding of Mathematical concepts is attainable where materials are adequately available for pupils to work on under the auspices of the teaching during class interaction. The success or otherwise of pupils in Mathematics is measured by the attainment of the performance, interest in and dexterity of pupils in Mathematics.

2.2 Conceptual Review

2.2.1 Concept of Team Teaching

Different scholars have various views about team teaching. To Quinn and Kanter (1984), team teaching is viewed as teaching between or among more than professional teachers who co-teach a subject content to a class of students. These teachers are addressed as instructors while their students are referred to as audience. According to Cohen and Hoffman (2014) and Christina (2012), The team teaching approach is a participatory method in which more than two professional meet to share experiences, responsibilities to provide a greater opportunity for students. They also provide social interaction for instruction, greater opportunity to differentiate pupils' needs as well as increasing pupils' achievements. Peeler (2010) viewed team teaching as a service delivery option of two or more teachers with equal status sharing a classroom with both teachers actively engaged in purposeful instruction in the general education classroom which provides opportunities for differentiated instruction. Team teaching is an instructional strategy in which a group of teachers co-plan, co-conduct, co-teach and co-evaluate the teaching and learning activities of a set of students. To Friend (2008), team teaching is a method that allows more than one certified professional to share responsibility for course planning, instruction delivery, and progress monitoring for all students assigned to their class. As a team, these professionals share the same physical classroom, make collaborative instructional decisions, and take responsibility for students' learning.

In a typical team teaching class, team teachers' names are on the board and report cards. Both teachers in the team teaching setting have space for personal belongings and have similar furniture. Any of the teachers can take a lead role in the classroom interaction. Both teachers talk during instruction and give direction to students without any objection from the other teacher. Team teachers work with all students and they are considered as equal teachers by all of the students (Peeler, 2010). Also, specially designed instruction, strategies being implemented and the level of students' engagement are evident in a team teaching instructional setting.

Team teachers believe that each of them has a unique experience, peculiar expertise and views needed to enhance learners' or students' learning. Thus, they give chance for learners to learn from more than one teacher who may possess varied thinking abilities or instructional styles. The team work hand in hand to attain common, pre-determined instructional objectives. In a team teaching classroom, team teachers assume different roles as they navigate among different team teaching models to meet specific learning objectives and student needs efficiently. However, team teaching is misinterpreted and carried out by some as teaching different courses in which one teacher teaches while the second marks students' notes, stands, and observing without any input. That is only a teacher decision is employed in determining the content of instruction and methods to be used in teaching students (Villa, Thousand, and Nevin, 2004).

In addition, Kohler-Evans (2006) viewed team teaching as a professional marriage. It is a strong personal partnership, of building a strong and parity-based relationship. It is a model that involves two or more adults in a classroom. It is reasonable solution to the challenge of allowing a single professional keeping up with all the knowledge and skills required for instructional needs of the diverse student population with complexity of problems attending public schools. The objective of team is to make accessibility of the general curriculum possible for disabled students and exposing them to merits of learning from specialized instructional strategies (Friend and Cook, 2010).

Friend (2008) and Hughes and Murawski, (2001) also emphasised that team teaching was initially centred on the partnering of a general education teacher and a special education teacher or another specialist for the purpose of jointly delivering instruction to a diverse group of students, including those with disabilities or other special needs, in a general education setting in a way that flexibly and deliberately meets their learning needs. In this method, the general education teacher as well as the special educator has the joint responsibility to co-plan, co-deliver and co-evaluate students' performance as the lesson progresses (Cook and Friend, 2010). It is also adopted as an alternative approach to teaching (Bacharach, Heck and Dahlberg, 2008). With increase in enrolment rate of disabled students into the general education classroom, teachers and researchers are continually making efforts to improve overall academic performance of student irrespective the problem that are confronting them with these students. Classroom teachers have adopted inclusive models of instruction in the process of overcoming these challenges. These models involve collaborative structures like team teaching (Tobin, 2005). Through this approach, a general educator and special educator with different skills and expertise effectively teach students with various academic abilities and different affective behaviour. Both teachers provide instruction, discipline, and support for all students. In addition, downgrading, humiliation and rejection that students with special needs may face in a conventional classroom setting is catered for.

In recent time, team teaching is being implemented in regular education programme (Pardini, 2006). Today, team teaching is being adopted in across schools in the United States to cater for the varied categories of learners' needs. According to Basso and McCoy (2007), team teaching model aggregate the knowledge and skills of more than one teacher to that learners gain maximally in immeasurable ways. It is obvious there is an increase adoption of collaboration as a standard of practice as it is evolving in other disciplines. Through collaboration, innovate options that are more responsive to the variety of students are created by professionals within a single system of education (Rosen, 2007; Sawyer, 2007).

2.2.2 Models of Team teaching

Team teaching has different models with various forms and settings. Each of the models may be used independently or combined (Cook and Friend, 2010). Cook and Friend (2004) identify that team teaching exist in six models which are:

1. One teaches/ one observes
2. One teaches/one drifts
3. Parallel teaching
4. Station teaching
5. Alternative teaching and
6. Team teaching.

Also, Maroney (1995) and Robinson and Schaible (1995) identified these models of team teaching as

1. Traditional team teaching
2. Parallel team teaching
3. Collaborative teaching
4. Differentiated split class
5. Complimentary/supportive team teaching and
6. Monitoring teacher.

2.2.2.1 Traditional Team Teaching (One teaches/One Observes)

In this model, one teacher teaches the students, while the other teacher observes students and collects data that are related to the students. It is also called one teach - one observe model. This model of team teaching ensures teachers observe how students are engaged during the classroom activities in the process of meeting students' individual needs through their various expertise. However, there is need for pre-determined ways of type of data to be collected during classroom activities, methods to be employed in collecting the data and how such data will be analysed to engender subsequent teaching (Friend, 2008; Friend, 2007; Cook and Friend, 2004; Maroney,1995; Robinson and Schaible, 1995).

Some other advantages of this approach as cited by Friend and Cook (2010) are:

1. Students receive individual help in a timely manner
2. Students are easily put on tasks.
3. It enhances time management in that it saves time
4. The supporting teacher can easily see behavior that may be hidden with sole teaching
5. It gives opportunity to observe students and the teacher that is teaching.

Some demerits of this approach are:

1. Students may tag one teacher as a real teacher and the other as an aid due to the roles they play.
2. Some students may be easily distracted while a teacher walks around the class during the lesson.

2.2.2.2 Complimentary/Supportive Team Teaching

This model is similar to the one teaches - one observes model by Cook and Friend (2004) but the other teacher is involved more in the teaching and learning process. While one teacher is teaching, the other moves throughout the classroom to provide one to one instructional assistance to students, ensures that students understand the content being taught, and make sure that pre-determined instructional objectives are attained (Cook and Friend, 2004). It is also known as one teaches /one assists model or one teaches / one drifts model. In implementing this model, both teachers take an active role and swop roles where possible to ensure parity.

2.2.2.3 Parallel Team Teaching

In parallel team teaching, the teachers divide the class into 2 equal groups. Both teachers teach the same topic at the same time using the same amount of time within the same classroom setting (Cook and Friend, 2004). It reduces the pupil-teacher ratio and allows mind – on and hands-on practical of learning, it enhances peer interaction as well as students' verbal responses. In implementing this model, students may be randomly assigned into groups or may be grouped according to their intellectual abilities, skills, behavior and attitude (Karten, 2005). In addition, both teachers must co-plan and co-work on the content of instruction together to ensure equality of quality of instruction received by both groups. In implementing this model, relatively equal content mastery and pace should be maintained by both teachers and noise making in class should be reduced to barest minimum (Cook and Friend, 2010).

Some advantages of this approach are:

1. Planning before teaching enhances instructional delivery.

2. Working with small number of students is an added advantage.

3. Allowing each teacher teaching the same content individually gives a measure of comfort.

To implement this model,

1. Teachers' competence in the instructional content is required to equal benefits to the learners.

2. Equal amount of time should be allotted to each group. Time should not be an added advantage to a group at the expense of the other group. Teachers should move at the pace.

3. The classroom should be spacious enough for the groups

4. Teacher should control their voices

2.2.2.4 Station Team Teaching

In station team teaching, the content of instruction is divided into three or more groups called stations and students move within these stations (Cook and Friend, 2010). In this model, the teachers may have three groups or stations by dividing the content of instructions into two sections and allow students to take the two sections sequentially, while the third sections or station is usually used learners' independent or peer work (Maroney, 1995; Robinson and Schaible,1995). The learners may be randomly put in groups or they may be grouped based on their intellectual abilities, skills, behaviors, and attitude. In using this model, both teachers co-plan and co-deliver instruction. The model decreases pupil- teacher ratio and caters for various needs of the students. Station teaching can be helpful for students in all levels of education and students see both teachers as equal because they both teachers play active role in classroom teaching. Some advantages of this approach are:

1. Each teacher is assigned a distinct role.
2. Learning in small groups benefit students.
3. More contents are covered within a short time.
4. Students are engaged in active, hands-on learning, there will be no room for negative behaviour.
5. It is easier to put students who influence each other or one another negatively in a separate groups or stations.
6. This approach maximizes the use of volunteers or extra adults in the room.

For effective implementation of this model,

1. It requires adequate planning before instruction.
2. Advance preparation and organization of learning materials before lesson.
3. Teaching must commence and conclude at the same time.
4. Independent work must be given to one or more stations

2.2.2.5 Alternative Teaching (Differentiated Split Class Model)

In alternative team teaching model, the class is divided into two groups, one group may be large, while the other group is small (Cook and Friend, 2010). This method provides feedback and remediation, review of content taught, assessment of skills, extra practice, re-teaching, reduced size, and extra activities. Alternative method may be helpful for teaching learners with learning disabilities.

Some advantages of this approach are:

1. Individual needs of students are met.
2. Both teachers can stay in the class to observe the teaching of other teacher

For effective implementation of the model,

1. Students wrong perception as the teacher working with the larger group as a better teacher than the other teachers. This can be overcome by exchanging roles by the teachers. For instance, a teacher who works with a larger group for today's lesson will be assigned to the smaller group in the subsequent lessons and vice versa.
2. Control of noise.
3. Spacious classroom is required.

2.2.2.6 Collaborative Team Teaching

In collaborative team teaching, both teachers co-plan and co-deliver instruction in the classroom (Cook and Friend, 2010). They also deliver the same instruction at the same time within the same classroom setting. Collaborative team teaching is called having "one brain two bodies" by Cook and Friend (2004). Many people view this model as the most satisfying way of co-teaching although it requires mutual understanding, commitment, trust and collaboration.

Some advantages of this approach are:

1. Each teacher plays active role.
2. Students perceive both teachers as the same.
3. Both teachers participate in the organization and management of classroom.
4. This models encourages innovation and creativity.
5. "Two heads are better than one."

Some disadvantages of this approach are:

1. It takes more time for planning before and after instructional activities.
2. There is need to defined teachers' specific roles to achieve success.

2.2.3 Issues in Team Teaching

Team teaching is a complex activity that involves different issues (TEA, n.d; Friend et al, 2010; Mastropieri et al 2005). Some of the issues involved in team teaching are identified as follows:

2.2.3.1 Building Partnership

Implementing team teaching in school settings requires partners to build partnership. Building a team teaching partnership takes time as with any human relationship. The team teachers build trust and create a conducive atmosphere or structure in which both teachers can work smoothly as teachers work together. Gately and Frank (2001) identified three stages of the experiences of team teachers as they develop their relationship as

(i) Beginning Stage: During beginning stage, teachers' interactions and communication with each other on instructional matters is somehow restricted. One of the teachers may be playing a leadrole and viewed as the lead teacher (the leader), while the other teacher is seen as helper (playing the supportive role). At this stage, teachers pass through a challenge of finding time for pre-instructional planning.

(ii) Compromise Stage: At this stage, teachers communicate with each other in an unrestricted manner, they feel less stricted, open and relate freely with each other. They share ideas, views, opinions and experiences about the content of instruction in a confident way. They interact in a give and take way when planning and lesson delivery. They develop rules, implement instructional plans in class as well as engage different assessment methods to evaluate students' learning.

(iii) Collaborative Stage. At this stage, team teachers employ body language in communication, use body signals to interact in the classroom. Students observe and view both teachers as the same as they present, coordinate, instruct, and structure classroom activities during interaction. They also involve equally in implementing rules, regulations and daily routines in class; they also employ different methods of evaluation to assess students' learning.

In a nutshell, at the initial level of partnership, when a partner interrupts the content of the instruction, the other may be offended. As the partnership moves to the greater level (that is collaborative level), a teacher may view the input of the other teacher as additional way of enhancing lesson delivery.

In order to build a strong team relationship, the following steps should be considered

(i) Both teachers should share their views on students' achievement and collaboration.

(ii) Communication about each teacher's preferences as teachers have different ways of passing instruction, dispositions, aspirations, expectations, and capabilities to embrace change. This can be done by providing inventories to rate or describe various aspects of teaching and to recognise any matter considered to be pertinent to the teaching. They complete the inventory individually and jointly discuss their responses. They jointly decide how best to handle any aspect of difference. Using inventories resolved issues before they arise.

(iii) Both teachers must maintain open communication and build trust.

(iv) The team teachers should have a shared belief about team teaching

(v) Both teacher should Find time for planning and using it effectively

(vi) They should take decision on meeting students' specific needs during lesson.

(vii) They should determine how to resolve conflicts during teaching.

(viii) They should establish classroom routines and behavior management;

(ix) They should share teaching styles and preferences

(x) They should determine procedures for assessment of students learning

(xi) They should have the understanding that they are a team and walk in that consciousness. They should be viewed as equal partners in the classroom

(xii) They should introduce to the students as a team

2.2.3.2 Planning Time: Planning for Instruction is a key factor in team teaching as pre-planning for lesson is an important subset of instruction. During instructional planning, teachers determine and reflect on instructional objectives as well as how to achieve the objectives. Pre-instructional planning is essential in discussing teachers' roles and contributions towards the success of lesson delivery (TEA, n.d). Pre-instruction planning by both teachers is a continuous activity which should be carried out in a specified designated place at agreed upon time. Brandenburg (1997) asserted that variables needed for the success of every student should be identified, implemented and analysed on a regular basis. Goetz (2000) suggested that team teachers should meet daily or weekly to take some relevant decisions on – content of instruction, order of presentation, who to teach what, and method of assessment to be adopted during the lesson. Through team teaching planning process, team's ability to orchestrate each lesson by tapping into each teacher's area of expertise and having thoughtful conversations about student needs (i.e., grouping, modifications, grading considerations) are carried out. It also allows teachers to reflect on the effectiveness of co-teaching, celebrate successes, and address any questions or concerns. Planning should include components like goals or objectives of the lesson; lesson activities; assessment techniques to be used for evaluating students' learning outcomes, instructional materials/supports needed (Dieker, 2006).

2.2.3.3 Compatibility of Team Teachers

The success or otherwise of the team teaching is dependent on the compatibility of the team teachers. When team teachers get along well, there bounds to be students' success in learning outcomes. Conversely, when there are rivalry, ranchor and conflicts between the team teachers, learning experiences become challenging to the students in the team taught class ((Mastropieri et al., 1998). Teachers must have compatible perception of effective teaching to achieve success in team teaching. Conflicting beliefs about how to plan for co-teaching, how to manage behaviours, and how to interact with students can seriously inhibit positive relations and these should be handled with caution.

2.2.3.4 Monitoring Students' Progress

Team teaching gives opportunity to the teachers to share responsibility of teaching activities. Collecting information on students' progress on the three domain of learning and its documentation should be shared by the team teachers. This could be done with the use of appropriate instruments like checklists, rating scale, test e.t.c. depending on the skill being measured. Grading of students' scores should be carried out according to the standards.

2.2.4 The Place of Mathematics in the Society

Mathematics is an aspect of science which deals with numerals/figures and their operations which involve calculating, computing and problems solving etc. It is also the science of figures or numeral and space. Mathematics is the science of measurement, magnitude, capacity and quantity. Through its concealed structures, arrays and configuration, we have full understanding of the world around us. with inference, deduction, and proof; and with mathematical models of natural phenomena, human behavior, and social systems, Mathematics is applied to diverse disciplines that deal with data, measurements and observations from science. It is the study of quantity, structure, space and change. Its development has spanned through the application of abstraction, generation and logical reasoning, from counting, calculation, measurement, and the study of the shapes and motions of physical objects (Roohi, 2015).

Anice (2016) stated that the knowledge of counting, addition, subtraction, multiplication, and division is a necessity at the basic level. Through Mathematics, analytic mind is developed which is useful in better organisation of ideas and accurate expression of thoughts. Generally, its applicability in science and technology is evident in the day-to-day activities of life. The role of Mathematics has been viewed as subject that is inseparable from the world and natural phenomena, with this regards, Galileo in Anice (2009) defined Mathematics as a language in which God had written the world.

According to (NCF, 2005), the need to understand and be able to use Mathematics in everyday life and in the workplace will continue to increase for the following reasons

1. Mathematics is useful for Living: Knowing Mathematics can be personally satisfying and empowering. The issues of everyday life are mathematically and technologically inclined

2. Cultural Heritage: Mathematics is one of the greatest cultural and Intellectual achievements of man.

3. Workplace: The level of mathematical thinking and problem solving required in the workplace is increasing. This affects different professional areas such Medicine, Pharmacy, healthcare, graphic design e.t.c.

4. Scientific and Technical Community. All professions require a basic knowledge of Mathematics; some are more mathematically driven. Some of the students that plan to work as mathematicians, statisticians, engineers, and scientists cannot do without in-depth knowledge of Mathematics Mathematical competence opens doors to productive futures because the knowledge of Mathematics engendered opportunities and options for futures.

In addition, development, intellectual development, vocational development, moral development, spiritual development and cultural development require the knowledge of Mathematics. With a robust education system, economic development, science and technology, medical science, agricultural field and cultural and morality, the knowledge of Mathematics is inevitable (Roohi, 2015).

In addition, Musa (2010) stressed the applicability of Mathematics in many fields: business and insurance (payments, interest, value calculation); national budget planning; census; equitable distribution of amenities; medical field (weight, height, temperature); agriculture (porosity of soil, quantity of fertilizer, volume, weight). The role of Mathematics in career choice and in understanding the changing world through logical reasoning, reflective thinking, creative ability as well as problem solving skills cannot be over-emphasised. Tiemo cited in Oyegoke (2014) emphasized that Mathematics is an essential tool in the society which helps an individual to carry out their daily activities. The knowledge of Mathematics is efficacious in improving people's logically, analytically and critically thinking.

Ale (2007) stressed that Mathematics is a compulsory subject for all students at both basic and secondary levels of education irrespective of their aptitude for it neither due to the its importance throughout the world. Mathematics is an important subject in many fields. That is why the National Mathematics Centre, Abuja was established by the Federal Government of Nigeria to encourage the teaching and learning of Mathematics in schools. The centre is saddled with the responsibility of encouraging and providing necessary activities for improving teaching and learning of mathematical sciences at all levels of the educational system.

In the same vein, Kulbir (2006), Musa (2010), Pragati (2010) and Oyegoke (2014) identified different areas, subjects and disciplines where the role of Mathematics cannot be relegated. Such areas include:

1. Chemistry: chemical combination, chemical equations, formation of chemical compound, manufacturing of chemicals, estimation of elements in organic compounds, molecular weights of organic compounds. Mathematics is important in physical chemistry such as quantum. Quantum relies on group theory and linear algebra and knowledge of mathematical topics as Hilbert and Hamiltonian operators.
2. Biological Sciences: According a famous philosopher Kant, “A science is exact only in so far it employs Mathematics”. Comte also emphasised, “the claim of any particular branch of natural science can be assessed only on the basis of the amount of Mathematics employed in it. Mathematics is applicable in life process, calculations in biological laws (e.g Mendelian laws, Schultz-Borissoff law of action of enzymes), respiratory exchange, experimentation in biological sciences, nutrition, human weights, genetics, ecology, neuro-physiology, development of computer software for biological problems, mathematical theory of epidermics, biosciences, biomechanics, bioengineering and bioelectronics.
3. Laboratory Sciences: Laboratory scientists apply mathematical skills to solve medical problems.
4. Economics: demand and supply, marketing, production, budget, markets, expenditure, figures on accidents, calculation on cost, investment of money. Matrices, probability and statistics are used in econometrics. A number of mathematical models are employed in national economic planning.
5. Social Sciences: Mathematic models like calculus, probability, network theory, game theory and computations are employed in disciplines such as sociology, psychology, and economics.
6. Physics: measurement, cubical expansion of liquids, laws of motion, friction, liquid pressure, expansion of solids, light, waves and sound, electricity e.t.c.
7. Engineering: The use of Mathematics in engineering is very well known, in fact Mathematics is considered as the pillar and foundation of engineering.

Mathematics is applicable in surveying, levelling, designing, estimation and construction.

8. Geography: dimension and magnitude of earth, its situation and position in the universe, formation of days and nights, lunar and solar eclipses, latitude and longitude, height, rainfall, maximum and minimum temperature, barometric pressure, all these and other topics in geography require the knowledge of Mathematics.
9. Political Science: In political science, past election results are analysed to see changes in voting pattern and the influence of various factors on voting behaviour, switching of votes among political parties and conflict resolution. Also, Mathematics is very useful in resource sharing.
10. Agriculture: measurement of land or area, average investments or expenditure, average returns or income, production per unit area, cost of labour, time and work, seed rate, manure rate e.t.c.
11. Actuarial Sciences: Mathematics and statistics are employed in actuarial science to make meaningful decision for future finance. Actuarial scientists also worked in insurance company, setting premium to match liabilities and other financial matters which depend greatly on the Mathematics as a tool.
12. Computer Sciences: there are applications of Mathematics in the development of theories that are related for the development of computers.
13. Music and Art: Mathematics is related to notes, rhythms, pitch, tone and intensity in music. Mathematics and art are two different languages that can be used to express the same ideas.
14. Technology: information theory, designs of computers, analysis and synthesis of networks, cybernetics require mathematical skills. The development of information technology (IT) devices is not unconnected to Mathematics. In this period of high technology and internet super highway, no nation can make any meaningful achievement particularly in economic development without technology whose based are science and Mathematics.

2.2.5 Concept of Self-efficacy

Self-efficacy measures of one's own capability to complete tasks and attain goals (Bandura, 2001). Ormrod (2006) referred to self-efficacy as the conviction of one's enablement to do tasks to achieve stated and specified objectives. It is relevant and applicable to every sphere of human activity. Self-efficacy is a psychological concept that has to do with one's view of one's ability to attain one's goals and being capable of doing it. By determining the belief, a person holds regarding his or her power to affect situations. It strongly influences both the power a person actually has to face challenges competently and the choices a person is most likely to make. The study of self-efficacy from several perspectives by psychologists is done by observing various patterns of development of self-efficacy; the changing nature of self-efficacy in different settings. To people with high self-efficacy, challenges are surmountable through, endurance self-development and perseverance, thus, they stay on course in the face of impediments, and remain resilient to adversity. However, people with low self-efficacy give up easily when facing difficult situations and see effort as an exercise in futility. Self-efficacy affects the quality of emotional life and susceptibility to pressure, stress, worry anxiety and depression. Also, the choices people make at important decision points is a function of their self-efficacy (Pajares, 2002; Zeldin and Pajares, 2000).

In addition, self- efficacy from academic point of view is an individual assessment of one's capabilities to carry out series of action to attain educational success (Pajares, 2002). Mathematics Self-efficacy indicates students' self-belief in their ability to overcome difficulties or obstacles to solving Mathematics problems. Such a belief has been shown to be important to motivation because confidence that one will be able to solve a problem is a precursor to investing the time and effort needed to tackle it.

2.2.6 Concept of Dexterity

Dexterity has been a challenging construct to define due to the embedded structural complexity of the human hand and the variety of tasks it performs. Some of the existing definitions of dexterity include versatile capacity, the ability to carry out harmonious movements, finding an efficient motor solution, and the ability to correctly solve a motor problem in any situation (Kimmerle et al, 2003). Although these attempts have resulted in conceptual definitions of dexterity, important factors of dexterity are still vague. Bicchi (2000) viewed dimension of dexterity as qualities of tasks such as force magnitude, distance traveled, and speed. Elements of internal models and range of joint motion are embedded in dexterity. Due to its relation to different professions such as robotics, physiotherapy, hand surgery, and physiology, vagueness is associated with its definition. According to the Oxford dictionary (2010), dexterity is a skill especially with the use of hands to performing tasks.

Dexterity is also called fine motor skills which are the collective skills and activities that involve using the hands and fingers (Case-Smith and Shortridge, 2006; Amundson and Weil, 2001). That is, fine motor skills are those skills that require the small muscles of the hand to work together to perform precise and refined movements. These muscles are developed during childhood stage Exner, 2001). The process start at infancy stage with a 2- to 3-month-old baby bats at a toy, then progresses to grasping, releasing, and transmitting objects between their hands (Case-Smith and Shortridge, 2008; Edwards, Buckland, and McCoy-Powlen, 2002). It later developed to use of fingers to manipulate and explore things, stack blocks, feeding, dressing and use of tools like scissors, markers, crayons, pencils, and glue.

Early developmental skills and milestones work together to provide a solid foundation for the more integrated motor skills required in upper grades (Yakimishyn and Magill-Evans, 2002). According to Case-Smith and Shortridge (2008), to help children's dexterity skills, they must be engaged in activities such as

1. using tongs and tweezers to pick objects
2. use toys to play
3. use a stick, feathers, or straws to draw on sand
4. hanging clothes or pictures with pegs

During primary school, dexterity is demonstrated in pupils' ability to:

1. demonstrate finger control
2. using fingers tips and the thumb together
3. holding a writing tool between the thumb tips, the tips of the thumb, index finger, and middle finger.
4. follow an object smoothly with the eyes only with the head remains still
5. cut around reasonably complex designs such as a combination of straight and curved
   lines and corners, with less than 1 cm deviation from set lines
6. drawing of circle, triangle, square, picture of a person and a house.
7. Using one hand to perform a task and another to perform a different task.
8. manipulate small objects within the hand
9. put together a complex, interlocking puzzle
10. independent complete of many self-care tasks such as simple dressing, toileting,
    shoelace tying, and lunch set-up. (Edwards et al 2002; Shaffer, 2002; Exner, 2001).

However, some children have challenges in working with their hands and fingers as a result of poor coordination of their hands and fingers (Woodward and Swinth, 2002). They may be frustrated and reject any activity that requires the use of hands and fingers. to coordinate all of the muscles and joints in their hands and fingers. If this is not corrected on time, it may lead to poor development of higher-level fine motor skills and they may be referred to as having fine motor weakness in the future (Amundson and Weil,2001; Dennis and Swinth, 2001). Children with motor skill exhibit behaviour like:

1. absolute refusal to participate in an activity

2. avoidance
3. outpouring of anger
4. sadness leading to crying
5. defeatist behaviour (‘I’m no good, I can’t do this’).

2.2.7 Concept of Learning Styles

Learning styles is an elusive term. It is defined loosely defined in the literature and often used as ‘thinking styles’, ‘cognitive styles’ and ‘learning modalities’. Research in the field of learning styles is conflicting with a lot of methodologically flawed. Its simple definition is different methods of learning or understanding new information. It is the way a person takes in, understands, expresses and remembers information. According to Harold et al (2009), learning styles refers to the concept that individuals differ with regard to what mode of instruction or study is most effective for them.

In assessing learning style, people are requested to identify their preference for information presentation which may be words, pictures or speech and/or mental activity (analyzing or listening) they find most engaging or congenial. Based on this, Wilfrid (2008) identified four major learning

styles as visual, auditory, read/write, and kinesthetic. Pupils with visual learning styles learn through seeing. Things such as pictures, symbols, diagram and flowcharts are pertinent to them in learning a new concept. Learning to a pupil with auditory style is through listening. Such pupil does not joke with class attendance, tutorials, and discussions for better learning. An auditory pupil focuses on text book readings by reading them aloud, so he/she can hear how the words sound. Pupils with read/write style acquire knowledge through reading and writing. Kinesthetic pupils acquire knowledge through doing. Dipa (2015) classified learning styles into visual, auditory, kinesthetic learning, interpersonal and intrapersonal styles.

Wilfrid (2008) identified 4 principal learning styles as visual, auditory, read/write, and kinesthetic.

1. Visual Learners: Visual learners engage their sense of sight in learning learn through seeing. Learners with visual style prefer learning through images than learning through words or by doing. They learn new concepts using diagrams, flowcharts, pictures and symbols. Using colour code may also motivate or arouse learning.

2. Auditory learners: Auditory learners use their sense of hearing in learning, they learn through listening. As such, lectures attendance, tutorials, and group discussions are paramount to them. They focus on text book by reading aloud to hear the sound of what they read. They also engage in group discussion to aid their learning. It may also be helpful for leaners with auditory learning style to leave some blank lines on their note while taking notes during class interaction and make it up with their ideas after discussing the new concepts with others after the class.

3. Read/write learners: Read/write learners learn through reading and writing. A learner with read/write learning styles pays wrap attention to textbook glossaries and make his/her own notes as he/she progress through a course. A read/write learner reviews his/her read them over and then creates a new note for studying. They also rewrite explanation and notes out into your own words. If you can’t rewrite a definition or describe a concept using their own words in a concise and precise manner.

4. Kinesthetic Learners: These set of learners learn through manipulative skills, they learn by doing. Learners with kinesthetic learning style engage their sense of touch to acquire knowledge. They enjoy learning environment with diverse opportunities to engage hands on learning. For this type of learners, laboratory may be one of the best places to learn.

There are several theories and opinions on learning styles, but few generally agreed on general facts. Some researchers emphasised the importance of working memory in learning, while adopt the concept of multiple intelligences. Most of them lack clear concept and this has led to more confusion of the concept in terms of models and tools. Thus, no model of learning styles is universally accepted. However, a number of researchers (Cassidy 2004) have simplified the underlying concepts and processes of learning styles. Thus, learning styles comprised three inter-related elements:

1. information processing – habitual modes of perceiving, storing and organising information (for example pictorially or verbally)

2. instructional preferences – predispositions towards learning in a certain way (such as collaboratively or independently) or in a certain setting (environment or time of day, for instance)

3. learning strategies – adaptive responses to learning specific subject matter in a particular context. One of the key differences between the various theories of learning styles is the extent to which they are thought to be stable, or 'hard wired' into learners' minds. Some theorists believe that learning styles are rooted in fixed genetic traits, while others emphasised the influence on how students learn from experience, the environment and curriculum design.

The assumption that an individual has a stable, permanent, innate learning style has empirical evidences and studies to back it up. There is further associated with genuineness of the validity and reliability of the instruments used to measure stability of learning styles even if learning styles are constant. When measuring the preferred learning styles of a learner, it is important to think of learning styles as range of styles in which a learner has some degree of strength. It is probably impossible for person to have a learning style but one may have a dominant or prominent learning style.

Dipa (2015) also identified the following learning styles:

1. Visual Learning: This includes visualising subject matter, pictures, writing and real objects, concept mapping, plans and diagrams, film, video and computer images, etc.

2. Auditory Learning: This includes read aloud, role-playing, interviewing and telephoning, hearing the voice, talking about words, etc.

3. Kinesthetic Learning: This includes practical investigations, feeling the meaning of concepts, moving around while studying, moving ideas physically, etc.

4. Interpersonal Learning: This includes working in other (teamwork or collaboration), collaboration to develop reasoning, etc.

5. Intrapersonal Learning: This according to Dipa (2015), includes knowing learning objectives, feedback, reflection of opportunities, etc.

2.2.8 Concept of Interest

Oxford Advanced Learner Dictionaries defines interest as a condition of desire to know or learn something. Interest is a state of concern, keenness, eagerness or curiosity. To show interest in a thing is to be actively involved with that thing; to show concern, for or have curiosity in that thing. For instance, to be interested in Mathematics involves showing sufficient concern for and curiosity in the subject by being actively involved in all activities related to the subject. This will entail doing Mathematics in all its reifications (Ivowi, 2001).

Interest in Mathematics can be manifested in many ways, some of which include:

1. reading Mathematics materials in the subject area;
2. having right attitude and disposition towards learning of Mathematics
3. manipulation of Mathematical equipment, tools and numerical data
4. Using numerical data for charts, graphs e.t.c
5. Applying Mathematics concepts, principles and ideas in different circumstances of life.

Students show their interest in Mathematics is by repeating some related Mathematics activities without being bored, desire for increase achievement or success in Mathematics and desire for creativity, originality and innovation (Ivowi, 2001). Sustaining interest in Mathematics can be achieved by making some c

oncrete factors like intrinsic or extrinsic motivation factors available in order to prevent being lost.

It is a well-known fact that students possess low interest in Mathematics at all levels of learning (Abubakar, 2011). Some of the factors responsible for student's low interest in Mathematics are:

a) The nature of Mathematics: with a highly structured subject that is abstract in nature

b) Teacher factor

c) Lack of Mathematics laboratory: Most of schools do not have Mathematics laboratory where students can put into practice what they have learnt in the subject.

d) Students' poor background in Mathematics: Mathematics is likened to a pyramid, its contents logically and sequentially structured from concrete to abstract, simple to complex and known to unknown.

e) Lack of cultural bearing of some mathematics contents: have real life experience of some Mathematics concepts at post-secondary level of Nigerian educational system because those concepts are not relevant to our society (Obodo, 2001). Thus, students cannot experience them in real life situations.

According to Abubakar (2011), the following are generators of students' interest in Mathematics:

1. The teachers: Interest of the Mathematics teacher in the subject has a great influence on the students' interest in the subject. If a Mathematics teacher has

interest in the subject, there is likelihood that his students will be interested in the subject and verse versa.

2. Motivation: motivation according to Unrau and Quirk (2014) is a force that propels a person to act, conduct or comport himself/herself or behave in a certain manner. Hence, the need for students to be internally and externally motivated in order to develop interest in Mathematics.

3. Effective use of instructional materials: use of instructional materials helps in students' active participation in learning. This in turn has a potential to increase students' interest in Mathematics.

4. Through students' ability to master a previous topic before the introduction of the new one.

5. Catering for students' individual differences is capable of arousing their interest in the subject.

6. Application of Mathematics to other professional fields or careers

7. Statement of behavioural objectives

8. Recreational values inherent in Mathematic: This includes use of mathematical puzzles and quiz use also motivate students' interest in the subject.

9. Use of Mathematics Laboratory: Another method of motivating students' interest in Mathematics is through use of Mathematics laboratory. Such laboratory can be furnished with geometric shapes, relia, models and other instructional materials. Such materials that are constructed, made or bought.

10. Mathematical Game and Simulation: Some of the abstract Mathematics concepts can be better understood through playing games like ludo, chess e.t.c, Computer games and simulation are also helpful in this regards. Some of these games include ludo, chess, e.t.c

2.3 Empirical Review

2.3.1 Team Teaching and Students' Learning Outcomes (Cognitive, Affective and Psychomotor Domains)

The study of Syh-Jong (2006) examined the effects of team teaching upon two secondary school teachers of the 8th-graders of a secondary school in Taoyua, Taiwan using two certified Mathematics teachers. Four classes participated in this study. Two classes with 63 pupils were used as the experimental group, and the remaining two classes with 61 pupils were the control group. The findings showed that the two teaching methods showed significant difference in respect of students' achievement. The results showed that on the average team teaching was more effective than traditional teaching. Students who were taught with team teaching had higher mean score in the final examinations than their counterparts who were taught with traditional method. It was also discovered that More than half of the students that participated in the experiment preferred team teaching to traditional teaching. The study indicated that team teaching has a tendency to improve students' performance. These findings could be attributed to the context of the study, the sample used (secondary school students) as well as the location of the study which is different from the present study that used Mathematics at primary school level.

Also, Almon and Feng (2012) carried out a study that examined how students' performance in Mathematics was comparatively affected by co-teaching and conventional teaching in inclusive basic school. The study participants were two fourth grade classes. The Mathematical concepts taught were multiplication, number sense and division. The result showed that students taught with solo teaching had higher mean score than students taught with co-teaching in achievement in multiplication. On the contrary, students taught with co-teaching had higher mean score in number sense than students taught with solo-teaching. However, no statistical significant difference was shown in the mean score of the two groups in division unit. It implies that the study on co-teaching is inconclusive. These results implied that despites the fact that the same instructional method (co-teaching) was employed in three topics in Mathematics (Multiplication, Division and Number system), different results were obtained. Co-teaching proved positive on students in Number system unit but proved otherwise with students in multiplication and division units. These differences however, could be that different co-teachers handled each of the topics, some could find it difficult working as a team, while other could get along easily. This has a tendency to affect the outcome of the instruction.

In addition, Rogozinski (2008) carried out a study to investigate the difference in students' academic achievement between students taught by a teacher and students that are co-taught by two teachers. Secondary Mathematics class is taught by both general and special education Mathematics teachers using two tenth grade level in Geometry classes. The control group was taught by a general education Mathematics teacher. The experimental group was co-taught by both a general and special education Mathematics teacher. Both classes used the same textbook and covered the same curriculum. The results revealed that co-teaching method was more effective than traditional method with students taught having an improved mean score. Carpenter, Crawford, and Walden (2007) investigated the differences between team-taught and solo-taught sections of a graduate introductory course on research and statistics in terms of students' perceptions and achievement. The result showed that students that were taught by a teacher and those taught by two teachers performed the same way.

In a study conducted by Achor, Imoko, and Jimin (2012), they investigated the effect of team teaching on the achievement of SSI students in geometry using 288 sample size randomly selected from a population of 7128 students. The result revealed a significant difference between the mean achievement of the groups taught Geometry using team approach and the group that interacted with their class teachers only, ($F_{1, 287} = 117.961$, $p<0.05$). The students who were co-taught had higher mean score than those who were taught by traditional method. Likewise, the study of Uwameiye and Ojikutu (2014) examined the effect of team teaching on the academic achievement of students in introductory technology. The result of this study showed that there was a significant difference between the posttest achievement means of students taught using team teaching and those taught in a conventional single-teacher classroom with the students taught with team teaching having a higher mean score than the control group. The finding indicated that students in the experimental group serve as models for teaching positive teamwork skills and attitudes to students as observed by the team teachers as against students in the control group. The study investigated the effect team teaching on students' performance in Introductory Technology whereas the present study focused on Mathematics in primary schools.

Moreover, Haselden (2011) carried out a study on a co-teaching intervention that included operationalized components of instructional delivery and a support class was compared to the traditional instructional delivery of students receiving science instruction from a general education teacher alone in four high school biology classrooms. The findings indicated that there were no significant differences in the mean score of students educated in the co teaching class and those educated in a typical classroom setting. Also, Akpan, Usoro, Akpan and Ekpo (2010) investigated the effects of team teaching on students' performance in Introductory Technology. A total of 316 Junior Secondary School Two students in Akwa Ibom were randomly selected as sample for the study. The study revealed that students taught using team teaching instructional approach performed significantly better in Introductory Technology than students taught by a single instructor. In the same vein, Esomonu, Akudolu and Ezenwosu (2015) examined the effects of team teaching approach on the achievement of students in English language comprehension and how the effects vary across gender using a total of 189 students (97 males and 92 females). The results of the study showed that team teaching was more effective in teaching English Language than conventional method. Students taught with team teaching achieved significantly better than those in the control group. Also, the female students in team teaching group performed significantly higher than their male counterparts.

Furthermore, Coodin and Chisholm (2001) investigated the effect of a team taught seminar on medical students' attitudes toward schizophrenia using fourth year medical students. The study consisted of 24 students in the experimental group and 10 students in the control group totaling 34 students. The result of the study showed that students that were co-taught had positive attitudinal change towards schizophrenia as compared to students in the control group. Little and Hoel (2011) carried out a study on interdisciplinary team teaching as an effective method to transform student attitudes. The study adopted a business-biology team teaching approach to maximize development of student in an interdisciplinary context. The results of the groups were compared in cognitive and affective domains. In the cognitive domain, the treatment group (team-taught group) had higher significant gains in linking interdisciplinary thinking and an understanding of both business and natural systems to future success as against the traditional group. Also, the participants in treatment group experienced an affective transformations compared to traditional group.

Also, Oyegoke (2017) investigated the effect of co-teaching on pre-service teachers' performance in and attitude to Statistics in Research Methods course in Primary education. The study adopted pre-test, post-test control group quasi experimental design using 2×2 factorial matrix. The participants consisted of 293 pre-service primary teachers drawn from two public college of Education in South West, Nigeria. The study tested six hypotheses at 0.05 significant level. There were random selection and random assignment of participants to groups and treatment. Four self-constructed instruments (two stimuli and two response instruments) were used for collecting data. Analysis of Covariance was used in analysing data. The findings showed that a significant effect of team teaching on pre-service teachers' performance in research methods course [$F_{(1, 288)}$ =277.935 P< 0.05]. The pre-service teachers that were team-taught had higher mean score in performance in statistics aspect of research methods course than those taught using solo teaching with mean score. The findings also indicated that there was significant main effect of treatment on pre-service teachers' attitude towards statistical aspect of research methods. The mean scores of the attitude of the pre-service teachers taught with team teaching was higher than those taught with solo teaching.

In addition, Johnson (2012) carried out a study on how co-teaching model affect teaching and learning in the secondary school classroom was investigated. The findings of the study revealed that students in the experimental group had positive social aspects and improved academic achievement. The study indicated that general and special education students experience satisfaction with co-taught instruction and emphasised that co-teaching engendered performance, enhanced social skills, study skills, and improved classroom community. Also, students in team-taught group were acceptable to all students. The study revealed that co-teaching helps in reducing stigmatisms of students with special needs, gives opportunities for peer role models; engendered greater opportunities for individualised instruction for students have difficulties with learning in a general classroom setting.

In a study carried out by Parka (2010) to investigate the impact of co-teaching on general education students educated within a classroom inclusion model, In the study, general education students who received instruction during their 10thgrade year in a co-taught language arts and Mathematics class were compared with other 10th-grade students receiving instruction from the same teacher but without the additional co-teacher. The study also compared the difference in DSS from 9th-grade to 10th-grade of general education students in co-taught classes. The study showed no statistically significant difference for general education students in co-taught language arts classes but a significant difference for those in Mathematics classes as compared to their peers not in co-taught classes. The study also investigated the effect of co-teaching on overall performance of students and found out that there was no significant difference in learning outcome of co-taught students in general education as compared to peers not in co-taught classes.

Gamsky (2016) investigated the effects of team teaching on selected attitudes and achievement of ninth grade students in English and World History. The sample size for the study was 145 students, 74 students were taught with team teaching, while 71 students were taught with traditional method. Data for the study were collected with the use of self-constructed test and a personality inventory. The findings of the study indicated that the team teaching approach did not appear to complement academic growth over traditional teaching methods. Meanwhile, the result showed that team teaching had significant impact on student attitudes toward teachers, interest in subject matter, sense of personal freedom, and self-reliance. Also, the study of Osinubi (2017) revealed that the psychomotor skills of students in the experimental group did not significantly different from the students in the control group.

The study of Tumba, Chinda and Andeyarka (2014) determined the comparative effects of team learning and conventional teaching methods on students' skill acquisition in radio, television and electronics servicing trade at technical college. The study answered two research questions and tested two hypotheses. The sample size for the study was 84 Senior Secondary School Students. Findings of the study indicated that team teaching method is comparatively more effective than conventional teaching method for skills acquisition in radio, television and electronics trade. Also, students in the cooperative group were also found to be relatively more socialised during the learning process than those in the conventional group.

Farahi and Mohseni (2014) conducted a study on the impact of co-teaching model on improving achievement and motivation of Iranian young EFL learners. The study investigated the statistical significant impact of co-teaching on improving motivation and achievement of Iranian Young EFL Learners. The study was carried out at Salehin English Language Department in Tehran. The initial sample of 91 participants was reduced to 62 homogenous students using YLE test. The experimental group comprised 30 learners, while 32 learners served as control group. Test and questionnaire were used as methods of data collection. Data analysis was done through t-test. The results indicated that learners in team teaching group significantly outperformed those in traditional teaching method. The result showed that students were taught with team teaching had better motivation to learning than those taught with conventional method.

In the same vein, some studies adopted qualitative approach to research. Mastropieri et al (2005) carried out investigations of co-teaching in science and social studies classes. In this study, collaborating teachers, students with special need and normal students were observed and interviewed on effectiveness, efficiency and challenges associated with inclusive education. The finding revealed the efficacy of team teaching for engendering disabled students' academic in inclusive classes in some cases, while a lot of challenges inhibited the success of team teaching in other cases. Disabled students in the upper elementary, middle, and secondary classes took part in the studies. In these studies, researchers reported that they worked in tandem with general and special education teachers. They also claimed that those teachers were observed them between 1semester and two years. Throughout the studies, data were collected through observing classroom activities, taking field notes, recording videotapes of class activities, interviewing students as well as teachers and evidences of artifacts like quiz, assignment, homework, examinations, tests, projects.

Two set of team teachers (general education teachers and a special education teachers) was observed. All the teachers had teaching experience and credentials in their respective fields. One team was co-teaching in a fourth-grade upper elementary– age class. This comprised 25 students with emotional disturbance, mental retardation, learning disabilities and physical disabilities. The other team was co-teaching in a seventh grade science class which comprised 25 students, 7 of which had emotional disabilities, while 1 was hearing impaired. The findings from the two teams yielded similar results. Each team indicated that they had excellent working relationships, used their strengths as motivators, had co-planning time and had effective instructional skills.

The two teams revealed that they had true trust and reverence for each other which helped their working interaction. Also, both claimed that all of the students in their respective classes belong to them. Although, they reported had no allocated time but they squeezed time out before or after school or during lunch to discuss about the lesson and they spelt out roles and responsibilities for individual teacher in the team. However, they reported that their experience would had been more exciting if they had specific time for co-planning. These two teams made the content real and concrete by employing a hands-on, mind-on, activity-based method of teaching. They also possessed good instructional skills and good skills for class management. The methods adopted are reviewed of daily work, independent practice activities, presentation of new information and formative review.

Yanamandram and Noble (2006) examined students' experiences and perceptions of two models of team-teaching adopted in teaching undergraduate marketing subject a large at a regional Australian university. The two team-teaching forms used involved a large number of ten and six team members which involved a low level of participation of team members in the planning and management of the team-teaching process. The study investigated students' perception of merits and demerits of the team-teaching approach by identifying aspects of the team-teaching approach that facilitate and impede student learning. A total number of 440 students participated in the study. The result showed that majority of the students embraced team-teaching as a concept. The students perceived the advantages of team teaching as a method that facilitates students learning through the generation of interest and exposure to experts. They also perceived that team teaching can hinder students learning if the team refuses to work as a cohesive entity and harmoniously work together as a unit to effectively co-ordinate learning concepts. The emphasised the composition of team as a key determinant of the success or otherwise of team teaching process.

The study of Španović, Đukić and Ivanović (2015) investigated students' perspective of team teaching by examining different interpretations of the definition, features, merits and demerits of team teaching. The emphases were on personal integration of teachers and team worker associates, who working together, plan, conduct and evaluate the programme with one group of students. The study adopted descriptive survey method using a questionnaire method of data collection. The data were collected during the two school years; that is, June 2011 and June 2012. The sample size consisted of 165 students. 36.36% of the students were sampled from basic academic studies of Teacher Education Programme at the Faculty of Education in Sombor, 24.24% of the students were sampled from the Teacher Education Programme of the Faculty of Teacher Education in Hungarian in Subotica while 39.39 % of the students were sampled from the Study Programme in Pedagogy in the

Department of pedagogy at the University of Novi Sad. The participants showed high interest in team teaching and showed preference for certain team roles based on their educational profiles. Majority of the students viewed trust, effective communication between team members, good organization skills, creativity, innovations, good imaginations, friendliness, and willingness to help others as criteria for building strong, effective and efficient team.

From studies reviewed above, it could be observed that some of the studies on team teaching had significant effect on students' academic achievement while other studies did not. These findings could be traced to the fact the some of the studies were carried out at different levels of educational systems (secondary and tertiary level) using different subjects. Such subjects include Mathematics, Introductory Technology, Special Education course, General Education course among others. The few studies conducted at primary level focused on inclusive programme of special needs education. In addition, some of the studies were carried out within Nigeria while others were conducted off-shore. Thus, the locations and the cultural contexts of the studies were not the same. Furthermore, sampling techniques employed in each of the studies may not be the same. The studies used different designs, some adopted quasi-experimental design while other adopted non-experimental design. All these could account for differences in their findings. It then implies that the study on team teaching is inconclusive. There is need for more research to shed more light on the effect of team teaching on academic achievement of students. Moreover, most of the studies reviewed so far were carried out on students' academic achievement with little effort other domains (affective and psychomotor) of learning.

2.3.2 Learning Styles and Students' Learning Outcomes (Cognitive, Affective and Psychomotor Domains)

Nzesei (2015) conducted a study to identify the learning style preference among secondary school students. The study also determined the relationship between learning styles (based on Visual (V), Auditory (A) and Kinesthetic (K) modalities) and academic achievement of the students by gender. The study adopted purposive sampling techniques using Barsch Learning Style Inventory (BLSI) to collect data. Findings reveled that majority of the students are trimodal (VAK) learners, followed by bimodal (VA) learners and thirdly by unimodal (V) learners. The finding of the study also showed that there was no significant difference between the learning style preferences among male and female students and among high and low academic achievement groups. However, there was a positive significant relationship between learning styles and academic achievement for the trimodal learners among male and female students.

Also, in a study carried out by Vaishnav and Chirayu (2013) to analyse learning styles-visual, auditory and kinesthetic (VAK) prevalent among secondary students in Maharashtra. The findings indicated a significant main effect of the learning styles - visual, auditory and kinesthetic on academic achievement of the student. The study also showed a high positive correlation between kinesthetic learning style and academic achievement. The kinesthetic learning style was found to be more prevalent than visual and auditory learning styles among secondary school students.

Warn (2009) in his study investigated the relationship between students' learning style and their academic performance in two final year subjects using Kolb's Learning Style Inventory (LSI). In the study, the students were requested to fill two sets of LSI questionnaires in relation to two final year subjects with different final assessment orientation, such as Malaysian Taxation which is mainly computational oriented and Financial Strategy which is mainly theoretical oriented. The students' final examination results for both subjects were extracted for study of its association with their learning style. Finding showed that students' learning style did not relate to students' academic performance.

In the study conducted by Abidin, Rezaee, Abdullah and Singh (2011), the relationship between learning styles and overall students' academic achievement was investigated. The study was carried out on 317 students using Learning Styles Survey (LSS) instrument which is based on Joy Reid's Perceptual Learning-Style Preference

Questionnaire. The findings of the study showed a significant relationship between overall academic achievement and learning styles. Also, Chermahini, Ghanbari and Talab (2013) examined relationship between learning styles and the academic performance of students who attended an English Language class to learn English as a second language in Iran. 317 students participated in the study. The study adopted Kolb's Learning Styles Inventory to identify four basic learning types: Accommodating, Diverging, Assimilating, and Converging. Academic performance was evaluated by achievement test in the English language. The findings showed different learning styles related the performance in English test.

Mazini et al (2013) carried out a study to determine learning style and Mathematics achievement among High Performance School (HPS) students. The sample for the study comprised 362 form four students. The findings of the study revealed that most students tend to balance learning style among active, concrete, visual, sequential and gobal. Furthermore, there is a significance difference between learning style of visual, verbal, sequential and global based on gender. In addition, there existed a relationship between active and reflective learning style and Mathematics achievement. Alireza et al (2011) also conducted a study investigating the impact of learning styles on the academic achievement of secondary school students in Iran. The Kolb Learning Style Inventory was administered in eight public schools in Tehran. The mean of test scores in five subjects, namely English, science, Mathematics, history and geography was calculated for each student and used as a measure of academic achievement. A total of 285 Grade 10 students were randomly selected as sample of this study. The results of the analyses of variance showed that there was a statistically significant difference in the academic achievement of the Iranian students that correspond to the four learning styles [$F (3, 285) = 9.52$, $p < .05$]; in particular, the mean scores for the converging and assimilating groups are significantly higher than for the diverging and accommodating groups.

In the same vein, Meryem and Buket (2002) investigated how learning styles influence students' achievement in different learning environments using principles of

Generative Theory of Multimedia Learning. The framework used in the study was single group repeated measures experimental design model. Three different learning environment used were text based, narration based and computer mediated (this includes narration, music, text and static picture). Students grouped in these environments were examined at different times. The two instruments used were students' achievement test and Kolb's Learning Style Inventory. The study indicated that learning style was effective in promoting students' achievement in different learning environments.

Also, Mutua (2015) conducted a study on the determination of the relationship between learning style and academic achievement among secondary school students in Kenya. The objectives of the study objectives were to: (a) identify the learning style preference among secondary school students; (b) determine the academic achievement levels of the students; and (c) determine the relationship between learning style and academic achievement of the students by gender. The sampling technique used was purposive. The instrument used for data collection was the Barsch Learning Style Inventory (BLSI). This was used to identify the learning style preference among the students based on Visual (V), Auditory (A) and Kinesthetic (K) modalities. The instrument had a reliability coefficient of 0.862. The findings indicated that majority of the students are trimodal learners, followed by bimodal (VA) learners and thirdly by unimodal (V) learners. The least preferred learning style was the single kinesthetic modality which was preferred by only 2 female students. There was no significant difference in learning style preference among male and female students and among high and low academic achievement groups. There was a strong positive and statistically significant relationship between learning styles and academic achievement for the trimodal learners, and among male and female students.

Moreover, Almigbal (2015) carried out across sectional study on the relationship between the learning styles preference of medical students and academic achievement using 600 medical students at King Saud University in Riyadh, Kingdom of Saudi Arabia. The Visual, Aural, Read/Write, and Kinesthetic questionnaire (VARK) questionnaire was used to categorize learning style preferences. The study showed a significant difference in learning style preferences between male and female students. In contrast, the study revealed that students' learning style preferences did not relate to student's academic achievements. The study of Ghaffari, Ranjbarzadeh, Azar, Hassanzaseh, Safaei, Golanbar, Mazouchian and Abbasi (2013) examined different learning styles and their relation to academic achievement in medical students of Basic Sciences program at Tabriz University of Medical Science. The study there was revealed no significant relationship between students' learning styles preference and students' academic achievement. Reid (1999) stated that dimensions such as multiple intelligence, perceptual learning styles, field dependence/independence, analytic/global learning styles and reflective/impulsive learning styles have been investigated in the area of language learning. Reid (1999) also stated that learning styles cause positive changes in the affective domain of learners which could in turn result in more effective learning. Such changes could be increased in learners' interest and motivation in the learning process, students' responsibility for their learning as well as greater classroom participation.

In addition, the study of Oyegoke (2015) examined the predictive power of learning styles (visual, auditory and kinesthetic) and quantitative ability on pupils' performance in Mathematics. Correlation research design was employed in the study using 200 primary four pupils as the sample. The sample was randomly selected from eight primary schools in Orelope and Irepo local government areas, Oyo state. Data collection was carried out using three instruments (Learning Styles Scale (LSS), Quantitative Ability Test (QAT) and Mathematics Achievement Test (MAT)). The study revealed that learning styles are linearly related to quantitative ability. There was a moderate relationship between learning styles and quantitative ability and pupils' performance in Mathematics. Also, the study indicated that the three learning styles and quantitative ability contributed significantly to the pupils' achievement in Mathematics. This shows that visual, auditory and kinesthetic learning styles and quantitative ability are factors to be considered in pupils' performance in primary Mathematic.

Furthermore, Fayombo (2015) investigated the learning preferences (visual, auditory, kinesthetic), the teaching strategies (videos, games, role-play, discussion, group work, clarification pauses, five minute-paper, discussion forum and glossary activity) and their influence on the academic achievement of 171 undergraduate Psychology students at the University of the West Indies, Cave Hill Campus, Barbados. The study employed three instruments to collect data - Active Learning Strategies Questionnaire, Learning Style Survey and Academic Achievement Scale. The results of the study revealed that the majority of the students benefited from the learning strategies utilised in the classroom. Additionally, the teaching strategies and learning styles contributed 20% (R2 = 0.20) to the variance in academic achievement and this was statistically significant ($F (2,168) = 21.04$, $p < .05$). The study carried out by Tulbure (2012) established a significant interaction effect of cooperative learning strategy and three learning styles (convergers, divergers and accommodators) students of two faculties of a Romanian University.

Also, Damrongpanit and Reungtragu (2013) reported a significant interaction effect of students' learning styles and teachers' teaching styles on academic achievement of 3,382 ninth-grade students. Both teaching styles and learning styles effectively improved achievement in second language acquisition of tertiary learner (Liu and He, 2014). The two variables affect students' attitude and interest to learning (Felder, 1996). In contrast, the studies of Massa and Mayer (2006) and Fardon (2013) revealed that instructional strategies and students' learning styles did not have joint effect on students' performance. Grants and Spencer (2003) discovered instructional methods and learning approaches improved the manipulative skills of students.

In addition, Wilson (2011) investigated the interaction effect of students' learning style preferences and teachers' Instructional strategies on academic achievement of 308 fourth grade in English Language Art, Mathematics, Science and Social Studies. 308 students were randomly selected from three school districts in Northwestern South Carolina. Two hundred and three students returned consent and assessment forms out of which 187 forms were completed. The final participants were 187 participants; 93

were females and 94 were males. Also, 133 participants were Caucasians, 40 were African Americans, and 14 of other descent. The results of the study revealed a weak relationship between teaching strategies and learning styles and academic achievement in English Language Art, Mathematics, Science and Social Studies. Moreover, the study revealed that teaching strategies and learning styles did not have a joint effect on students' performance in English Language Arts, Mathematics, Science and Social Studies.

Literature reviewed so far on the empirical studies of learning styles and students learning outcomes revealed that most of the studies reviewed were conducted on students' achievement, much efforts had not been concentrated of the other domains (affective and psychomotor) of learning. Also, most of the studies focused on Mathematics and other subjects at both secondary and tertiary levels of education with little attention on primary level of education. The literature reviewed so far revealed that some studies showed that learning styles relate and support students' academic growth, while other studies proved otherwise. The disparity observed in the outcomes of these studied could be attributed to the fact that various researchers based their studies on different samples, using different design, sampling methods and instrument. Some studies were conducted using experimental design, while others used survey design. Another factor for the disparity could be the areas of interest of the researchers as well as the cultural settings of the places where the studies were conducted.

2.3.3 Self-efficacy and Students' Learning Outcomes (Cognitive, Affective and Psychomotor)

In a recent development about research studies on self-efficacy and learning outcomes, Sartawi, Alsawaie, Dodeen, Tibi, and Alghazo (2012) carried out a study to investigate the predictive power of self-efficacy and motivation on Mathematics achievement of fifth grade students in United Arab Emirates (UAE) across gender and achievement levels. Two scales with different levels of specificity (Category Specific and Task Specific) were used to measure Self-efficacy. Motivation was measured through four sub-constructs of motivation which are a motivation, external regulation, introjected regulation, and intrinsic motivation. A total of 287 fifth grade students with an average age of 10.3 years were randomly selected to participate in the study. The study showed that the predictor variables contribute 32% to the observed variance of Mathematics Achievement. The study indicated that the best predictors were the task specific aspect of self-efficacy, external regulation and intrinsic motivation. Also, Olosunde, Oyegoke and Ojebisi carried out a study to investigate attitude, Mathematics anxiety and self-efficacy of pre-service teachers as determinants bbof performance in primary school Mathematics. A sample size of 400 students was randomly selected from the department of Primary Education Studies in two colleges of Education in Oyo state. Four instruments (Mathematics Attitude Scale (MAS), Self-efficacy Scale (SEF), Mathematics Anxiety Questionnaires (MAQ) and Score Sheets) were used for data collection. There was a moderate relationship between students' attitude, self-efficacy and Mathematics anxiety and students' performance in primary Mathematics course.

In addition, the study Akujieze (2013) of adopted quasi experimental design using 110 low achieving students to investigate the effect of out of class activity and counseling strategies on leaning outcomes in Geometry among low-achieving senior secondary students in Ibadan. The study used self- efficacy and gender as moderators. The finding of the study showed significant effect of teaching method on students' achievement and attitudes. Self- efficacy had significant effect on achievement but no significant effect on attitude. The combination of the teaching method and self-efficacy produced no significant effect on both achievement and attitude. Also, Wendel in Akujieze (2013) observed that the pattern of achievement of high and low Mathematics self-efficacy of participants in the study groups were not significant difference from one another. Durowoju (2014) examined the effect of continuous assessment modes on students' learning outcomes in Commerce in Senior Secondary schools in Ibadan. The study adopted quasi experimental design with sample size of 846, using commerce self-efficacy and teacher students' relationship as moderating variables. The finding revealed that commerce self-efficacy did not influence students' performance in Commerce but had influence on students' attitude to Commerce.

In the study of Tenaw (2013), the level of students' self-efficacy, gender difference in self-efficacy and achievement were examined. The relationships between self-efficacy and achievement for second year students in the fall of 2012 in Analytical Chemistry I (ACI) at Debre Markos College of Teacher Education (DMCTE), were also investigated. The self-efficacy survey and the ACI achievement test were completed by 100 students. The analysis of the data indicated that a significant relationship existed between self-efficacy and achievement. The study of Nicolaidou and Phillipou (2003) showed that students' attitude towards Mathematics, self-efficacy belief in Mathematics relate to achievement with self-efficacy had stronger relationship with achievement in Mathematics than attitude towards Mathematics. Also, it was established in the study that students' attitude towards Mathematics and self-efficacy predicted achievement in Mathematics.

Furthermore, Liu and Koirala (2009) investigated how Mathematics Self-efficacy affect Mathematics achievement of high school students. The finding of the study showed that Mathematics self-efficacy and Mathematics achievement were positively related. Students with high Mathematics self-efficacy were associated with high Mathematics achievement. In addition, the finding indicated that Mathematics achievement was significantly predicted by Mathematics self-efficacy. Mathematics self-efficacy significantly predicted of Mathematics achievement. This finding suggested that students who were confident of their performance in Mathematics tended to have better Mathematics achievement. In other word, students who were confident that they could do excellently well in Mathematics tests, they could understand the most difficult material presented in Mathematics texts, they could understand the most difficult material presented by their Mathematics teachers, they could do excellently well in Mathematics assignments, and they could master the skills being taught in their Mathematics classes, were more likely to have better Mathematics achievement. Also, the study of Arizpe, Dwyers and Stevens (2006) showed that self-efficacy significantly predicted students' achievement in Mathematics significantly.

In the same vein, Oyegoke (2015) investigated the extent to which self-efficacy and physical facilities predicted students' achievements in Basic Mathematics. Correlation design was used in the study. The sample size was 1, 080 students.in Oyo metropolis. Three instruments were used for data collection namely; Physical Facility Inventory, Students' Mathematics Self –Efficacy Scale and Mathematics Achievement Test. There was a linear relationship between self-efficacy, physical facilities and students' performance in basic Mathematics. In addition, self-efficacy and availability of physical facilities are most influential in predicting students' performance in basic Mathematics.

Bandura and Schunk (1981) tested the hypothesis that self-motivation through proximal goal setting serves as an effective mechanism for cultivating competencies, self-percepts of efficacy, and intrinsic interest. The result showed that learners who exhibited gross deficits and lack of interest in mathematical tasks pursued a program of self -directed learning under either proximal subgoals, distal goals, or no goals conditions. Also, result of the study was in support of proximal self- influence. Personal self-efficacy and intrinsic interest in arithmetic activities of children with proximal sub goals help in rapid progress self-directed learning and achieved substantial mastery of mathematical operations. In contrast, self-efficacy and intrinsic interest in arithmetic activities of children with distal sub goals had no demonstrate effect on their self-directed learning and mastery of mathematical operations. Furthermore, the study reflected a high congruence between mathematical self-efficacy and mathematical performance. In addition, the result of the study showed that self-efficacy was positively related to accuracy of mathematical performance and intrinsic interest in arithmetic activities.

Silvia (2003) carried out experimental studies of optimal incompetence on self-efficacy and interest. Experiment 1 asked people to rate the interestingness of differentially difficult activities; while experiment 2 manipulated self-efficacy regarding a fuzzy dart game. The studies tested the prediction that interest model assumed that factors that induced interest novelty, complexity, conflict, and uncertainty were non-linearly. Self-efficacy should thus affect interest quadratic ally, because it reflects uncertainty about an activity's outcome. The study showed that low self-efficacy implied low interest, moderate self-efficacy does not implied success on the task and when self-efficacy becomes very high, success seems completely certain, and the task is thus uninteresting. Both experiments showed that interest was a quadratic function of self-efficacy. Kerrigan and Hayes (2016) observed that there is little understanding of how to support practitioners' learning of and engagement with research and few studies on the research experiences of students enrolled in Doctorate of Education (EdD) programs. The success of students enrolled in Doctor of Philosophy (PhD) programmes in conducting research was found to enhance students' self-efficacy and interest, but these concepts have not been explored with EdD students who are more likely to engage in applied research in their workplace than to create a research focused career. The study investigated the self-efficacy and interest that EdD students enrolled in an Educational Leadership Programme have in research skills and tasks in order to improve research course offerings. The findings with EdD students were consistent with existing studies on PhD students regarding research self-efficacy. That is, self-efficacy improved students' success but self-efficacy did not change students' interest over time.

Furthermore, the study of Rashid (2004) investigated the impact of learning styles (Accommodating, Diverging, Converging, and Assimilating) and self-efficacy on the academic performance of MBA candidates. The study also examined the effect of the interaction between these two independent variables on the academic performance (CGPA). A total of 122 responses were used from the candidates in USM and UM because the two programs are among the best in the nation. The findings showed candidates with different learning styles did not differ in their performance, self-efficacy had a strong positive impact on the academic performance. Also, the interaction between learning styles and self-efficacy had a strong positive impact on the academic performance. Also. Turner and Schallert (2001) observed that self-efficacy beliefs did not only improve occupational interest and choices of persons but also aroused or motivated a person to strife against odds for success in their occupation. Ilori (2004) carried out a study to establish the relationship between self-efficacy and academic achievement among secondary school students in Irewole Local Government in Osun State. The result revealed no significant relationship between self-efficacy and academic achievement of secondary students.

In the light of the studies reviewed so far on effect of self-efficacy and students learning outcomes, it is observed that almost all studies reviewed were conducted on students' achievement. Efforts have not been concentrated of the other domains (affective and psychomotor) of learning.

2.4 Conceptual Framework

The conceptual framework for the study is presented in Figure 2.3

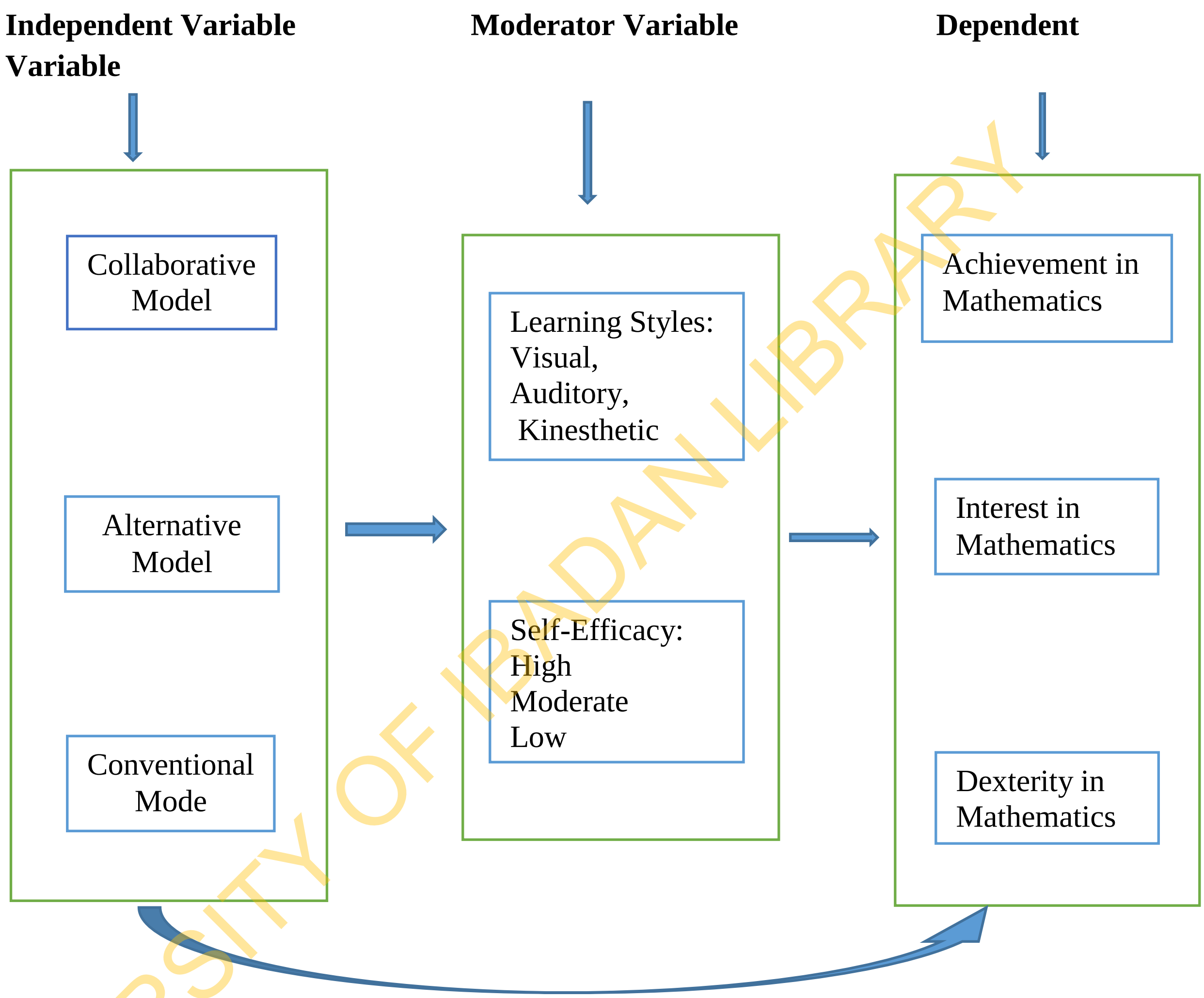

Figure 2.3: Conceptual Framework

2.5 Appraisal of Literature

Team teaching as a method of teaching in the classroom has gained attention in the recent times among both special and general educators. It is a method of teaching which the government of some countries emphasises their teachers to adopt because it encompasses lots of models. Numerous research works had been conducted on team teaching as a method of teaching students in the classroom, but most time often than none, previous studied did adopt only one model of the team teaching. The literature reviewed in this study shed enough light on the concept of team teaching and its applications as it relates to Mathematics at all levels of education with the exception of the primary school level. The void to be filled by this present study is the use of multiple models of team teaching in primary school Mathematics using a team of two teachers for each class. The study also focused on three domains of learning – cognitive, affective and psychomotor as against one domain (cognitive) common to previous studies. Furthermore, the study also investigated the stakeholders' perception of adoption of team teaching at primary level. Challenges of team teaching and possible solutions to the challenges were also examined.

Available literature showed that some studies had been carried out focusing on team teaching employing qualitative approach for data collection. Such studies used observation and interview schedules to investigate the perception of some team teachers and students on team teaching. Other studies used experiments. There seemed to be dearth of literature on studies that combined both qualitative and quantitative methods to observe the effect of team teaching on students' learning outcomes. This is parts of the gap that this study is set out to fill.

In addition, empirical evidences in the literature reviewed were concerned about the effect of team teaching on students' academic achievement. Some studies were carried out on the effect of team teaching on affective domain of students learning such as attitude and motivation. Others studies examined the effect of team teaching on psychomotor domain -social skills. There seemed to be little empirical evidences on the effect of tem teaching on affective domain of learning (interest as well as psychomotor domain of learning such as dexterity). This is also one of the issues that this study addressed.

Learning styles is used interchangeably with thinking styles, cognitive styles and modalities is different methods of learning or understanding new things. Various researchers viewed learning styles from different perceptive and as a result, came up with various types and classifications. Predominant among these classifications are classifications propounded by Wilfrid (2008) and Chisslet and Chapman (2005).

Literature search on learning styles showed that studies had been conducted on the effect of learning styles on students' academic achievement. Also, some studies examined the relationship between learning styles and students' academic achievement. Other studies examined the effect of learning styles on students' interest, attitude and motivation and found that learning styles caused positive changes in the affective domain of learning. Literature reviewed showed the need for more empirical studies on the effect of learning styles on affective domain. Also, available literature showed that there seemed to be no enough empirical evidences on the effect of learning styles on psychomotor domain of learning most especially on dexterity. This is another gap filled by this study.

Self-efficacy is a belief in one's ability to perform tasks to attain certain goals. This has been found to affect every area of human endeavours. Literature have established the relationship between self-efficacy and academic achievement. Some studies also investigated the effect of self-efficacy on affective domain of learning. Various studies based on the literature reviewed were on motivation, self-regulation and attitude. Many studies had not been carried out on the effect of self-efficacy on interest as a variable in affective domain of learning.

Scanty studies on literature are available on the combined effect of teaching methods and learning styles on students' learning outcomes. These studies had shown that the combination of teaching methods and learning styles either promote or inhibit student' achievement. Although, few studies had examined the combined effect of teaching methods and learning styles on students' attitude to and interest in learning, there is need for more empirical studies on interaction effect of teaching methods and learning styles on students' interest in learning. Available literature is grossly devoid of the interaction effect of teaching methods and learning outcomes on students' psychomotor of learning.

In addition, available literature had shown gross dearth of studies on the interaction effect of teaching methods and self-efficacy on learning outcomes. Also, there seemed to be shortage of empirical evidences on the interaction effects of teaching methods, learning styles and self-efficacy on students' learning outcomes in the three domains of learning (achievement, affective and psychomotor).

CHAPTER THREE

METHODOLOGY

This chapter describes the various procedures that were followed in carrying out the study.

3.1 Research Design

This study used mixed methods approach. The study adopted explanatory sequential mixed methods design (QUAN $\longrightarrow$ qual) with dominant quantitative components (QUAN-dominant). In QUAN-dominant mixed methods, the quantitative methods are given more weight than the qualitative components (Falaye, 2018). The quantitative aspect of the study used a 3 x 3 x 3 factorial matrix.

3.1.1 Outline of the Quantitative Aspect of the Study

Experimental 1	0_1	X_1	0_2
Experimental 2	0_1	X_2	0_2
Control	0_1	X_3	0_2

Where:

0_1 represents pre-test scores of the experimental group 1, 2 and control group

0_2 represents post-test scores of the experimental group 1, 2 and control group

X_1 represents treatment that was given to experimental group 1 (pupils who were taught using collaborative team teaching)

X_2 represents treatment that was given to experimental group 2 (pupils who were taught using alternative team teaching)

X_3 represents treatment that was given to Control group (pupils who were taught using conventional method)

3.1.2 Factorial Matrix of the Quantitative Aspect of the Study

Table 3.1: Showing 3x3x3 Factorial Design

Learning Style	Treatment								
	Collaborative Team Teaching			Alternative Team Teaching			Conventional Teaching		
	Self-efficacy			Self-efficacy			Self-efficacy		
	L	M	H	L	M	H	L	M	H
Visual	15	20	10	12	15	13	18	11	15
Auditory	27	30	11	12	19	34	30	21	11
Kinesthetic	8	13	9	8	7	9	7	8	8
Total	50	63	30	32	41	56	55	40	34

3.2 Variables of the Study

The variables in this study were as follows:

3.2.1 Independent Variable

Treatment (teaching methods) operated at three levels which were

- Collaborative team teaching
- Alternative team teaching
- Conventional Method

3.2.2 Moderator Variables

- Learning styles, varied at three levels (visual, auditory and kinesthetic)
- Self-efficacy, operated at three levels (low, moderate and high)

3.2.3 Dependent Variables

- achievement in Mathematics
- interest in Mathematics
- dexterity in drawing and labeling of Mathematics concepts

3.3 Population of the Study

The target population for this study comprised all primary five pupils, primary five Mathematics teachers and head teachers in public primary schools in Oyo, Nigeria.

3.4 Sampling Techniques and Sample

The study adopted multi-stage sampling procedures. The study area was Oyo, Nigeria. The choice of Oyo was due to the need to improve pupils' achievement in Mathematics in Oyo State in general and Oyo town in particular. Oyo is one of the cities in Oyo State with 201 public primary schools. The Oyo educational zone is one of the eight educational zones in Oyo State. Oyo educational zone has four Local Government Areas which include Oyo West, Oyo East, Atiba and Afijio. The sampling for the study was carried out in two stages as indicated in 3.4.1 and 3.4.2.

3.4.1 Stage 1: Sampling Techniques and Sample for the Quantitative Aspect of the Study

For this stage, three Local Government Areas (LGA 1, LGA 2 and LGA 4) were randomly selected from the Local Government Areas in Oyo educational zone. Three public primary schools were randomly selected from each Local Government Area making, a total of nine schools. The nine selected schools were randomly assigned to treatment. In each of the selected Local Government Areas, two schools were assigned to experimental group 1 and 2, while one school served as the control group. Intact classes of the selected schools were used. A total number of 401 pupils participated in the study. Sample frame for this stage is shown in Table 3.2

Table 3.2: Sample Frame for Pupils that Participated in the Study

Selected Educational Zone	Number of Local Government Areas	Number of Public Primary Schools in the Local Government Areas	Number of Local Government Selected	Number of Public Primary schools in the selected Local Governments	Number of Public Primary Schools Selected per LGA	Number of Pupils per LGA
Oyo Zone	4	LGA 1 = 35	3	LGA 1 = 35	3	116
		LGA 2 = 27		LGA 2 = 27	3	160
		LGA 3 = 70		LGA 4 = 69	3	125
		LGA 4 = 69				
Total	**4**	**201**	**3**	**131**	**9**	**401**

3.4.2 Stage 2: Sampling Techniques and Sample for the Qualitative Aspect of the Study

At this stage, homogenous purposive sampling method was used to select twelve pupils (six males and six females) from each of the six experimental schools, making seventy-two primary five pupils that took part in the Focus Group Discussion. The twelve pupils selected from each school were put into two groups (six pupils per group), totalling of twelve groups. Twelve primary five Mathematic teachers that served as team teachers and six head teachers of the six experimental schools were purposively selected to participate in the interview sessions. The sample size for this stage include seventy two primary five pupils, twelve primary five Mathematics teachers and six head teachers.

3.5 Instrumentation

Two sets of instruments were used for the study. They were stimulus instruments (packages) and response instruments.

3.5.1 Stimulus Instruments

Three stimulus packages used in the study are:

i. Collaborative Team Teaching Package (CTTP)
ii. Alternative Team Teaching Package (ATTP)
iii. Conventional Teaching Package (CTP)

3.5.1.1 Collaborative Team Teaching Package (CTTP)

Collaborative Team Teaching Package (CTTP) was developed by the researcher (see Appendix I). CTTP was used for experimental group 1. Prior to the teaching with the use of this package, a team of two teachers were selected for each class. The two teachers were labeled as Teacher A and Teacher B. Teacher A was the first teacher that started the lesson while Teacher B was the other teacher. The teachers for each class met to plan and design the instructional activities for their class. Both teachers taught each of the lessons together by exchanging roles.

In a collaborative lesson, Teacher A introduced the lesson, Teacher B explained the lesson and gave relevant examples and Teacher A evaluated and concluded the lesson. These roles were exchanged in the subsequent lessons. While one teacher was teaching, the other teacher ensured that pupils actively participated in the teaching-learning process. This was done by checking, discouraging and correcting pupils' negative behaviour. The teacher ensured pupils' attention, participation and right disposition to the lesson. The teacher also called the attention of the pupil that was not concentrating on the lesson.

The teachers met to preview the lesson for the week by

(i) identifying the behavioural objectives for the topic to be taught for the week and classifying them based on the daily sub topic;
(ii) identifying the instructional materials needed for the topic;
(iii) distributing roles;
(iv) identifying teachers' demonstration activities related to the topic;
(v) identifying pupils' demonstration activities related to the topic; and
(vi) deciding methods of assessment to be used for the week.

3.5.1.1.1 Specific Steps involved in Collaborative Team Teaching Class

Step 1: Teacher A introduced the topic; Teacher A assessed the previous knowledge of the pupils that was related to the sub-topic to be taught.

Step 2: Teacher B also assessed any other previous knowledge that was relevant to the topic

Step 3: Teacher B explained the lesson by giving different examples on the topic being taught.

Step 4: While teacher B was teaching, teacher A moved round the class to ensure pupils' attention, participation and right disposition to the lesson.

Step 5: Teacher B asked oral questions to check pupils' learning. He/she also encouraged pupils to seek clarification on unclear aspect.

Step6: Teacher B clarified unclear questions to the pupils.

Step7: Teacher A evaluated the lesson by writing questions on the chalkboard

Step8: Both teachers ensured that all pupils were engaged with the exercise.

Step9: Teacher A gave feedback and corrections while teacher B ensured pupils' participation.

Step 10: Teacher A wrote the homework on the chalkboard while teacher B ensured that pupils copy it in their notes

Pupils' activities during the lesson were:

1. Copying of notes
2. Asking questions or seeking clarification on unclear aspect of the lesson
3. Responding to teachers' or mates' questions
4. Active participation during the lesson
5. Practical discovery of some Mathematics concepts

Post Instructional Planning: The teachers met to preview the subsequent lesson.

After the construction of the initial package, the researcher invited eight of her colleagues (Doctoral students of the International Centre for Educational Evaluation) and explained the purpose of the package to them. The package was demonstrated amidst them to ensure its practicability. The observations and inputs of the colleagues were used to expunge some steps; some steps were added while some were modified. The inputs of the supervisor of the researcher was also considered and used to modify the package. Furthermore, the validity of the package was further established by giving the package to five experts in the field of educational evaluation to rate the appropriateness of each of the steps of the package. Lawshe's Content/Construct Validity Index (CVI) was used to established the validity of the package.

$$CVI = \frac{Ne - N/2}{N/2}$$

Where:

CVI = Content Validity Index

Ne = Number of panelists rating the item good

N = Total number of panelists

Each of the five experts indicated the appropriateness of the steps of the package, the validity index of each step was computed. The average of the validity indexes of the entire package was calculated and it was found to be 0.98. During the training of research assistants, two research assistants rated the instrument using observation technique. The reliability coefficient of the instrument was computed using Scott pie and was found to be 0.89.

3.5.1.2 Alternative Team Teaching Package (ATTP)

Alternative Teaching Package (ATTP) was developed by the researcher (see Appendix II). ATTP was used for experimental group 2. Prior to the teaching with the use of this package, a team of two teachers (A and B) was selected for each class. The lesson was divided into two sections (A and B). Section A was handled by teacher A, while section B was handled by teacher B and vice versa. For instance, if Teacher A handles section A during a lesson, Teacher A will handle section B in the subsequent lesson and vice versa. In Section A of alternative teaching lesson; Teacher A taught the lesson, oral assessment was carried out to check pupils' learning as the lesson progressed; written assessment was carried out at the end of the lesson. While Teacher A was teaching the lesson, Teacher B was taking note of the aspect of the lesson that

Teacher A did not explain well as well as the aspect of the lesson that the pupils did not perform well through the class assessment. In Section B of alternative teaching lesson, Teacher B re-taught the same topic to the entire class using different examples where applicable. Observation and assessment carried out during section A informed the direction of the re-teaching. While Teacher B was re-teaching, Teacher A ensured pupils' attention and active participation.

The teachers met to preview the lesson for the week by

(i) identifying the behavioural objectives of the topic to be taught for the week and classifying them based on the daily sub topic;

(ii) identifying the instructional materials needed for the topic;
(iii) distributing roles;
(iv) identifying teacher demonstration activities related to the topic;
(v) identifying pupils' demonstration activities related to the topic; and
(vi) deciding methods of assessment to be used for the week.

3.5.1.2.1 Steps involves in Alternative Team Teaching Class

Section A

Step 1: Teacher A assessed the previous knowledge of the pupils that was related to the sub-topic to be taught and introduces the lesson.

Step 2: Teacher A presented the lesson by giving examples on the topic being taught.

Step 3: Teacher A asked oral questions to check pupils' learning as lesson progresses. He/she also encouraged pupils to seek clarification on unclear aspect.

Step 4: Teacher B took note of the aspect of the lesson that teacher A did not explain well

Step 5: Teacher A gave written class assessment

Step 6: Teacher A asked the pupils to exchange their notes for marking.

Step 7: Teacher gave feedback on the class assessment

Step 8: Teacher A requested the pupils to mark the exercise. Teacher A encouraged the pupils to be truthful in the marking and emphasised that the scores obtained would not be used for grading but for the purpose of re-teaching.

Step 9: Teacher A identified the pupils that did not perform well as well as the area they did not perform well

Section B

Based on the observations and assessment carried out during section A

Step 1: Teacher B re-taught the lesson using different examples where applicable focusing more on the aspect of the lesson that Teacher A did not explain well as well as the aspect of the lesson that pupils did not perform well in the assessment carried out during section A.

Step 2: While Teacher B was teaching, Teacher A moved round the class to ensure pupils' attention and active participation.

Step 3: Teacher B asked oral questions to check pupils' learning as the lesson progressed. He/she encouraged pupils to seek clarification on unclear aspect.

Step 4: Teacher B re-assessed the entire class.

Step 5: Both teachers marked the pupils' books

Step 6: Teacher B gave feedback and corrections to the pupils

Step 7: Teacher B concluded the lesson

Pupils' activities during the lesson were:

1. Copying of notes
2. Asking questions or seeking clarification on unclear aspect of the lesson
3. Responding to teachers' or mates' questions
4. Active participation during the lesson
5. Practical discovery of some Mathematics concepts

Post Instructional Planning: The teachers met to preview the subsequent lesson.

After the construction of the initial package, the researcher invited eight of her colleagues (Doctoral students of the International Centre for Educational Evaluation) and explained the purpose of the package to them. The package was demonstrated amidst them to ensure its practicability. The observations and inputs of the colleagues were used to delete some steps; some steps were added while some were modified. The inputs of the supervisor of the researcher was also considered and used to modify the package. Furthermore, the validity of the package was further established by giving the package to five experts in the field of educational evaluation to rate the appropriateness of each of the steps of the package. Lawshe's Content/Construct Validity Index (CVI) was used to established the validity of the package.

$$CVI = \frac{Ne - N/2}{N/2}$$

Where:

CVI = Content Validity Index

Ne = Number of panelists rating the item good

N = Total number of panelists

Each of the five experts indicated the appropriateness of the steps of the package, the validity index of each step was computed. The average of the validity indexes of the entire package was calculated and it was found to be 1.0. During the training of research assistants, two research assistants rated the instrument using observation technique to ensure its reliability. The reliability coefficient of the instrument was computed using Scott pie and it was found to be 0.85

3.5.1.3 Conventional Teaching Package (CTP)

Conventional Teaching Package (CTP) was developed by the researcher. CTP was used for control group (group 3). In control group, two teachers were in class but they taught different subjects. One teacher taught Mathematics, while the other teacher taught any other subject. The major steps in conventional teaching are introduction, presentation; evaluation and conclusion (see Appendix III).

3.5.2 Response Instruments

Seven response instruments were used for data collection. Five instruments were used to collect quantitative data, while two instruments were used to collect qualitative data.

For the collection of quantitative data, the following instruments were used

i. Achievement in Mathematics Test (AMT)

ii Interest in Mathematics Scale (IMS)

iii Dexterity in Mathematics Test (DMT)

iv. Pupils' Learning Style Scale (PLSS)

v. Mathematics Self-efficacy Scale (MSS)

The following instruments were used to collect qualitative data

vi. Focus Group Discussion Guide (FGDG)

vii. Interview Guide (IG)

3.5.2.1 Achievement in Mathematics Test (AMT)

Achievement in Mathematics (AMT) was developed by the researcher to gauge the knowledge acquired in Mathematics before and after the treatment. It was made up of two sections A and B. Section A contained the demographic data of the pupils, while section B contained 40 multiple-choice items with four options A, B, C and D (see Appendix IV). The initial test was constructed on the selected contents based on the table of specification drawn to reflect the three levels out of the six levels of behavioral objectives of cognitive domain by Bloom. The three levels are knowledge, comprehension and application. The topics included in the test were

1. Identification of Angles
2. Line and Plane Shapes
3. Circles
4. Solid Shapes
5. Binary Number System.

The test was given to ten primary Mathematics teachers to ascertain its content coverage, relevance and appropriateness. The content validity of the test was established using Lawshe's Content Validity Index (CVI).

$$CVI = \frac{Ne - N/2}{N/2}$$

Where:

CVI = Content Validity Index

Ne = Number of panelists rating the item good

N = Total number of panelists

Each of the ten teachers indicated the appropriateness of the items of the test, the content validity index of each item of the test was computed. The average of the content validity index of the entire test was calculated. This was used as the content validity index of the test and it was found to be 0.91. The reliability of the items of the test was established using KR_{20} by administering the items on 100 pupils who were not part of the sample and was found to be 0.78. Items with the discrimination index above 0.3 and difficulty level indices between 0.40 and 0.60 were included in the final test. The test blueprints for the final AMT is given in Table 3.3

Table 3.3: Test Blueprints for the Achievement in Mathematics Test

S/n	Content	Knowledge (35%)	Comprehension (15%)	Application (50%)	Total
1.	Identification of angles (22.5%)	1, 2, 3	4	5,6, 7, 8,9	9
2.	Line and plane shapes (22.5%)	10, 13, 14, 15, 16	11, 12,17	18	9

3.	Circles (25%)	19, 20	21, 27	22, 23, 24, 25, 26, 28	10
4.	Solid shapes (15%)	29, 30, 31, 32		33, 34	6
5.	Binary Number System (15%)			35, 36, 37, 38, 39, 40	6
	Total	**14**	**6**	**20**	**40**

AMT was dichotomously scored. 1 was assigned to a correct response while 0 was assigned to a wrong response.

3.5.2.2 Interest in Mathematics Scale (IMS)

Interest in Mathematics Scale (IMS) was constructed by the researcher after review of literature on interest coupled with the researcher's interaction with the pupils. The IMS consisted of Parts A and B. Part A contained demographic information of the respondents such as age and sex, while part B contained statements (items) on the interest of Pupils in Mathematics. The scale had three options Always, Often and Rarely (see Appendix V). The scale was given to five primary Mathematics teachers and five experts in educational psychology to check its relevance and appropriateness in terms of clarity and language used to ensure its applicability to the level of the pupils. Based on their comments, some items were totally expunged while some were modified. All of them confirmed the suitability of the IMS in measuring pupils' interest in Mathematics. The final scale comprised 20 items. Thereafter, they rated the scale and the its validity ratio was 0.93 using Lawshe's Content Validity Index (CVI). The reliability coefficient of the final scale was ascertained by giving the instrument with 100 primary five pupils of the schools that were not selected in the sample for the study. Cronbach alpha was used to establish internal consistency and reliability coefficient of IMS. The reliability of the instrument was found to be 0.93. The scoring of IMS was done as follows: For positively worded items; "always" = 3; "often" = 2 and "rarely" = 1. For negatively worded items; "always" = 1; "often" = 2 and "rarely" = 3.

3.5.2.3 Dexterity in Mathematics Test (DMT)

Dexterity in Mathematics Test (DMT) was constructed by the researcher after a careful review of literature. The test had Parts A and B. Part A focused on the personal information of the pupils, while part B contained items measuring dexterity of pupils in drawing and labeling Mathematics concepts (see Appendix VI). The test was given to ten primary Mathematics teachers to ascertain the appropriateness of the test. All of them confirmed that the instrument was appropriate for measuring pupils' dexterity in Mathematics and later rated the items of the scale. However, their comments were used to modify some of the items of the scale. The validity index of the scale was computed and found to be 1 using Lawshe's Content Validity Ratio. Also, the researcher developed a marking guide for the scoring of items of the test. DMT was dichotomously scored. A correct response was scored 1, while a wrong response was scored 0.

3.5.2.4 Pupils' Learning Style Scale (PLSS)

Pupils' Learning Styles Scale (PLSS) was adapted from Chislett and Chapman (2005). The scale contained two sections A and B (see Appendix VII). Section A focused on the demographic information of the pupils, section B contained items measuring the learning styles of the pupils. Section B of the scale contained ten items. Each item has 3 options – a, b and c. Option a represented visual learning styles, option b represented auditory learning styles, option c represented kinesthetic learning style. The highest number of option chosen by a pupil represented his/her learning style. In other word, a pupil that picked the higher number of option "a" belonged to visual learning style, a pupil that picked the higher number of option "b" belonged to auditory learning style, while a pupil that picked the higher number of option "c" belonged to kinesthetic learning style. PLSS was given to five primary Mathematics teachers and five experts in educational psychology to ascertain its validity and suitability in terms of clarity, language appropriateness and applicability to the level of the pupils. All of them approved the items of the scale and its validity indices was found to be 1. The inputs and observations of the teachers and the experts were considered to modify the scale.

Cronbach alpha was used to establish the reliability coefficient of PLSS and it was 0.84.

3.5.2.5 Mathematics Self-efficacy Scale (MSS)

This scale was constructed by the researcher. MSS consisted of two parts (A and B). Part A contain personal information of respondents, while part B comprised items on pupils' self-efficacy in Mathematics. The scale had three options which are; always, often and rarely (see Appendix VIII). The scale was given to five primary Mathematics teachers and five experts in educational psychology to ascertain its validity in terms of clarity, language appropriateness and applicability to the level of the pupils. They also rated the scale, the validity ratio of the scale was established using Lawshe's CVI and was 0.95. The reliability of the instrument was established by giving the scale to 100 primary five pupils of the schools that were not selected in the sample. The reliability coefficient of MSS established using Cronbach alpha and was found to be 0.82. The scoring of MSS was done as follows: For positively worded items; "always" = 3; "often" = 2 and "rarely" = 1. For negatively worded items; "always" = 1; "often" = 2 and "rarely" = 3.

3.5.2.6 Focus Group Discussion Guide (FGDG)

Focus Group Discussion Guide (FGDG) was constructed by the researcher to guide the discussion process during the FGD sessions. It was used to obtain qualitative information on the perception of pupils on issues related to team teaching (Appendix IX). To ensure the trustworthiness of FGDG, the researcher was objective in the study by analysing and reporting negative cases during the discussions. Also, the study adopted a combination of quantitative and qualitative approaches in its methodology (methodological triangulation). This is also a way of establishing trustworthiness of the qualitative research instruments for the study in which FGDG was one.

3.5.2.7 Interview Guide (IG)

Interview Guide (IG) was constructed by the researcher to guide the discussion process during the interview sessions. It was used to obtain qualitative information on perception of primary five teachers and head teachers on issues related to team teaching (see Appendix X). The trustworthiness of IG was established by reporting negative cases in the study. In addition, the study used a combination of quantitative and qualitative approaches in its methodology (methodological triangulation) which served as a means of ensuring trustworthiness of the qualitative research instruments used in the study.

3.6 Procedure for Data Collection

The researcher collected a letter of introduction from the Head of the International Centre for Educational Evaluation (ICEE), Institute of Education, University of Ibadan, to the head teachers of the selected primary schools for permission to conduct the research. The researcher met with the head teachers and the primary five teachers Mathematics teachers of the selected schools and discussed the reasons for the study; the dimension of the study as well as the use of their school for the period of the study. Eighteen research assistants were trained and used for the study. They comprised twelve primary five Mathematics teachers, three post graduate students in the ICEE, Institute of Education, University of Ibadan and three lecturers in the School of Early Childhood, Primary, Adults and Non-formal Education (ECPAE), Federal College of Education (Special), Oyo. The twelve primary five Mathematics teachers served as team teachers and possessed a minimum of Nigerian Certificate in Education (NCE). The post graduate students conducted the discussion sessions for FGD and interviewed team teachers while the lecturer conducted interview sessions for the head-teachers. Data collection for both quantitative and qualitative components of the study was carried sequentially over a period of ten weeks. General planning and training of research assistants lasted a week. Pretest was administered within a week using the developed instruments – Achievement in Mathematics Test (AMT), Interest in Mathematics Scale (IMS) and Dexterity in Mathematics Test (DMT). Implementation of treatments, (implementing the new models in the class) lasted five weeks. All the three groups were taught from Monday to Friday for five weeks. After the exposure of the participants to treatments, posttest was given to the pupils using AMT, IMS and DMT. The researcher ensured proper monitoring of the administration of the experimental packages. Interview sessions were conducted at the end of the experiment. FGD session lasted for a week. FGD was carried out after the administration of posttest. The period of data collection is summarised as follows:

Week 1 - General planning for teaching and training of research assistants.

The three groups involved in the study included Collaborative Team Teaching group, Alternative Team Teaching group and control group. A week training was given to the research assistants on the use of instructional guides and instruments. The twelve team teachers demonstrated the instructional guides to ensure uniformity of use. The areas of discrepancies in the use of the instruments were discussed and the reason for uniformity of administration of the guides was explained. However, teachers in the control group did not participate in the training on the use of Collaborative and Alternative Team teaching models.

Week 2 - Administration of Pretest

Sequel to the implementation of treatments in the selected schools, Achievement in Mathematics Test (AMT), Interest in Mathematics Scale (IMS) and Dexterity in Mathematics Test (DMT) were administered to all the pupils used for the study (both in the experimental and control groups). AMT was administered first, followed by IMS and DMT.

Week 3-7 - Implementation of Treatments

This was conducted by exposing the pupils of the selected schools to the experiments. Pupils in experimental group 1 were exposed to Collaborative Team Teaching Model, pupils in the experimental group II were exposed to Alternative Team Teaching Model while pupils in the control group were exposed to the conventional teaching. The experiment was carried out for five periods per week for five weeks. During the administration of the treatment, the researcher went round the selected schools to monitor that team teachers followed the steps as contained in the instructional guides.

Week 8 - 9 - Posttest/Interview Schedule

After the administration of the treatments to the experimental groups, posttest was conducted to all the pupils using AMT, IMS and DMT as used for pretest. AMT was administered first, followed by IMS and DMT. Interviewed sessions were conducted for team teachers and head-teachers of the experimental schools.

Week 10 - FGD

FGD was conducted for selected pupils in the six schools that were used for collaborative and alternative team teaching.

3.7 Methods of Data Analysis

Data generated from the experiments was analysed using Analysis of Covariance (ANCOVA). Scores obtained from the data was analysed to determine the main effect and interaction effect of all variables involved. All hypotheses were tested at 0.05 - level of significance. Also, interview and FGD data was analysed using content analysis. Post hoc test was carried out using Sidak (Sidak post hoc is used when the groups are unequal). Hypotheses were analysed using ANCOVA while research questions were analysed using manual inductive approach of content analysis.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

This chapter presents the sequence of data analysis, results and discussion in line with the hypotheses stated and research questions. Hypotheses were tested and findings were interpreted at 0.05 level of significance (P<0.05).

4.1 Testing of hypotheses

4.1.1 Hypothesis 1(a): There is no significant main effect of treatment on primary pupils' achievement in Mathematics.

Table 4.1.1a: Summary of the Analysis of Covariance (ANCOVA) of Pupils' Achievement in Mathematics by Treatment (Collaborative, Alternative and Conventional team teaching), Learning Styles and Self-efficacy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	9405.644[a]	26	361.756	7.552	.000	.344
Intercept	15992.103	1	15992.103	333.834	.000	.472
Pre Achievement	33.174	1	33.174	.693	.406	.002
Main effect						
Treatment	6031.519	2	3015.760	62.954	.000	.252
Learning styles	136.455	2	68.227	1.424	.242	.008
Self-efficacy	73.428	2	36.714	.766	.465	.004
2-Way Interaction effect						
Treatment * learning styles	352.042	4	88.011	1.837	.121	.019
Treatment * self-efficacy	87.502	4	21.876	.457	.768	.005
Learning styles * self-efficacy	302.901	4	75.725	1.581	.179	.017
3-way interaction effect						
Treatment * learning styles * self-efficacy	426.057	7	60.865	1.271	.265	.023
Error	17916.256	374	47.904			
Total	106507.000	401				
Corrected Total	27321.900	400				

a. R. squared = .285 (Adjusted R squared = .235)

Table 4.1.1a reveals the summary of Analysis of Covariance (ANCOVA) of pupils' posttest achievement scores in Mathematics by treatment, learning styles and self-efficacy. The table indicates that after adjusting for the covariance (pretest scores in Mathematics), main effect of treatment was significant on pupils' achievement in Mathematics; $F_{(2,374)} = 62.954$, $p<0.05$. The null hypothesis which stated that there is no significant main effect of treatment on pupils' achievement in Mathematics was therefore rejected. This implied that the treatment improved pupils' achievement in Mathematics. The adjusted R squared value of .299 showed that the independent variables accounts for 29.9% of the variance observed on pupils' academic achievement in Mathematics. Also, the table shows that the partial eta squared was estimated to be 0.252. This indicated that treatment accounted for 25.2% of the observed variance on the pupils' academic achievement in Mathematics. The results of the estimated marginal means and pairwise comparison of pupils' achievement in Mathematics are displayed in Table 4.1.1b and Table 4.1.1c.

Table 4.1.1b: Estimated Marginal Means of Pupils' Achievement in Mathematics by Treatment

			95% Confidence Interval	
Treatment	Mean	Std. Error	Lower Bound	Upper Bound
Collaborative	12.13	.744	10.656	13.601
Alternative	21.09	.737	19.639	22.537
Control	9.84	.749	8.377	11.302

a. Covariates appearing in the model are evaluated at the following values: pre achievement = 7.28

Table 4.1.1c: Pairwise Comparison of Pupils' Achievement in Mathematics by Treatment

					95% Confidence Interval for Difference	
(I) Treatment	(J) Treatment	Mean Difference (I-J)	Std. Error	Sig	Lower Bound	Upper Bound
Collaborative	Alternative	-10.208*	.848	.000	-12.24	-8.17
	Control	-1.758	.848	.112	-3.79	.28
Alternative	Collaborative	10.208*	.848	.000	8.17	12.74
	Control	8.450*	.870	.000	6.36	10.54
Control	Alternative	-8.450*	.870	.000	-10.54	- 6.36
	Collaborative	1.758	.848	.112	-.28	3.79

Based on estimated marginal means
The mean difference is significant at 0.5 level
Adjusted for multiple comparisons: Sidak

Table 4.1.1b shows that pupils in experimental group II (alternative team teaching) had the highest mean score 21.09, followed by pupils in experimental group I (collaborative team teaching) with the mean score 12.13 while the control group had the least mean score 9.84. Table 4.1.1c displays the result of the pairwise multiple comparison which indicated that there existed a significant mean difference between the achievement of pupils in collaborative and alternative team teaching groups. The mean difference between the alternative team teaching and collaborative team teaching as well as the mean difference between the alternative team teaching and control group were significant. In the same vein, the result shows that there existed significant mean difference between the control group and alternative team teaching. The estimated marginal mean scores were further displayed in the Figure 4.1.1

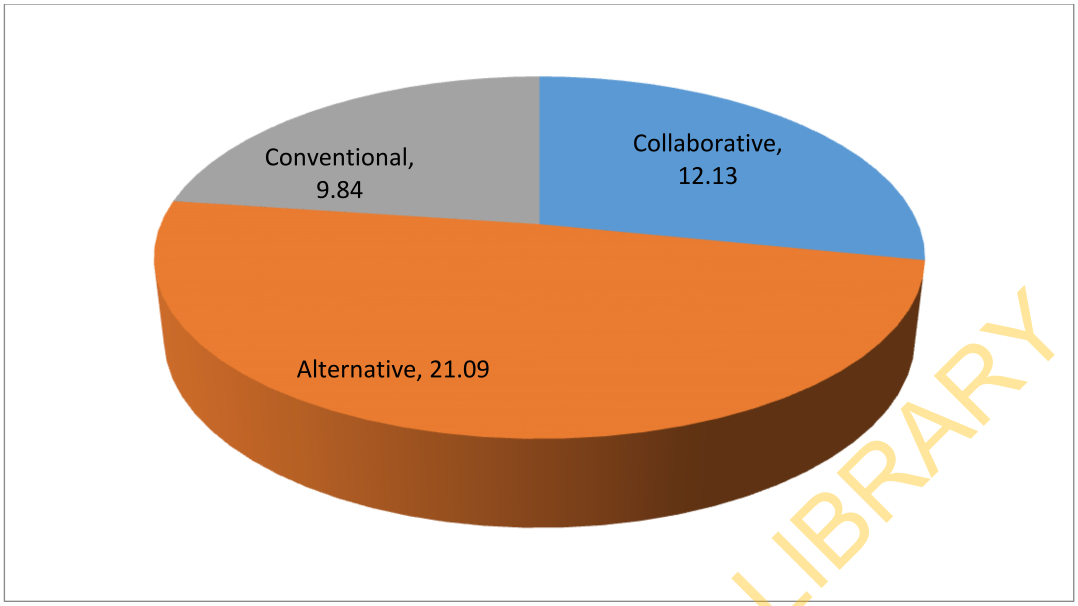

Figure 4.1.1: Chart showing Estimated Marginal Means of Pupils' Achievement by Treatment (Collaborative team teaching, Alternative team teaching and control group)

4.1.2 Hypothesis 2a: There is no significant main effect of learning styles on primary pupils' achievement in Mathematics.

Table 4.1.1a shows that there was no significant main effect of learning styles on primary pupils' academic achievement in Mathematics, $F_{(2,374)} = 1.424$; $p>0.05$. The null hypothesis that stated that there is no significant main effect of learning styles on primary pupils' achievement in Mathematics was not rejected.

Table 4.1.1d: Estimated Marginal Means of Pupils' Achievement in Mathematics by Learning Styles

			95% Confidence Interval	
Learning Styles	Mean	Std. Error	Lower Bound	Upper Bound
Visual	15.31	.748	12.838	16.781
Auditory	13.92	.604	12.735	15.112
Kinesthetic	14.04	.870	12.323	15.746

Covariates appearing in the model are evaluated at the following values: pre achievement = 7.28

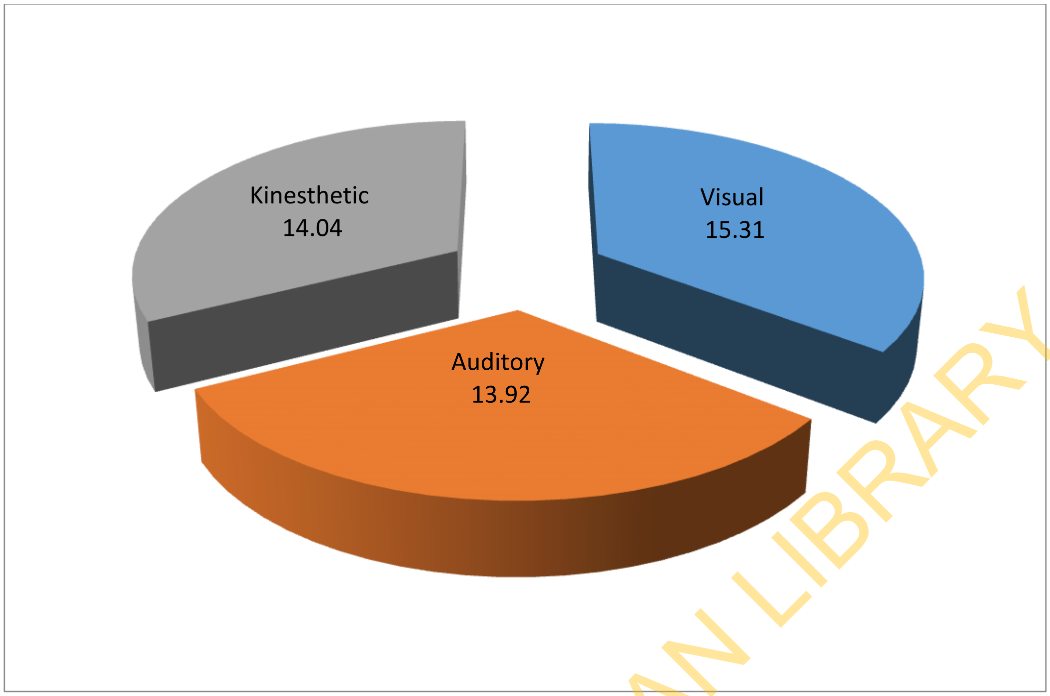

Figure 4.1.2: Chart showing Estimated Marginal Means of Pupils' Achievement by Learning Styles (Visual, Auditory and Kinesthetic learning styles)

Estimated marginal means in Table 4.1.1d and Figure 4.1.2 showed that pupils with visual learning style had the highest mean with the mean score 15.31, followed by pupils with kinesthetic learning style with mean score 14.04 while pupils with auditory learning style had the least mean score 13.92. However, the differences in their mean scores were not statistically significant.

4.1.3 Hypothesis 3a: There will be no significant main effect of self-efficacy on primary pupils' achievement in Mathematics

Table 4.1.1a shows no significant main effect of self-efficacy on primary pupils' academic achievement in Mathematics, $F_{(2,374)} = .766$; $p>0.05$. Consequently, the null hypothesis that stated that there is no significant main effect of self-efficacy on primary pupils' achievement in Mathematics was not rejected.

Table 4.1.1e: Estimated Marginal Means of Pupils' Achievement in Mathematics by Self-efficacy

			95% Confidence Interval	
Self-efficacy	Mean	Std. Error	Lower Bound	Upper Bound
Low	14.11	.725	12.680	15.531
Moderate	14.93	.601	13.749	16.114
High	14.26	.899	12.488	16.024

a. Covariates appearing in the model are evaluated at the following values: pre achievement = 7.28.

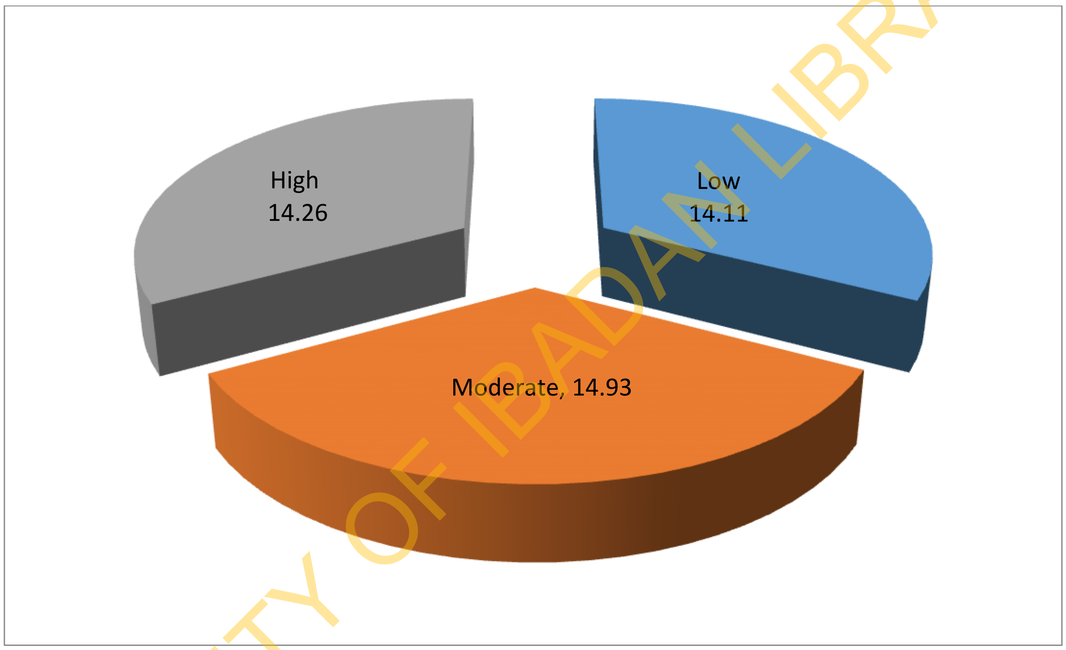

Figure 4.1.3: Chart showing Estimated Marginal Means of Pupils' Achievement by Self-efficacy (Low, Moderate and High Self-efficacy).

Table 4.1.1e and Figure 4.1.2 present the estimated marginal means of pupils' achievement by self-efficacy. It indicated that pupils with moderate self-efficacy had the highest mean score 14.93, followed by pupils with high self-efficacy with the mean score 14.26, while pupils with low self-efficacy had the least mean score 14.11. The difference in their mean score was not statistically significant.

4.1.4 Hypothesis 4a: There will be no significant combined effect of treatment and learning styles on primary pupils' achievement in Mathematics.

The result on Table 4.1.1a reveals no significant joint effect of treatment and learning styles on primary pupils' academic achievement in Mathematics, $F_{(4,374)} = 1.837$; $p>0.05$. Consequently, the null hypothesis that stated that there is no significant interaction effect of treatment and learning styles on primary pupils' achievement in Mathematics was not rejected.

Table 4.1.1f: Estimated Marginal Mean of Pupils' Achievement in Mathematics by Treatment and Learning Styles

Treatment	Learning Styles	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Collaborative team teaching	Visual	9.58 [a]	1.269	7.078	12.074
	Auditory	10.66 [a]	1.057	8.580	12.736
	Kinesthetic	9.28 [a]	1.495	6.344	12.223
Alternative team teaching	Visual	21.45 [a]	1.314	18.871	24.036
	Auditory	19.98 [a]	.939	18.135	21.829
	Kinesthetic	21.83 [a]	1.490	18.898	24.758
Conventional team teaching	Visual	14.90 [a]	1.321	12.300	17.494
	Auditory	11.13 [a]	1.137	8.895	13.366
	Kinesthetic	9.47 [a]	1.457	6.607	12.336

a. Covariates appearing in the model are evaluated at the following values: pre achievement = 7.28

Table 4.1.1f presents the estimated marginal mean of pupils' achievement in Mathematics by treatment and learning styles. It is indicated in the table that pupils with visual learning style in the alternative team teaching model had the highest mean score 21.45; followed by pupils with visual learning style in the conventional teaching,14.90, while pupils with visual learning style in the collaborative team teaching model had the least mean score (9.58). Also, Table 4.1.1 f shows that pupils with auditory learning style in the alternative team teaching model had the highest mean score (19.98); followed by pupils with auditory learning style in the conventional teaching (11.13) while pupils with auditory learning style in the collaborative team teaching model had the least mean score (10.66). Moreover, Table 4.1.1f indicated that pupils with kinesthetic learning style in the alternative team teaching model had the highest mean score (21.83); followed by pupils with kinesthetic learning style in the collaborative team teaching model (9.58) while pupils with kinesthetic learning style in the conventional teaching had the least mean score (9.47). However, the difference in their mean scores was not statistically significant.

4.1.5 Hypothesis 5a: There will be no significant joint effect of treatment and self-efficacy on primary pupils' achievement in Mathematics

Table 4.1.1a shows no significant interaction joint of treatment and self-efficacy on primary pupils' academic achievement in Mathematics, $F_{(4,374)} = .457$; $p>0.05$. The null hypothesis that stated that there is no significant interaction effect of treatment and self-efficacy on primary pupils' achievement in Mathematics was therefore not rejected.

Table 4.1.1g: Estimated Marginal Mean of Pupils' Achievement in Mathematics by Treatment and Self-Efficacy

Treatment	Self-efficacy	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Collaborative team teaching	Low	9.30 [a]	1.186	6.968	11.633
	Moderate	10.99 [a]	.817	9.391	12.606
	High	9.22 [a]	1.700	5.877	12.564
Alternative team teaching	Low	21.96 [a]	1.606	18.797	25.112
	Moderate	20.82 [a]	1.149	18.562	23.080
	High	20.49 [a]	.959	18.603	22.374
Conventional team teaching	Low	11.06 [a]	.869	9.352	12.770
	Moderate	12.97 [a]	1.127	10.759	15.990
	High	12.46 [a]	2.098	8.336	16.585

Covariates appearing in the model are evaluated at the following values: pre achievement = 7.28

Table 4.1.1g showed pupils with low self-efficacy in the alternative team teaching model had the highest mean score (21.96) in achievement in Mathematics; followed by pupils with low self-efficacy in the conventional teaching (11.06), while pupils with low self-efficacy in the collaborative team teaching model had the least mean score (9.30). In addition, Table 4.1.1g shows that pupils with moderate self-efficacy in the alternative team teaching model had the highest mean score (20.49), followed by pupils with moderate self-efficacy in the conventional teaching (12.97) while pupils with moderate-self-efficacy in the collaborative team teaching model had the least mean score (10.99). In addition, Table 4.1.1g shows that pupils with high self-efficacy in the alternative team teaching model had the highest mean score (20.49); followed by pupils with high self-efficacy in the conventional teaching (12.46), while pupils with high self-efficacy in the collaborative team teaching mode had the least mean score (9.22). The difference in their mean scores was not statistically significant.

4.1.6 Hypothesis 6a: There is no significant interaction effect of learning styles and self-efficacy on primary pupils' achievement in Mathematics

Table 4.1.1a reveals that there was no significant interaction effect of learning styles and self-efficacy on primary pupils' academic achievement in Mathematics, $F_{(4,374)} = 1.581; p>0.05$. Consequently, the null hypothesis that stated that there is no significant interaction effect of learning styles and self-efficacy on primary pupils' achievement in Mathematics was not rejected.

Table 4.1.1h: Estimated Marginal Mean of Pupils' Achievement in Mathematics by Learning Styles and Self-efficacy

Learning Styles	Self-efficacy	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Visual	Low	16.81 [a]	1.252	14.350	19.274
	Moderate	15.54 [a]	1.641	13.491	17.583
	High	13.58 [a]	1.549	10.535	16.626

Auditory	Low	13.79 [a]	.892	12.032	15.541
	Moderate	13.65 [a]	.831	12.013	15.280
	High	14.34 [a]	1.344	11.969	16.981
Kinesthetic	Low	11.72 [a]	1.537	8.694	14.741
	Moderate	15.61 [a]	1.216	13.220	18.001
	High	15.15 [a]	1.867	11.475	18.817

Covariates appearing in the model are evaluated at the following values: pre achievement = 7.28

Table 4.1.1h shows pupils with low self-efficacy in the visual learning style group had the highest mean score (16.81); followed by pupils with low self-efficacy in the auditory learning style group (13.79), while pupils with low self-efficacy in the kinesthetic learning style group had the least mean score (11.72). In addition, Table 4.1.1g shows that pupils with moderate self-efficacy in the kinesthetic learning style group had the highest mean score (15.62); followed by pupils with moderate self-efficacy in the visual learning style group (15.54), while pupils with moderate-self-efficacy in the auditory learning style group had the least mean score (13.65). In addition, Table 4.1.1g shows that pupils with high self-efficacy in the kinesthetic learning style group had the highest mean score (15.15); followed by pupils with high self-efficacy in the auditory learning style group (14.33) while pupils with high self-efficacy in the visual learning style group had the least mean score (13.58). The difference in their mean scores was not statistically significant.

4.1.7 Hypothesis 7a: There will be no significant combined effect of treatment, learning styles and self-efficacy on primary pupils' achievement in Mathematics

Table 4.1.1a reveals no significant interaction combined of treatment, learning styles and self-efficacy on primary pupils' academic achievement in Mathematics, $F_{(7,374)} = 1.271$; $p>0.05$. Therefore, the null hypothesis which stated that there is no significant interaction effect of treatment, learning styles and self-efficacy on primary pupils' achievement in Mathematics was not rejected.

4.1.8 Hypothesis 1b: There is no significant main effect of treatment on primary pupils' interest in Mathematics

Table 4.2.1a: Summary of the Analysis of Covariance (ANCOVA) of Pupils' Interest in Mathematics by Treatment (Collaborative, Alternative and Conventional team teaching), Learning Styles and Self-efficacy

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	21061.820[a]	26	810.070	4.501	.000	.238
Intercept	73012.244	1	73012.244	405.687	.000	.520
Pre Interest	112.115	1	112.115	.623	.430	.002
Main effect						
Treatment	10747.486	2	5373.743	29.859	.000	.138
Learning styles	22.204	2	11.102	.062	.940	.000
Self-efficacy	49.035	2	24.518	.136	.873	.001
2-Way Interaction effect						
Treatment * learning styles	403.449	4	100.862	.560	.692	.006
Treatment * self-efficacy	454.669	4	113.667	.632	.640	.007
Learning styles * self-efficacy	251.038	4	62.760	.349	.845	.004
3-way interaction effect						
Treatment * learning styles * self-efficacy	546.348	7	78.050	.434	.881	.008
Error	67309.427	374	179.972			
Total	530954.000	401				
Corrected Total	88371.247	400				

R. squared = .238 (Adjusted R squared = .185)

4.2.1a reveals the summary of Analysis of Covariance (ANCOVA) of pupils' posttest interest scores in Mathematics by treatment, learning styles and self-efficacy. The table indicates that after adjusted for the covariance (pretest scores in interest in

Mathematics), there was significant effect of treatment on pupils' interest in Mathematics; $F_{(2,374)} = 29.859$, $p<0.05$. The null hypothesis which stated that there is no significant effect of treatment on pupils' interest in Mathematics was therefore rejected. This implied that the treatment improved pupils' interest in Mathematics. The adjusted R squared value of .185 showed that the independent variables accounts for 18.5% of the variance observed on pupils' interest in Mathematics. Also, the table shows that the partial eta squared was estimated to be 0.138. This indicated that treatment accounted for 13.8% of the variance observed on the pupil' interest in Mathematics. The results of the estimated marginal means and pairwise comparison of pupils' interest in Mathematics are displayed in Table 4.2.1b and Table 4.2.1c.

Table 4.2.1b: Estimated Marginal Means of Pupils' Interest in Mathematics by Treatment

			95% Confidence Interval	
Treatment	Mean	Std. Error	Lower Bound	Upper Bound
Collaborative	27.83 [a,b]	1.712	24.458	31.190
Alternative	42.82 [a]	1.414	40.035	45.597
Control	28.15 [a]	1.553	25.095	31.204

Covariates appearing in the model are evaluated at the following values: pre interest =18.35

Table 4.2.1c: Pairwise Comparison of Pupils' Interest in Mathematics by Treatment

(I) Treatment	(J) Treatment	Mean Difference (I-J)	Std. Error	Sig	95% Confidence Interval for Difference Lower Bound	Upper Bound
Collaborative	Alternative	-14.569*	1.608	.000	-18.43	-10.71
	Control	-.011	1.608	1.000	-3.87	3.85
Alternative	Collaborative	14.569*	1.608	.000	10.71	18.43
	Control	14.558*	1.649	.000	10.60	18.51
Control	Alternative	-14.558*	1.649	.000	-18.51	-10.60
	Collaborative	.011	1.608	1.000	-3.85	3.87

Based on estimated marginal means

The mean difference is significant at 0.5 level

Adjusted for multiple comparisons: Sidak

Table 4.2.1b shows that pupils in experimental group II (alternative team teaching) had the highest mean score 42.82, followed by pupils in the control group with the mean score 28.15, while pupils in experimental group I (collaborative team teaching) had the least mean score 27.83. Table 4.2.1c displays the result of the pairwise multiple comparison which indicated that there existed a significant mean difference between the interest of pupils in collaborative and alternative team teaching groups. The mean difference between the alternative team teaching and collaborative team teaching was significant. The mean difference between the alternative team teaching and control group was significant. Also, the result showed that there existed a significant mean difference between the control group and alternative team teaching. However, the results show that the mean difference between the collaborative team teaching and control group was not significant. The mean difference between the control group and the collaborative team teaching group was not significant. The estimated marginal mean scores were further displayed in the Figure 4.2.1

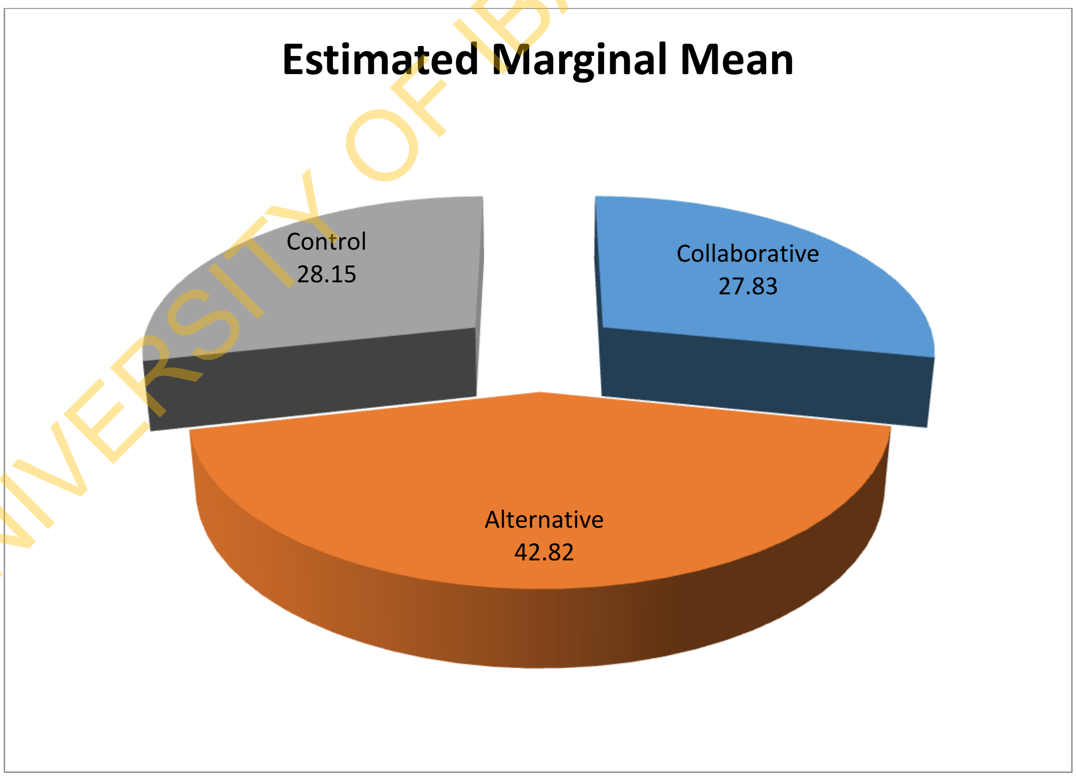

Figure 4.2.1: Chart showing Estimated Marginal Means of Pupils' Interest in Mathematics by Treatment (Collaborative team teaching, Alternative team teaching and control group)

4.1.9 Hypothesis 2b: There is no significant main effect of learning styles on primary pupils' interest in Mathematics

Table 4.2.1a shows that there was no significant main effect of learning styles on primary pupils' interest in Mathematics, $F_{(2,374)} = .062$; $p>0.05$. The null hypothesis which stated that there is no significant main effect of learning styles on primary pupils' interest in Mathematics was not rejected.

Table 4.1.1d: Estimated Marginal Means of Pupils' Interest in Mathematics by Learning Styles

Learning Styles	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Visual	33.32[a]	1.581	30.213	36.430
Auditory	32.60[a]	1.319	30.005	35.194
Kinesthetic	33.50[a,b]	1.774	30.010	36.986

Covariates appearing in the model are evaluated at the following values: pre achievement = 18.35

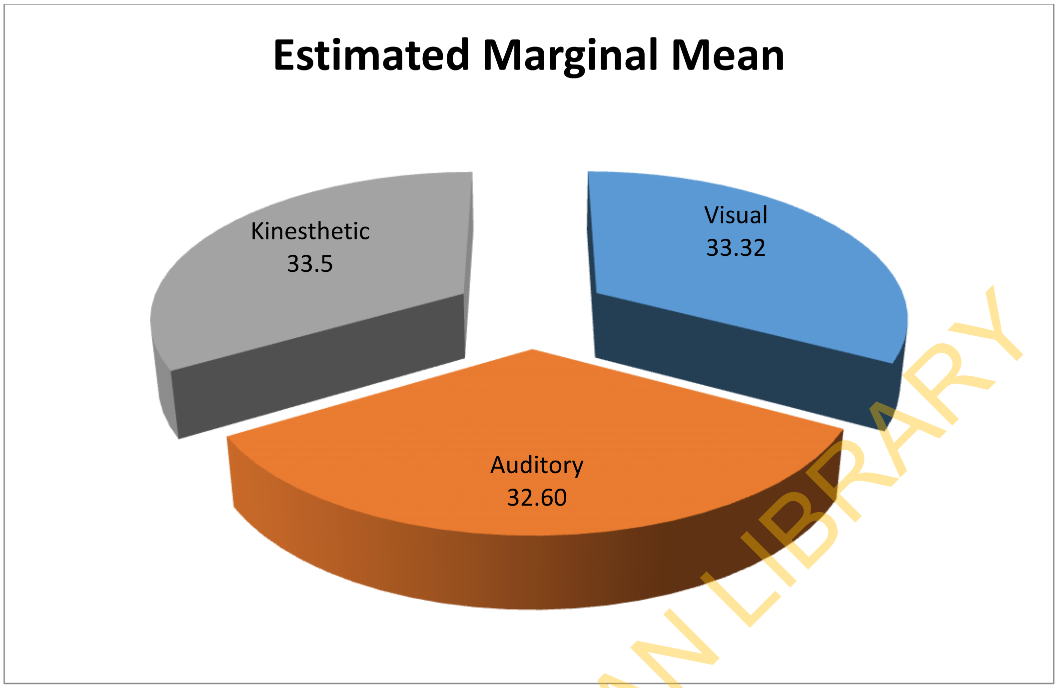

Figure 4.2.2: Chart showing Estimated Marginal Means of Pupils' Interest in Mathematics by Learning Styles (Visual, Auditory and Kinesthetic learning styles)

Table 4.2.1d and figure 4.2.2 present the estimated marginal means of pupils in interest. Table 4.2.1d shows that pupils with kinesthetic learning style had the highest mean with the mean score 33.50, followed by pupils with visual learning style with mean score 33.32, while pupils with auditory learning style had the least mean score with the mean score 32.60. This implied that the mean score of pupils with kinesthetic learning styles was greater than the mean score of pupils with visual learning style by 0.18. The mean score of pupils with visual learning style was greater than the mean score of pupils with auditory by 0.72. The differences in their mean scores were not statistically significant.

4.1.10 Hypothesis 3b: There is no significant main effect of self-efficacy on primary pupils' interest in Mathematics

Table 4.2.1a indicates that there was no significant main effect of self-efficacy on primary pupils' interest in Mathematics, $F_{(2,374)} = .136$; $p>0.05$. Consequently, the null hypothesis which stated that there is no significant main effect of self-efficacy on primary pupils' interest in Mathematics was not rejected.

Table 4.2.1e: Estimated Marginal Means of Pupils' Interest in Mathematics by Self-efficacy

			95% Confidence Interval	
Self-efficacy	Mean	Std. Error	Lower Bound	Upper Bound
Low	32.58[a]	1.381	29.859	35.291
Moderate	33.52[a]	1.159	31.236	35.795
High	33.31[a,b]	2.102	29.173	37.441

Covariates appearing in the model are evaluated at the following values: pre interest = 18.35

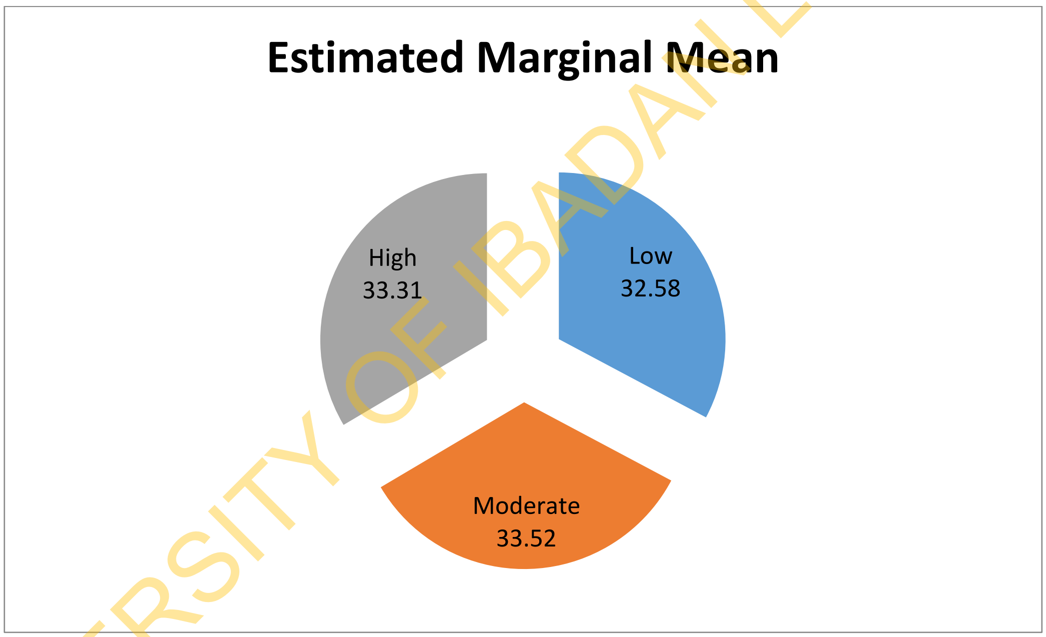

Figure 4.2.3: Chart showing Estimated Marginal Means of Pupils' Interest in Mathematics by Self-efficacy (Low, Moderate and High Self-efficacy)

The estimated marginal mean of pupils in interest is presented in Table 4.1.1e and Figure 4.2.3. It indicated that there were differences in the estimated marginal means of pupils in interest based on their level of self-efficacy. Pupils with moderate self-efficacy had the highest mean score 33.52, followed by pupils with high self-efficacy with the mean score 33.31, while pupils with low self-efficacy had the least mean score 32.58. Also, the difference between the mean score of pupils with moderate self-efficacy and those with high self-efficacy was 0.21 while the difference between pupils with high self-efficacy with those with low self-efficacy was 0.94. However, the differences in their mean scores were not statistically significant.

4.1.11 Hypothesis 4b: There is no significant interaction effect of treatment and learning styles on primary pupils' interest in Mathematics

The result on Table 4.2.1a reveals that there was no significant interaction effect of treatment and learning styles on primary pupils' interest in Mathematics, $F_{(4,374)} = .560; p>0.05$. Consequently, the null hypothesis which stated that there is no significant interaction effect of treatment and learning styles on primary pupils' interest in Mathematics was not rejected.

Table 4.2.1f: Estimated Marginal Mean of Pupils' Interest in Mathematics by Treatment and Learning Styles

Treatment Styles	Learning	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Collaborative team teaching	Visual	28.87 [a]	2,650	23.661	34.084
	Auditory	28.77 [a]	2.046	24.747	32.793
	Kinesthetic	26.81 [a]	3.248	20.418	33.192
Alternative team teaching	Visual	43.96 [a]	2.526	39.003	48.915
	Auditory	42.56 [a]	1.826	38.968	46.150
	Kinesthetic	41.93 [a]	2.885	36.256	47.603
Conventional team teaching	Visual	27.13 [a]	3.025	21.185	33.081
	Auditory	26.47 [a]	2.854	20.859	33.082
	Kinesthetic	30.89 [a]	2.823	25.340	36.443

Covariates appearing in the model are evaluated at the following values: pre interest = 18.35

Table 4.1.1f present the estimated marginal mean of pupils' interest in Mathematics by treatment and learning styles. It is indicated in the table that pupils with visual learning style in the alternative team teaching model had the highest mean score 43.96 in interest in Mathematics; followed by pupils with visual learning style in the collaborative team teaching model 28.87 while pupils with visual learning style in the conventional teaching had the least mean score 27.13. Also, Table 4.1.1f shows that pupils with auditory learning style in the alternative team teaching moderate had the highest mean score 42.93 in interest in Mathematics; followed by pupils with auditory learning style in the collaborative team teaching model 28.77, while pupils with auditory learning style in the conventional teaching had the least mean score 26.47. Moreover, Table 4.1.1f indicates that pupils with kinesthetic learning style in the alternative team teaching model had the highest mean score 41.93 in interest in Mathematics; followed by pupils with kinesthetic learning style in the conventional teaching with mean score 30.89 while pupils with kinesthetic learning style in the collaborative team teaching model had the least mean score 26.81. However, the difference in their mean scores was not statistically significant.

4.1.12 Hypothesis 5b: There is no significant interaction effect of treatment and self-efficacy on primary pupils' interest in Mathematics

Table 4.2.1a shows that there was no significant interaction effect of treatment and self-efficacy on primary pupils' interest in Mathematics, $F_{(4,374)} = .632$; $p>0.05$. The null hypothesis which stated that there is no significant interaction effect of treatment and self-efficacy on primary pupils' interest in Mathematics was therefore not rejected.

Table 4.2.1g: Estimated Marginal Mean of Pupils' Interest in Mathematics by Treatment and Self-Efficacy

Treatment	Self-efficacy	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Collaborative team teaching	Low	26.19 [a]	2.16	21.888	30.484
	Moderate	30.02 [a]	1.558	26.960	33.088
	High	28.26 [a]	3.616	20.734	35.741
Alternative team teaching	Low	42.41 [a]	3.111	36.294	48.528
	Moderate	41.52 [a]	2.211	37.171	45.865
	High	44.52 [a]	1.852	40.878	48.159

Conventional team teaching	Low	29.13 [a]	1.655	25.875	32.383
	Moderate	29.01 [a]	2.184	24.711	33.300
	High	24.09 [a]	5.478	13.324	34.865

Covariates appearing in the model are evaluated at the following values: pre interest = 18.35

Table 4.2.1g shows pupils with low self-efficacy in the alternative team teaching model had the highest mean score 42.41; followed by pupils with low self-efficacy in the conventional teaching with mean score 29.13, while pupils with low self-efficacy in the collaborative team teaching model had the least mean score 26.12. In addition, Table 4.2.1g showed that pupils with moderate self-efficacy in the alternative team teaching model had the highest mean score 44.52 in interest in Mathematics; followed by pupils with moderate self-efficacy in the collaborative team teaching model with mean score 30.02, while pupils with moderate-self-efficacy in conventional teaching had the least mean score 29.10. In addition, Table 4.2.1g showed that pupils with high self-efficacy in the alternative team teaching model had the highest mean score 44.52; followed by pupils with high self-efficacy in the collaborative team teaching model 28.26, while pupils with high self-efficacy in the conventional teaching had the least mean score 24.09. The difference in their mean scores was not statistically significant.

4.1.13 Hypothesis 6b: There is no significant interaction effect of learning styles and self-efficacy on primary pupils' interest in Mathematics

Table 4.2.1a reveals that there was no significant interaction effect of learning styles and self-efficacy on primary pupils' interest in Mathematics, $F_{(4,374)} = .845$; $p>0.05$. Consequently, the null hypothesis which stated there is no significant interaction effect of learning styles and self-efficacy on primary pupils' interest in Mathematics was not rejected.

Table 4.2.1h: Estimated Marginal Mean of Pupils' Interest in Mathematics by Learning Styles and Self-efficacy

Learning Styles	Self-efficacy	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Visual	Low	34.57 [a]	2.419	29.815	39.329
	Moderate	34.21 [a]	1.996	30.281	38.132
	High	31.19 [a]	3.560	24.185	38.187
Auditory	Low	31.50 [a]	1.715	28.125	34.870
	Moderate	33.59 [a]	1.611	30.424	36.761
	High	32.71 [a]	3.183	26.450	38.967
Kinesthetic	Low	31.66 [a]	2.894	25.959	37.354
	Moderate	32.75 [a]	2.348	28.131	37.366
	High	37.37 [a]	4.376	28.782	45.990

Covariates appearing in the model are evaluated at the following values: pre interest = 18.35

Table 4.2.1h shows pupils with low self-efficacy in the visual learning style group had the highest mean score 34.57 in interest in Mathematics; followed by pupils with low self-efficacy in the kinesthetic learning style group with mean score 31.66, while pupils with low self-efficacy in the auditory learning style group had the least mean score 31.50. In addition, Table 4.2.1h shows that pupils with moderate self-efficacy in the visual learning style group had the highest mean score 34.21 in interest in Mathematics; followed by pupils with moderate self-efficacy in the auditory learning style group 33.59, while pupils with moderate-self-efficacy in the kinesthetic learning style group had least mean score 32.75. In addition, Table 4.2.1h showed that pupils with high self-efficacy in the kinesthetic learning style group had the higher mean score 37.37 in interest in Mathematics; followed by pupils with high self-efficacy in the auditory learning style group 32.71 while pupils with high self-efficacy in the visual learning style group had the least mean score 31.19. The difference in their mean scores was not statistically significant.

4.1.14 Hypothesis 7b: There is no significant interaction effect of treatment, learning styles and self-efficacy on primary pupils' interest in Mathematics

Table 4.2.1a shows that there was no significant interaction effect of treatment, learning styles and self-efficacy on primary pupils' interest in Mathematics, $F_{(7,374)} = .434$; $p>0.05$. Therefore, the null hypothesis which stated that there is no significant interaction effect of treatment, learning styles and self-efficacy on primary pupils' interest in Mathematics was not rejected.

4.1.15 Hypothesis 1c: There is no significant main effect of treatment on primary pupils' dexterity in drawing and labeling of Mathematics concepts

Table 4.3.1a: Summary of the Analysis of Covariance (ANCOVA) of Pupils' Dexterity in Drawing and Labeling Mathematics Concepts by Treatment (Collaborative, Alternative and Conventional team teaching, Learning Styles and Self-efficacy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	162.948[a]	26	6.267	1.388	.100	.088
Intercept	3977.729	1	3977.729	880.874	.000	.702
Pre Dexterity	24.359	1	24.359	5.394	.021	.014
Main effect						
Treatment	4.876	2	2.438	.540	.583	.003
Learning styles	.534	2	.267	.059	.943	.000
Self-efficacy	3.775	2	1.887	.418	.659	.002
2-Way Interaction effect						
Treatment * learning styles	36.854	4	9.213	2.040	.088	.021
Treatment * self-efficacy	7.737	4	1.934	.428	.788	.005
Learning styles * self-efficacy	31.587	4	7.897	1.749	.139	.018
3-way interaction effect						
Treatment * learning styles * self-efficacy	42.742	7	6.106	1.352	.225	.025
Error	1688.858	374	4.516			
Total	33138.000	401				
Corrected Total	1851.805	400				

R. Squared = .088 ((Adjusted R. Squared = .025)

Table 4.3.1a presents the summary of Analysis of Covariance (ANCOVA) of pupils' post test scores in dexterity in drawing and labeling Mathematics concepts by treatment, learning styles and self-efficacy. The table shows that having adjusted for the covariance (pretest scores dexterity in drawing and labeling Mathematics concepts), there is no significant main effect of treatment on pupils' dexterity in drawing and labeling Mathematics concepts; $F_{(2,374)} = .540$, $p>0.05$. The null hypothesis which stated there is no significant main effect of treatment on pupils' dexterity in drawing and labeling Mathematics concepts was therefore not rejected. This implied that the treatment did not improve pupils' dexterity in drawing and labeling Mathematics concepts. The adjusted R squared value of .088 showed that the independent variables accounted for 8.8% of the variance observed on pupils' dexterity in drawing and labeling Mathematics concepts. Also, the table shows that the partial eta squared was estimated to be 0.003. This indicated that treatment accounted for 0.3% of the variance observed on the pupils' dexterity in drawing and labeling Mathematics concepts. 0.3% means no effect. The estimated marginal mean score was displayed in table 4.3.1b and Figure 4.3.1

Table 4.3.1b: Estimated Marginal Means of Pupils' Dexterity in Drawing and Labeling Mathematics Concepts by Treatment

			95% Confidence Interval	
Treatment	Mean	Std. Error	Lower Bound	Upper Bound
Collaborative	8.75[a]	.246	8.262	9.230
Alternative	8.74[a]	.224	8.300	9.180
Control	9.09[a,b]	.271	8.558	9.625

Coviates appearing in the model are evaluated at the following values: pre dexterity = 4.72

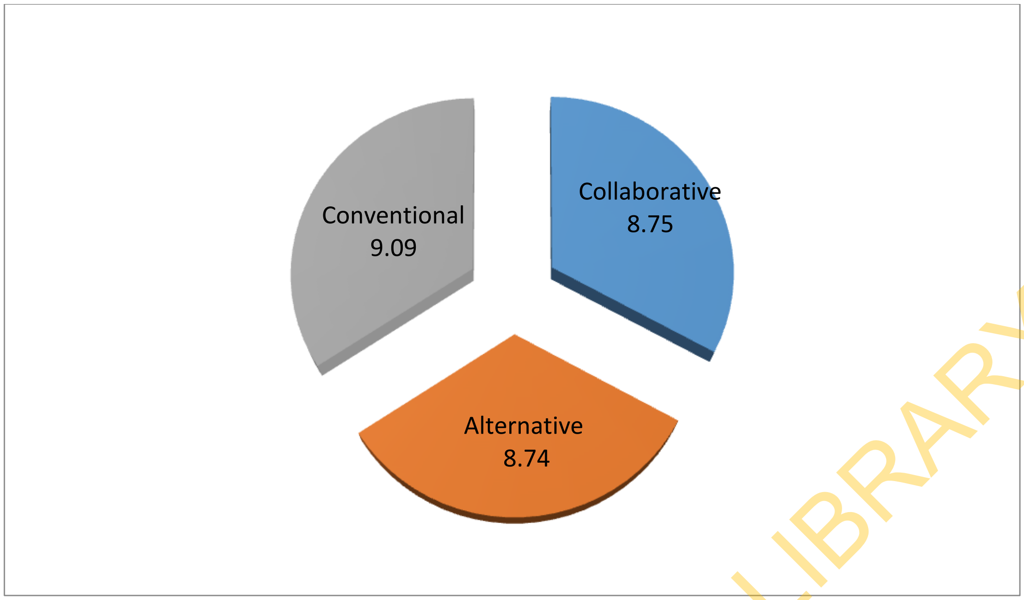

Figure 4.3.1: Chart showing Estimated Marginal Means of Pupils' Dexterity in Drawing and Labeling Mathematics Concepts by Treatment (Collaborative team teaching, Alternative team teaching and control group)

Table 4.3.1b and Figure 4.3.1show that pupils taught with conventional method had the mean score 9.09, then pupils taught with collaborative team teaching with mean score 8.75, while pupils taught with alternative team teaching had the least mean score 8.74. It implies that the difference between the mean score of pupils in control group and those in collaborative team teaching was 0.35, while the difference between the mean score of pupils in collaborative and alternative team teaching was 0.01. However, the difference in their mean scores was not statistically significant.

4.1.16 Hypothesis 2c: There is no significant main effect of learning styles on primary pupils' dexterity in drawing and labeling of Mathematics concepts

Table 4.3.1a shows that there was no significant main effect of learning styles on primary pupils' dexterity in drawing and labeling Mathematics concepts, $F_{(2,374)} = .059$; $p>0.05$. The null hypothesis which stated there is no significant main effect of learning styles on primary pupils' dexterity in drawing and labeling Mathematics concepts was not rejected. The partial eta squared estimated to be 0.000 indicated that learning styles did not account for any variance observed on the pupils' dexterity in drawing and labeling Mathematics concepts.

Table 4.3.1c: Estimated Marginal Means of Pupils' Dexterity in Drawing and Labeling Mathematics Concepts by Learning Styles

			95% Confidence Interval	
Learning Styles	Mean	Std. Error	Lower Bound	Upper Bound
Visual	8.93[a]	.251	8.440	9.428
Auditory	8.84[a]	.209	8.426	9.249
Kinesthetic	8.77[a,b]	.282	8.216	9.324

Covariates appearing in the model are evaluated at the following values: pre achievement = pre dexterity = 4.72

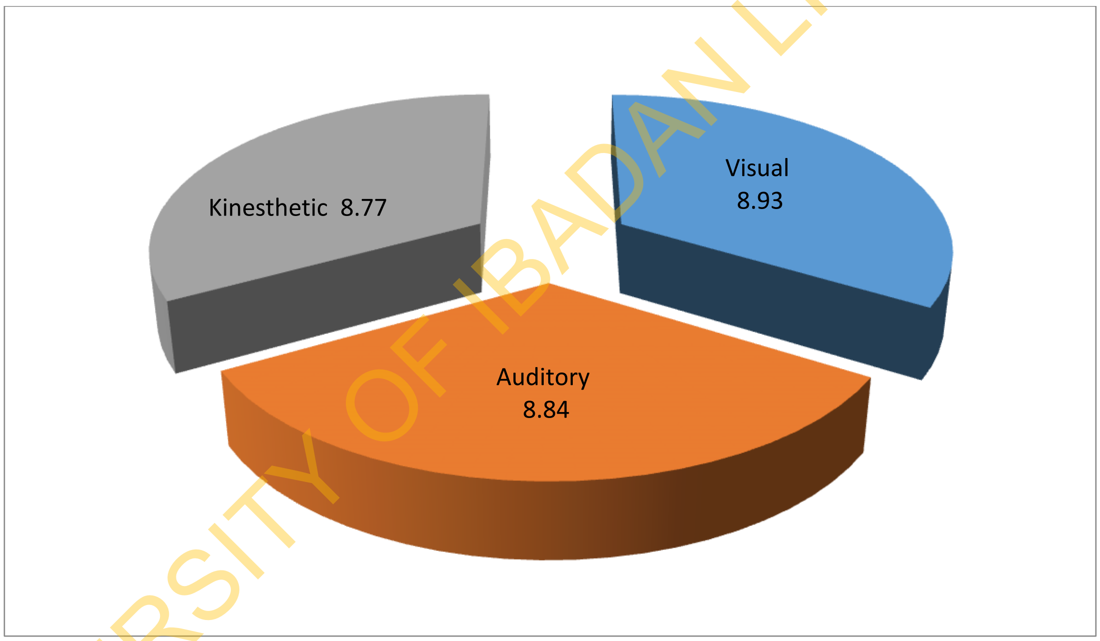

Figure 4.3.2: Chart showing Estimated Marginal Means of Pupils' Dexterity in Drawing and Labeling Mathematics Concepts by Learning Styles (Visual, Auditory and Kinesthetic learning styles)

Table 4.3.1c and Figure 4.3.2 present the estimated marginal means of pupils in interest. Table 4.3.1c shows that pupils with visual learning style had the highest mean with the mean score 8.93, followed by pupils with auditory learning style with mean score 8.84, while pupils with kinesthetic learning style had the least mean score with the mean score 8.77. This implies that the mean score of pupils with visual learning styles is greater than the mean score of pupils with auditory learning style by 0.11. Also, the mean score of pupils with auditory learning style is greater than the mean score of pupils with kinesthetic by 0.07. The differences in their mean scores were not statistically significant.

4.1.17 Hypothesis 3c: There is no significant main effect of self-efficacy on primary pupils' dexterity in drawing and labeling of Mathematics concepts

Table 4.3.1a indicates that the main effect of self-efficacy was not significant on primary pupils' dexterity in drawing and labeling Mathematics concepts, $F_{(2,374)}$ =.418; p>0.05. Consequently, the null hypothesis which stated there is no significant main effect of self-efficacy on primary pupils' dexterity in drawing and labeling Mathematics concepts was not rejected. The partial eta squared estimated to be 0.002 indicated that learning styles accounted for 0.2% of the variance observed on the pupils' dexterity in drawing and labeling Mathematics concepts.

Table 4.3.1d: Estimated Marginal Means of Pupils' Dexterity in Drawing and Labeling Mathematics Concepts by Self-efficacy

			95% Confidence Interval	
Self-efficacy	Mean	Std. Error	Lower Bound	Upper Bound
Low	9.05[a]	.220	8.612	9.479
Moderate	8.89[a]	.184	8.527	9.250
High	8.59[a,b]	.334	7.931	9.244

Covariates appearing in the model are evaluated at the following values: pre achievement = pre dexterity = 4.72

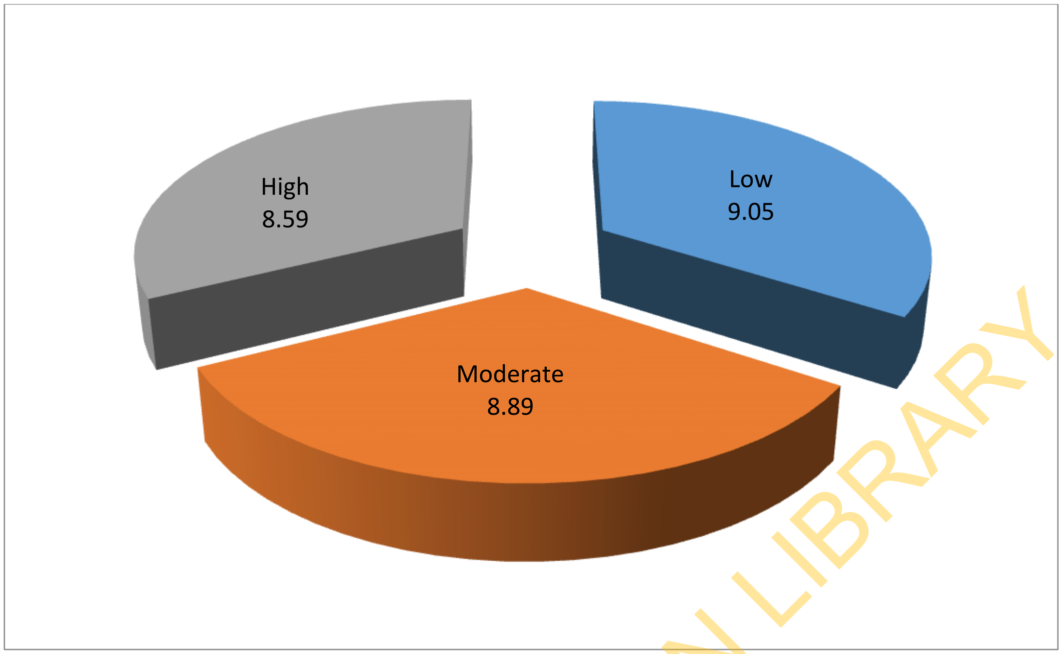

Figure 4.3.3: Chart showing Estimated Marginal Means of Pupils' Dexterity in Drawing and Labeling Mathematics Concepts by Self-efficacy (Low, Moderate and High Self-efficacy)

The estimated marginal mean of pupils in interest is presented in Table 4.3.1d and Figure 4.3.3. It indicated that there were differences in the estimated marginal means of pupils in dexterity based on their level of self-efficacy. Pupils with low self-efficacy had the highest mean score of 9.05 followed by pupils with moderate self-efficacy with the mean score of 8.89 while pupils with high self-efficacy had the least mean score 8.59. Also, the difference between the mean score of pupils with low self-efficacy and those with moderate self-efficacy was 0.16, while the difference between pupils with high self-efficacy with those with low self-efficacy was 0.404. However, the differences in their mean scores were not statistically significant.

4.1.18 Hypothesis 4c: There is no significant interaction effect of treatment and learning styles on primary pupils' dexterity in drawing and labeling of Mathematics concepts

Table 4.3.1a reveals that interaction effect of treatment and learning styles was not significant on primary pupils' dexterity in drawing and labeling Mathematics concepts, $F_{(4,374)} = 2.040$; $p > 0.05$. Consequently, the hypothesis that stated that there is no significant interaction effect of treatment and learning styles on primary pupils' dexterity in drawing and labeling Mathematics concepts was not rejected. The partial eta squared estimated to be 0.021 indicated that both treatment and learning styles accounted for 2.1% of the variance observed on the pupils' dexterity in drawing and labeling Mathematics concepts.

Table 4.3.1e: Estimated Marginal Mean of Pupils' Dexterity in Mathematics by Treatment and Learning Styles

Treatment	Learning Styles	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Collaborative team teaching	Visual	8.43	.419	7.605	9.254
	Auditory	9.31	.324	8.672	9.948
	Kinesthetic	8.50	.514	7.488	9.510
Alternative team teaching	Visual	9.25	.399	8.462	10.029
	Auditory	8.21	.288	7.645	8.778
	Kinesthetic	8.76	.457	7.864	9.661
Conventional team teaching	Visual	9.13	.482	8.179	10.076
	Auditory	8.99	.453	8.101	9,881
	Kinesthetic	9.19	.453	8.299	10.078

Covariates appearing in the model are evaluated at the following values: pre achievement = pre dexterity = 4.72

Table 4.3.1e presented the estimated marginal mean of pupils' dexterity in Mathematics by treatment and learning styles. It is indicated in the table that pupils with visual learning style in alternative team teaching model had the highest mean score 9.25 in dexterity in Mathematics; followed by pupils with visual learning style in conventional teaching with mean score 9.13, while pupils with visual learning style in collaborative team teaching had the least mean score 8.43. Also, Table 4.3.1e shows that pupils with auditory learning style in the collaborative team teaching had the highest mean score 9.31 in dexterity in Mathematics; followed by pupils with auditory learning style in conventional teaching with mean score 8.99, while pupils with auditory learning style in alternative team teaching model had the least mean score 8.21. Moreover, Table 4.3.1e indicates that pupils with kinesthetic learning style in the conventional teaching had the highest mean score 9.19; followed by pupils with kinesthetic learning style in alternative team teaching model with mean score 8.76, while pupils with kinesthetic learning style in collaborative team teaching model had the least mean score 8.50. However, the difference in their mean scores was not statistically significant.

4.1.19 Hypothesis 5c: There is no significant interaction effect of treatment and self-efficacy on primary pupils' dexterity in drawing and labeling of Mathematics concepts

Table 4.3.1a shows that the combined effect of treatment and self-efficacy was not significant on primary pupils' dexterity in drawing and labeling Mathematics concepts, $F_{(4,374)} = .428$; $p>0.05$. The null hypothesis which stated there is no significant interaction effect of treatment and self-efficacy on primary pupils' dexterity in drawing and labeling Mathematics concepts was therefore not rejected. The partial eta squared estimated to be 0.005 indicated that both treatment and self-efficacy accounted for 0.5% of the variance observed on the pupils' dexterity in drawing and labeling Mathematics concepts.

Table 4.3.1f: Estimated Marginal Mean of Pupils' Dexterity in Mathematics by Treatment and Self-Efficacy

Treatment	Self-efficacy	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Collaborative team teaching	Low	9.11 [a]	.346	8.431	9.793
	Moderate	8.56 [a]	.247	8.076	9.046
	High	8.57 [a]	.604	7.378	9.752
Alternative team teaching	Low	8.95 [a]	.493	7.977	9.915
	Moderate	8.86 [a]	.351	8.574	9.553
	High	8.40 [a]	.293	7.853	8.985
Conventional team teaching	Low	9.08 [a]	.269	8.554	9.603
	Moderate	9.24 [a]	.346	8.559	9,921
	High	8.89 [a]	.873	7.172	10.604

Covariates appearing in the model are evaluated at the following values: pre achievement = pre dexterity = 4.72

Table 4.3.1f shows pupils with low self-efficacy in the collaborative team teaching model had the highest mean score 9.11; followed by pupils with low self-efficacy in the conventional group with mean score 9.08, while pupils with low self-efficacy in the alternative team teaching model had the least mean score 8.95. In addition, Table 4.3.1f shows that pupils with moderate self-efficacy in the conventional teaching had the highest mean score 9.24; followed by pupils with moderate self-efficacy in the alternative team teaching model with mean score 8.86, while pupils with moderate-self-efficacy in collaborative team teaching had the least mean score 8.56. In addition, Table 4.3.1f shows that pupils with high self-efficacy in the conventional teaching had the highest mean score 8.89; followed by pupils with high self-efficacy in the collaborative team teaching model with mean score 8.57, while pupils with high self-efficacy in the alternative team teaching model had the least mean score 8.40. The difference in their mean scores was not statistically significant.

4.1.20 Hypothesis 6c: There is no significant interaction effect of learning styles and self-efficacy on primary pupils' dexterity in drawing and labeling of Mathematics concepts

Table 4.3.1a reveals that there was no significant interaction effect of learning styles and self-efficacy on primary pupils' dexterity in drawing and labeling Mathematics concepts, $F_{(4,374)} = 1.749$; $p>0.05$. Consequently, the null hypothesis which stated there is no significant interaction effect of learning styles and self-efficacy on primary pupils' dexterity in drawing and labeling Mathematics concepts was not rejected. The partial eta squared estimated to be 0.018 indicated that learning styles and self-efficacy accounted for 1.8% of the variance observed on the pupils' dexterity in drawing and labeling Mathematics concepts.

Table 4.3.1g: Estimated Marginal Mean of Pupils' Dexterity in Mathematics by Learning Styles and Self-efficacy

Learning Styles	Self-efficacy	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Visual	Low	9.51[a]	.383	8.753	10.254
	Moderate	9.10[a]	,317	8.418	9.724
	High	8.20[a]	.566	7.082	9.305
Auditory	Low	8.48[a]	.273	7.984	9.020
	Moderate	9.07[a]	.256	8.570	9.574
	High	8.96[a]	.506	7.961	9.952
Kinesthetic	Low	9.15[a]	,461	8.239	10.053
	Moderate	8.49[a]	.371	7.762	9.223
	High	8.62[a]	.692	7.262	9.985

Covariates appearing in the model are evaluated at the following values: pre achievement = pre dexterity = 4.72

Table 4.3.1g shows pupils with low self-efficacy in the visual learning style group had the higher mean score 9.51; followed by pupils with low self-efficacy in the kinesthetic learning style group with mean score 9.15, pupils with low self-efficacy in the auditory learning style group had the least mean score 8.48. In addition, Table

4.3.1g shows that pupils with moderate self-efficacy in the visual learning style group had the higher mean score 9.10; followed by pupils with moderate self-efficacy in the auditory learning style with mean score 9.07 while pupils with moderate-self-efficacy in the kinesthetic learning style group had the least mean score 8.49. In addition, Table 4.3.1g shows that pupils with high self-efficacy in the auditory learning style group had the higher mean score 8.96; followed by pupils with high self-efficacy in the kinesthetic learning style group with mean score 8.63, pupils with high self-efficacy in the visual learning style group had the least mean score 8.12. The difference in their mean scores was not statistically significant.

4.1.21 Hypothesis 7c: There is no significant interaction effect of treatment, learning styles and self-efficacy on primary pupils' dexterity in drawing and labeling of Mathematics concepts

Table 4.3.1a shows that there was no significant interaction effect of treatment, learning styles and self-efficacy on primary pupils' dexterity in drawing and labeling Mathematics concepts, $F_{(7,374)} = 1.352; p>0.05$. Therefore, the null hypothesis which stated there is no significant interaction effect of treatment, learning styles and self-efficacy on primary pupils' dexterity in drawing and labeling Mathematics concepts was not rejected. The partial eta squared estimated to be 0.025 indicated that treatment, learning styles and self-efficacy accounted for 2.5% of the variance observed on the pupils' dexterity in drawing and labeling Mathematics concepts.

4.2 Discussion on hypotheses

4.2.1 Main effect of treatment on primary pupils' achievement in Mathematics

The findings of the study showed that the treatment improved the performance of pupils' in Mathematics. The pupils taught with alternative team teaching model had the highest performance in Mathematics; followed by the pupils that were taught with collaborative team teaching model and those in control group had the least performance. The pupils in alternative team teaching model group made greater improvement in their performance than those pupils in both the collaborative and control groups. The result showed the existence of variation in pupils' scores in Mathematics was due to manipulation of treatment. The improvement observed in pupils' achievement in Mathematics as discovered in this study could be as a result of the combination of the expertise of the team teachers vis-a-vis adequate planning for instructional with the input of the teachers. Also, employing team teaching in classroom instruction gives room for consideration of pupils' needs and characteristics, outstanding working relationship between the teachers and effective instructional skills. All these could have produced the improvement observed in the pupils' scores in Mathematics. Furthermore, the improvement observed in pupils' achievement in Mathematics in the group taught with alternative team teaching model could be attributed to the fact that more explanation was made using different examples in regard to difficult aspects of the lesson by the second teacher during the re-teaching of the lesson.

In addition, the improved performance recorded could also be as a result of the fact that the team teachers reviewed each day's lesson with a view to making necessary improvement for the subsequent lesson. The finding of this study corroborates that of Achor, Imoko and Jimin (2012) who investigated the effect of team teaching on students' achievement in geometry and discovered that students who were taught with team teaching had higher mean score than those in the conventional group. Also, this finding supports the study of Syn-Jong (2006) who found that in Taoyua, Taiwan, team teaching was more effective than traditional teaching. In the same vein, the finding also agrees with the outcomes of studies by Rogozinski (2008) and Esomonu, Akudolu and Ezenwosu (2015) that team teaching achieved better results than traditional method.

However, the finding of this study contradicts the result of the study carried out by Carpenter, Crawford and Walden (2007) and that of Haselden (2011) who indicated that traditional teaching was more effective than team teaching. Also, the finding disagrees with that of Gamsky (2016) that team teaching approach did not appear to complement academic growth over traditional teaching method. The difference in the findings of the past studies and the results of this study may be traced to sampling techniques used by previous studies which may not be the same as employed in this study. The geographical areas covered by other researchers are different from the one covered in this study; this could also bring about variance in the results. Also, there are other intervening factors inherent within and outside the pupils aside the ones (learning styles and self-efficacy) considered in the study that can influence the results of other studies. This finding implies that using team teaching in teaching Mathematics is potent enough to bring improvement in pupils' academic achievement.

4.2.2 Main effect of treatment on primary pupils' interest in Mathematics

The results of this study showed that team teaching enhanced pupils' interest in Mathematics. It was unveiled that pupils who were taught with alternative team teaching had highest interest in Mathematics, then pupils in the control group, while those taught with collaborative team teaching had the least interest in Mathematics. This implied that interest is a factor to be considered when teachers want to adopt any of the approaches in this study in teaching Mathematics to pupils. When a good instructional method like team teaching is employed and implemented, pupils' interest in Mathematics would be aroused and stimulated, pupils would want to learn Mathematics concepts more. However, the fact that the interest of pupils in the control group was aroused better than those in collaborative group is an indication that despite the fact that both models improved performance than conventional method does not imply that both are effective in stimulating pupils' interest than the conventional method. During collaborative team teaching, pupils may not like the way both teachers exchanged roles as attested by the opinion of some pupils in FGD that showed dislike for team teaching and indicated preference for conventional method. This could have tendency to inhibit pupils' interest in Mathematics. Hence, the effectiveness of collaborative team teaching model in improving pupils' achievement Mathematics better than conventional teaching compared to its less effectiveness in arousing pupils' interest as against conventional could be attributed to the contribution of the co-planning of lesson by team teachers in addition to the classroom interaction.

Furthermore, another reason could be due to the fact that in conventional teaching, pupils are used to a single teacher; such teacher may have a way of motivating pupils to learn, thereby increasing their interest in Mathematics as against collaborative team teaching model where roles are exchanged between two teachers. Exchange of roles between two teachers could be confusing to pupils. The implication of this finding is that any Mathematics teacher that is aimed at stimulating pupils' interest in the subject should embrace alternative team teaching and conventional teaching rather than collaborative team teaching. The result of this study is in consonance with the study of Gamsky (2016) who found that team teaching approach did not complement academic growth over traditional teaching method, however, team teaching had a significant impact in improving students' interest in the subject matter. This means that team teaching arouses the interest of pupils in Mathematics. Also, the finding of the present study agrees with that of Tumba, Chinda and Andeyarka (2014) that team teaching improved the affective domain of students in the group than those taught with conventional method. In addition, the result of the study is in tandem with the finding of Farahi and Mohseni (2014) that students who were team-taught were better motivated to learn than those in the conventional teaching. Furthermore, the finding of this study confirms the study of Oyegoke (2017) who found that pre-service teachers taught with team teaching had better positive attitude to statistics aspect of research method than those in the control group.

4.2.3 Main effect of treatment on primary pupils' dexterity in drawing and labeling Mathematics concepts

Non-significant difference in the pupils' dexterity in labeling and drawing Mathematics concepts between the treatment groups and the control group means that the pupils in the groups have the same level of performance in dexterity. The finding revealed that method of teaching used in this study did not influence the manipulative skills (in terms of dexterity in drawing and labeling Mathematics concept) of pupils in any way. This finding could be connected to the fact that primary school curriculum emphasises that teaching of primary school subjects should be done through a lot of activities. Evidences such as Salami (2014) and Oyeniran (2015) attested to this fact. Some of the activities employed by primary school Mathematics teachers may cater for pupils of different dexterity irrespective of the method of teaching used by the teachers. This could be the reason team teaching did not support the growth of pupils' dexterity in Mathematics. Also, this could be the reason pupils in the conventional group had better dexterity than pupils who were taught with the two models (collaborative and alternative) of team teaching.

The finding supports that of Osinubi (2017) that the psychomotor skills of students in the experimental group did not differ from those in the control group. This result is not in harmony with the study of Tumba, Chinda and Andeyarka (2014) that investigated the comparative effects of cooperative and conventional teaching methods on students' skill acquisition and found that cooperative teaching method is more effective than conventional teaching method in improving students' skills acquisition. Also, the result of this study negates the outcomes of the study by Grants and Spencer (2003) and Uwameiye and Ojikutu (2014) that learning approaches improved the manipulative skills of students. It simply implies that team teaching is not a method to be used in increasing the dexterity of pupils in Mathematics since its usage would not be potent in improving students' dexterity.

4.2.4 Main effect of learning styles on primary pupils' achievement in Mathematics

The finding showed that pupils with visual learning style performed better in Mathematics, followed by pupils with kinesthetic learning style, while pupils with auditory learning style performed the least, however, the difference in their performance was the same in the experimental and control groups. That is, one group was not favoured more than the other. This may be connected with the fact that the pupils, irrespective of their learning styles were exposed to the same instructional method. This finding corroborates the finding of Almigbal (2015) who carried out a cross sectional study on the relationship between the learning styles preference of medical students and academic achievement in Riyadh, Kingdom of Saudi Arabia. The study showed that students' learning style preferences did not positively relate with student's academic achievements. Also, the finding agrees with the result of the study of Ghaffari et al (2013) who found that students' learning styles did not positively relate with their academic achievement and do not in any way improve achievement. However, the finding disagrees with the claim of Reid (1999) that learning styles caused positive changes in the affective domain of learners which could in turn, result in more effective learning.

4.2.5 Main effect of learning styles on primary pupils' interest in Mathematics

The finding unveiled that learning styles did not increase pupils' interest in Mathematics. By implication, learning styles did not stimulate or arouse pupils' interest in Mathematics. Pupils of different learning styles (visual, auditory and kinesthetic) had the same interest in Mathematics. It also, implies that whether pupils possess visual, auditory or kinesthetic learning styles, their interest in Mathematics remain the same if any of the team teaching models is adopted in teaching them. That is, pupils want to learn Mathematics more irrespective of their different learning styles. Pupils of different learning styles benefit optimally from the method used, hence, they learned the same way. This finding implies that learning styles is not a factor to be considered in arousing pupils' interest in Mathematics using any of the models of team teaching in this study. Also, the result of this study is an indication that method used might take individual uniqueness of pupils into cognizance. Such uniqueness which was catered for through team teaching in this study could be learning styles. The finding supports the view of Friend and Cook (2010) that team teaching caters for individual differences of the learners. This finding is not in tandem with the claim of Reid (1999) that learning styles cause positive changes in the affective domain of learners like interest, motivation, taking responsibility and classroom participation.

4.2.6 Main effect of learning styles on primary pupils’ dexterity in drawing and labeling Mathematics concepts

Ordinarily, one would have expected that learning styles would improve pupils’ dexterity in drawing and labeling Mathematics concept, which should be in favour of pupils with kinesthetic learning styles over those in visual and auditory learning study. This is because pupils with kinesthetic learning styles learn through manipulation of learning materials. This set of pupils learn through doing and they are always looking for opportunity to engage hands in learning. Since dexterity in this study is a measure of use of hands in drawing and labeling Mathematics concept, learning styles would have posed a significant influence on dexterity which would have been in favour of kinesthetic learners. In contrast, the result of this study showed that learning styles of pupils in terms of visual, auditory and kinesthetic did not affect their manipulative skill (dexterity in drawing and labeling Mathematic concepts).

4.2.7 Main effect of self-efficacy on primary pupils’ achievement in Mathematics

The result revealed there was no effect of self- efficacy on primary pupils’ achievement in Mathematics. This means that self-efficacy of pupils irrespective of the level (high, moderate or low) does not in any way affect their academic performance. In other words, whether, self-efficacy of pupils is high, moderate or low, their achievement in Mathematics is not likely to be affected if any of the models of team teaching is used by Mathematics teacher. Thus, self-efficacy is not a factor to be considered in the improvement of pupils’ achievement in Mathematics. The finding of this study confirms the study of Durowoju (2014) that found self-efficacy did not affect students’ achievement in Commerce. Ilori (2004) found that self-efficacy did not relate to academic achievement of secondary students. On the other hand, this result disagrees with that of Liu and Koirala (2009) that found a positive relationship between Mathematics self-efficacy and Mathematics achievement. This finding contradicts the studies of Tenaw (2013) and Sartawi et al (2012) that found a significant effect of self-efficacy on students' achievement in analytical Chemistry and Mathematics respectively. Furthermore, the result of this study is not in accordance with the study of Olosunde, Oyegoke and Ojebisi (2015) and Oyegoke (2015) that discovered that self-efficacy is a factor to be considered in predicting performance in Mathematics. In addition, this result contradicts that of Bandura and Schunk (1981) whose study reflected a high congruence between mathematical self-efficacy and Mathematical performance. The reason why self-efficacy does not affect pupils' achievement in Mathematics could be attributed to the difference in sample sizes and geographical locations used by other researchers. Also, most of the previous studies employed survey design as against experimental design adopted in this study. Furthermore, other factors aside self-efficacy could have contributed to the academic achievement of students.

4.2.8 Main effect of self-efficacy on primary pupils' interest in Mathematics

The findings showed that self-efficacy did not arouse pupils' interest in Mathematics. The finding of this study confirms the claim of Silvia (2003) that self-efficacy does not affect interest positively in that when self-efficacy becomes very high, success seems completely certain, and the task is thus uninteresting. The study of Kerrigan and Hayes (2016) discovered that self-efficacy did not significantly change students' interest. The finding of this study is not in tandem with that of Durowoju (2014) who established that self-efficacy had effect on students' attitude to commerce and argued that self-efficacy beliefs influence students‘perception, motivation, interest and disposition. Also, this finding disagrees with the statement of Pajares (2002) and Turner and Schallert (2001) that self-efficacy beliefs do not only affect occupational interest and choices of persons but also how much they are aroused or motivated to strife against odds for success in their occupation. Furthermore, this result contradicts that of Bandura and Schunk (1985) and Silvia (2003) who showed that self-efficacy did not affect students' intrinsic interest in arithmetic activities. This finding implies that self-efficacy is not a factor to be considered in stimulating the interest of pupils in Mathematics using any of models of team teaching in this study.

4.2.9 Main effect of self-efficacy on primary pupils' dexterity in drawing and labeling Mathematics concepts

On main effect of self-efficacy on pupils' dexterity in drawing and labeling Mathematics concepts, the study showed pupils dexterity in Mathematics was not determined by self-efficacy. It indicates that pupils of different self-efficacy have the same level of dexterity. The implication is that pupils' self-efficacy in terms of low, moderate or high do not produce significant influence on pupils' dexterity in drawing and labeling Mathematics concepts. That is, pupils of different levels of self-efficacy had the same measure of dexterity. It indicates that self-efficacy is not a factor to be considered when a Mathematics teacher aims at improving the ability of pupils in drawing and labeling Mathematics concept. In addition, the result of this study attested to the fact that if a pupil has high self-efficacy in Mathematics, there is need or the pupil to put commensurate effort to consciously learn and develop manipulative skills that are related to Mathematics concepts. A high self-efficacy without a commensurate effort would not produce a high dexterity. Actions must back up self-belief in developing pupils' dexterity. Contrary to the finding of this study is the view of Schunk (1985) that self-efficacy enhanced curiosity to acquire skills.

4.2.10 Interaction effect of treatment and learning styles on primary pupils' achievement in Mathematics

The result indicated there was no combined effect of treatment and leaning styles on pupils' achievement in Mathematics. It means that team teaching models and learning styles when taken together did not affect pupils' achievement in Mathematics. The combined effect of teaching methods and learning styles accounted for less than one percent of the variance observed in pupils' achievement in Mathematics. The finding earlier showed that the main effect of treatment was significant, while that of learning styles was not significant on pupils' achievement in Mathematics. It may mean that when taken both treatment and learning styles jointly, the effect that the treatment had on pupils' achievement was overpowered by that of learning styles. This finding may be traced to the sampling method used in this study, pupils were randomly put into treatment groups without taking their learning styles into consideration. The finding of this study is in agreement with the findings of the studies of Massa and Mayer (2006) and Fardon (2013) which revealed that the combination of instructional strategies and students' learning styles did not affect students' academic achievement.

Moreover, this result of this study is in tandem with the finding of the study of Wilson (2011) which indicated that both teaching methods and learning styles did not influence performance of students in English Language Arts, Mathematics, Science and Social Studied. In contrast, the finding of this study contradicts the result of the study of Fayombo (2015) which investigated the learning preferences (visual, auditory, kinesthetic), the teaching strategies (videos, games, role-play, discussion, group work, clarification pauses, five minute-paper, discussion forum and glossary activity) and their influence on the academic achievement of 171 undergraduate Psychology students at the University of the West Indies, Cave Hill Campus, Barbados. The study showed that both teaching strategies and learning styles contributed 20% to the variance observed in academic achievement and both had statistically significant effect on achievement. Also, the finding of this study disagrees with the studies of Tulbure (2012), Damrongpanit and Reungtragu (2013) and Liu and He (2014) that established a significant effect of teaching method and learning styles on students' academic achievement.

4.2.11 Combined effect of treatment and learning styles on primary pupils' interest in Mathematics

The interaction effect of treatment and leaning styles on pupils' interest in Mathematics was not significant. Team teaching models and learning styles when taken jointly had no effect on pupils' interest in Mathematics. The interaction effect of treatment and learning styles accounted for less than one percent of the variance observed in pupils' achievement in Mathematics. The finding earlier revealed a significant main effect of treatment on pupils' interest in Mathematics and there was no significant main effect of learning styles pupils' interest in Mathematics. The non-significant influence of treatment in combination with learning styles on pupils' interest in Mathematics may be linked to the fact the effect of treatment on pupils' interest in Mathematics was overcome by that of learning styles. The finding of this study confirms the study of Friend and Cook (2010). The result of this study is contrary to the studies of Reid (1999) and Felder (1996) that established a significant interaction effect of students' learning styles and teachers' teaching styles on students' attitude and interest to learning.

4.2.12 Combined influence of treatment and learning styles on primary pupils' dexterity in drawing and labeling Mathematics concepts

The combined effect of treatment and leaning styles on pupils' dexterity in drawing and labeling Mathematics concepts was not significant. The implication of this finding is that it is the same effect that team teaching models and learning styles produced on pupils' dexterity in drawing and labeling Mathematics concept. In other word, team teaching and learning styles do not support the growth of pupils' dexterity in Mathematics. The interaction effect of treatment and learning styles accounted for less than one percent of the variance observed in pupils' dexterity in drawing and labeling Mathematics concepts in Mathematics. This finding supports that of Tumba, Chinda and Andeyarka, (2014) and Osinubi (2017) and contradicts that of Uwameiye and Ojikutu (2014) that reported that teaching methods and learning styles did not support manipulative skills.

4.2.13 Combined effect of treatment and self-efficacy on primary pupils' achievement in Mathematics

The finding indicated there was no significant interaction effect of treatment and self-efficacy on pupils' achievement in Mathematics. This implies that team teaching models and self-efficacy jointly had no influence on pupils' achievement in Mathematics. The interaction effect of treatment and self-efficacy accounted for less than one percent of the variance observed in pupils' achievement in Mathematics. The study earlier showed that the main effect of treatment was significant on pupils' achievement in Mathematics, while that of self-efficacy was not statistically significant on pupils' achievement in Mathematics. It may mean that when taken the both treatment and self-efficacy interacted together, the effect that treatment had on pupils' achievement was overcome by that of self-efficacy. Another reason adduced to this result is that the sampling techniques used in the study did not consider disparity in the level of pupils' self-efficacy whether, low, moderate or high, that is pupils were randomly assigned to treatment groups without prejudice to their level of self-efficacy. This may seem to be why the interaction effect of treatment and self-efficacy did not produce a significant effect on pupils' achievement in Mathematics. Pupils tend to enjoy equal benefit when given equal opportunity to learn without being biased. The finding of this study supports the study of Durowoju (2014) that revealed the combination of treatment employed in the study and self-efficacy had no significant effect on students' achievement in Economics. The study also agrees with the finding of the study of Ilori (2004). However, the result of this study disagrees with the studies of Liu and Koirala (2009), Tenaw (2013), Olosunde, Oyegoke and Ojebisi (2015) and Oyegoke (2015) that found that treatment and self-efficacy affected students' achievement. In addition, this study contradicts that of Akujieze (2013) that indicated that the combination of learning strategies and self-efficacy had effect on students' achievement.

4.2.14 Interaction effect of treatment and self-efficacy on primary pupils' interest in Mathematics

The effect of both treatment and self-efficacy on pupils' interest in Mathematics was not significant. Team teaching models and self-efficacy when taken jointly had no effect on pupils' interest in Mathematics. The interaction effect of treatment and self-efficacy accounted for zero of the variance observed in pupils' interest in Mathematics. The study revealed a significant main effect of treatment on pupils' interest in Mathematics and no significant main effect of self-efficacy on pupils' interest in Mathematics. The non-significant effect of both treatment and self-efficacy on pupils' interest in Mathematics could be traced to the fact the effect of the treatment on pupils' interest in Mathematics was influenced by that of self-efficacy. This finding supports the study of Akujieze (2013) that found none significant combined effect of learning strategies and self-efficacy on students' attitude. Furthermore, this study is in tandem with Silvia (2003) and Kerrigan and Hayes (2016). On the other hand, the finding of this study contradicts the study of Durowoju (2014) that indicated non-significant effect of treatment and self-efficacy on students' attitude to Economic.

4.2.15 Interaction effect of treatment and self-efficacy on primary pupils' dexterity 1 drawing and labeling Mathematics concepts

The effect of both treatment and self-efficacy on pupils' dexterity in drawing and labeling Mathematics concepts was not significant. The interaction effect of treatment and self-efficacy accounted for zero percent of the variance observed in pupils' dexterity in drawing and labeling Mathematics concepts. The finding implies that pupils irrespective of different treatment groups and levels of self-efficacy had the same performance in dexterity. This finding may be connected to the sampling method employed in this study. Pupils were randomly selected and randomly assigned to experimental groups without consideration for their self-efficacy. This study confirms the findings of the studies of Osinubi (2017), Tunba, Chinda and Andeyarka (2014) and Schunk (1985). On the contrary, the result of this study is not in consonance with Grant and Spencer (2003).

4.2.16 Interaction effect of learning styles and self-efficacy on primary pupils' achievement in Mathematics

The combined effect of learning style and self-efficacy on pupils' achievement in Mathematics concepts was not statistically significant. The interaction effect of learning style and self-efficacy accounted for less than one percent of the variance observed in pupils' achievement in Mathematics. This simply means that learning styles and self-efficacy did not have interference effect on pupils' achievement in Mathematics. This finding negates the result of the study of Rashid (2004) who investigated the impact of learning styles (Accommodating, Diverging, Converging, and Assimilating) and self-efficacy on the academic performance of MBA candidates. The findings showed that the interaction between learning styles and self-efficacy had a strong positive impact on the academic performance. Furthermore, the study is in consonance with Almigbal (2015) and contradicts that of Reid (1999).

4.2.17 Combined influence of learning styles and self-efficacy on primary pupils' interest in Mathematics

The interaction effect of learning style and self-efficacy on pupils' interest in Mathematics concepts was not statistically significant. The interaction effect of learning style and self-efficacy accounted for almost percent of the variance observed in pupils' interest in Mathematics. This simply means that learning styles and self-efficacy did not have interference effect on pupils' interest in Mathematics. Pupils of different learning styles and levels of self-efficacy had the same interest in Mathematics. The finding of this study is in agreement with the studies of Friend and Cook (2010), Kerrigan and Hayes (2016) and disagrees with Durowoju (2014).

4.2.18 Interaction effect of learning styles and self-efficacy on primary pupils' dexterity in drawing and labeling Mathematics concepts

The interaction effect of learning style and self-efficacy on pupils' dexterity in drawing and labeling Mathematics concepts was not statistically significant. The interaction effect of learning styles and self-efficacy accounted close to zero percent of the variance observed in pupils' dexterity in drawing and labeling Mathematics concepts. This indicated that pupils of different learning styles and levels of self-efficacy had the same performance in dexterity.

4.2.19 Interaction effect of treatment, learning styles and self-efficacy on primary pupils' achievement in Mathematics

The combined effect of treatment, learning style and self-efficacy on pupils' achievement in Mathematics was not significant. The study established that considering each of variables separately, only treatment had significant effect on pupils' achievement in Mathematics, while neither learning styles nor self-efficacy when considered individually and jointly produced no significant effect on pupils' achievement in Mathematics. The three variables when taken together did not affect pupils' interest in Mathematics. The joint effect of treatment, learning style and self-efficacy accounted for less than one percent of the variance observed in pupils' achievement in Mathematics. It is indicated that pupils' achievement in Mathematics was not influenced by the joint interaction effect of treatment, learning styles and self-efficacy. This study supports that of Carpenter, Crawford and Walden (2007), Ghaffari et al (2013) and Ilori (2004). Contrarily, the result of the present study negates the findings of Syn-Jong (2006) and Reid (1999).

4.2.20 Interaction effect of treatment, learning styles and self-efficacy on primary pupils' interest in Mathematics

The interaction effect of treatment, learning style and self-efficacy on pupils' interest in Mathematics concepts was not statistically significant. The study revealed that when each of the treatment, learning styles and self-efficacy was taken separately, only treatment had significant influence on pupils' interest in Mathematics but when considered learning styles and self-efficacy separately and together, both did not have significant effect on pupils' interest in Mathematics. The three variables when taken together had no significant effect on pupils' interest in Mathematics. The interaction effect of treatment, learning style and self-efficacy accounted for almost one percent of the variance observed in pupils' interest in Mathematics. This study supports the study of Schunk (1985) and contradicts the studies of Farahi and Mohseni (2014) and Johnson (2012).

4.2.21 Interaction effect of treatment, learning styles and self-efficacy on primary pupils' dexterity in drawing and labeling Mathematics concepts

The interaction effect of treatment, learning style and self-efficacy on pupils' dexterity in drawing and labeling Mathematics concepts was not statistically significant. This indicated that the interaction of the three variables (treatment, learning styles and self-efficacy) had no significant effect on pupils' dexterity in drawing and labeling Mathematics concepts. The interaction effect of treatment, learning styles and self-efficacy accounted close to zero percent of the variance observed in pupils' dexterity in drawing and labeling Mathematics concepts. This implies that pupils' dexterity in drawing and labeling Mathematics concepts was not influenced by the joint interaction effect of treatment, learning styles and self-efficacy. The finding of the study is in harmony with the study of Tumba, Chinda and Andeyarka (2014) and contradicts the study of Grants and Spencer (2003).

4.3 Research Questions

4.3.1. Research question 1a(i): What are the stakeholder' (pupils, teachers and head teachers) perception of team teaching in terms of its benefits to pupils?

Majority of pupils that participated in the FGD as discussants perceived that team teaching was beneficial to pupils. Some of the benefits of team teaching as advanced by these pupils were that team teaching makes learning of Mathematics topics easy, meaningful and provides more understanding on the topics. One of the pupils in the alternative experimental group affirmed that: *when one teacher has taught, the other teacher will now explain any part of the topic that is not clear to us. This helps us to learn Mathematics more.* Also, the pupils reported that since it is like division of labour, each teacher was at his/her best to handle the aspect(s) of the lesson allotted to him/her. Another pupil also affirmed that:

> *I was able to learn parts of a circle well because the second teacher explained the part of the lesson that was not clear during the first lesson. The way the first teacher explained the lesson was not clear to me at all (a discussant in an alternative team teaching group).*

Another benefit of team teaching given by majority of the pupils was that they gained maximally from the teaching because they were not given any chance or opportunity to play during the lesson. This is revealed in this extract from one of the pupils:

> *I now know that I can be very good at Mathematics. Initially, I thought Mathematics is a subject that I cannot know at all because I don't like the subject at all. The subject is too tough for me. Because of this, I usually play during Mathematics lessons. But with this method, I was not given opportunity to play with my friend at all. The eyes of the second teacher that was not teaching was always on me, I don't have any choice than to comply. I am surprised that I performed well in almost all the class works. I am very happy and promising that I will not play during Mathematics class again. For the fact that the method did not allow me to play; and the method helped me a lot. I can say that it is a very good method for me (a discussant in a collaborative team teaching group).*

A pupil in an alternative team teaching group said: *a like two teachers teaching me Mathematics because there was more explanation on the lesson by the second teacher.* Another pupil in a collaborative team teaching group said: *Why I like team teaching is that, while one teacher was teaching a lesson, the other teacher was correcting us if we misbehave. Although, some of my friends did not like it because they are too playful.*

Another pupil was of the view that the way the roles were exchanged between the teachers benefited her a lot. This pupil admitted that the teachers in her school did not teach the same way and she preferred one teacher to the other. But she liked the way they exchanged their roles during teaching. The pupil further explained that:

> *If the teacher that I did not like very well was the only one that taught Mathematics throughout the experiment, I would not have gained much from the teaching. But with the two teachers, I have gained much from the lesson.*

In contrast, three pupils (two in the collaborative group and one in the alternative group) perceived team teaching as a method that is not beneficial to the pupils. A pupil in the alternative group perceived team teaching as a repetition of what the first teacher had done. One of the pupils in the collaborative group said:

> *Two teachers teaching me Mathematics is like a play to me. I did not like the way each teacher handled different parts of the lesson. It looked somehow to me and I did not like it. I prefer teaching of Mathematics by one teacher.*

The analysis of the interview schedule conducted on twelve teachers and six head teachers revealed that all of them viewed team teaching as a method that has a lot of benefits to the pupils as well as teachers. This is indicated in these extracts:

> *Team teaching exposes pupils to two teachers. Teaching a particular subject by two teachers exposes pupils to the strength of the two teachers. Where there are lapses on the part of one teacher, the other teacher will complement him/her. Any aspect of the lesson that pupils are not able to learn well through one teacher, they will be able to learn it better through the second teacher (teacher two)*

> *Team teaching provides a wide range of choices to pupils. This is because if a pupil does not like a particular teacher, the pupil may like the other teacher. So, such pupil will not lose interest totally in the subject being taught (head teacher five)*

A head teacher said: a *teacher may not have good mastery of the subject matter or may not know how to put the concept across to the pupils, his partner will bail him/her out (head teacher two).* A teacher also emphasised that: t*eam teaching benefited pupils compared to chalk and talk method due to diversities of knowledge of the team teachers (teacher four)*

In addition, the teachers and the head teachers perceived that team teaching provides more understanding on the subject being taught, enhances close interaction between the pupils and the teachers leading to better pupil teacher relationship. Better pupil-teacher relationship has a potential of enhancing academic performance of the pupils. One of the benefits of team teaching as advanced by the teachers is effective classroom management. This perception is reflected in this extract:

Team teaching will help pupils in paying more attention or more concentration to the concept being taught. This is because at all times, a teacher is monitoring pupils' behaviour, while the other teacher is teaching (teacher five).

The head teachers perceived that if team teaching is properly carried out, it will improve pupils' involvement and participation in the subject as evident in the extract below:

Pupils at primary schools are easily distracted. Team teaching makes pupils to pay more attention and through the method, there will be proper class control. There is no way pupils will not concentrate on the lesson (head teacher three).

In addition, the teachers and head teachers perceived that if team teaching is properly implemented, different categories of learners will be taken care of based on their learning rates. Since primary school pupils have different feelings for different teachers, If team teaching is adopted, there is probability that any pupil that does not like a teacher will possibly like the other teacher. Also, there is likelihood of improved behaviour on the part of the first teacher as working relationship develops between the teachers and subsequently improve pupils' likeness for both teachers. This will engender pupils' performance in the subject.

4.3.2 Research Question 1a(ii): What are the stakeholders' (teachers and head teachers) perception of team teaching in terms of its benefits to teachers?

On the stakeholders' perception of the benefits of team teaching to the teachers, eleven out of twelve teachers interviewed perceived that team teaching has a lot of advantages embedded in it which any serious teacher can take advantage of. However, one teacher perceived team teaching as a hiding place for lazy teachers.

The teachers ascertained that team teaching helps them to gain more knowledge in their respective areas of specialization. This is revealed in this extract:

Team teaching will help teachers to have a close relationship with each other and work hand in hand. Planning on getting teaching materials *to be employed in class interactions or improvisation of such will enrich the lesson. Cross fertilization of idea on the topic of interest is an added advantage since nobody is an island of knowledge. Using team teaching can lead to more research or update of knowledge in the area of interest by teachers (Teacher two)*

Also, they felt that team teaching will help the so called lazy teachers to take challenges as evident in this extract:

If a teacher is being corrected always, the teacher will not have a choice than to prepare well for the subsequent planning thereby improving himself or herself. If a teacher is fond of making unnecessary mistakes or he/she is not painstaking in discharging his/her duties or responsibilities, it will get to a time that such teacher will intentionally look for a way of improving himself or herself in order not to ridicule himself or herself in the presence of other colleagues. Therefore, the teacher will take deliberate effort to improve on his/her skills (Teacher ten)

The teacher perceived team teaching as a method that allows a teacher that is not versatile in any aspect of the subject to learn immensely from the others. Among other benefits of team teaching as advanced by them are: team teaching gives room for effective class control, different methods of teaching are employed by the teachers in imparting knowledge. They also viewed team teaching as a method that caters for difficult topics in a subject as confirmed by this extract:

Different teachers, despites that they are specialists in their fields have interest in different areas of the subject. Any aspect that is difficult for a teacher, the other teacher will help him/her out. If there are common difficult areas for both teachers, they can seek assistance from other colleagues. This has a lot of positive implications on learners (Teacher eight).

In addition, the head teachers perceived that team teaching has a tendency to alleviate fear of teachers. One of the interviewees argued that:

In team teaching, one is not alone in the boat; you have somebody to lean on if there is any challenge. The challenge will not create unnecessary anxiety and fear in you since you have somebody to share with. An adage says a problem shared is half solved (head teacher five)

It is evident that team teaching helps in improving deficiencies of teachers as they learn from each other or one another as the case may be. The seemingly weak teachers will be forced to learn in order to contribute to the planning session as he/she will not like to be passive during instructional planning interaction between the teachers. Also, team teaching allows interaction between or among teachers, it encourages innovation and creativity.

4.3.3 Research Question 1b: What are the stakeholders' (pupils, teachers and head teachers) perception of its introduction at primary education level?

On the adoption of team teaching at the primary level of education, majority of the pupils unanimously agreed that team teaching models should be employed in teaching primary school subjects. The reasons given by the pupils were hinged on the aforementioned benefits of team teaching to the pupils. In the contrary, three pupils perceived that team teaching was not a good method to be employed at primary school level. To a pupil in an alternative group, team teaching is like a teacher repeating what one teacher has done. One of the pupils in a collaborative group said that:

> *That type of teaching is a distraction to me. Anytime I want to concentrate on what a teacher was saying, the other teacher will distract my attention by either talking to somebody or may be passing by and I will have to turn to see what was going on. That was a serious distraction to me. I like where a teacher teaches and anytime he/she want to control the class, he/she will stop the teaching and finish before he/she continues. To me that is not distractive at all. I did not like this other one.*

Of the twelve teachers that took part in the interview session, eleven viewed team teaching as an appropriate method to be adopted in teaching primary school subjects. One of the interviewees (teachers) made this confession:

> *At the initial stage of this research work, when my consent was sought to be part of the research assistants, I did not see team teaching as anything that is serious and necessary to be adopted and used as a model of instruction in primary schools. As I went through the process, I discovered there are a lot things attached to team teaching especially*

> *the pre- instructional planning by the teachers. I then concluded that if team teaching is properly used to teach a compulsory subject like Mathematics, it will go a long way in helping pupils. It can even be extended to English Language which is also a compulsory subject. My view is that if government cannot employ it for all primary school subjects now, let them start with compulsory subjects like English Language and Mathematics. I am sure that as time goes by, government will see more reasons to adopt it for all other primary school subjects and teachers will also embrace it as I did (teacher ten)*

One teacher perceived that team teaching is not an appropriate method for teaching pupils at all classes of primary school level. This interviewee concurred that team teaching can be employed in teaching pupils at upper primary level (primary 4 to primary 6), it should not be used at lower primary level (primary 1 to primary 3). The reason adduced by the interviewee was that team teaching may be too cumbersome to implement at lower primary. However, the twelve teachers interviewed advised that if team teaching is adopted in teaching primary school subjects, the grassroots stakeholders such as pupils, parents, teachers and head teachers should be adequately involved in the planning stage. In fact, they should have input right from the planning stage, that is, they should be part of the decision making process. There should be enlightenment, awareness and orientation on team teaching at various fora.

Furthermore, on the perception of stakeholders on the introduction of team teaching at primary school level, five head teacher interviewed perceived the possibility of adopting team teaching at primary school level. The extracts below attested to their perception

> *Team teaching is an improvement over the present mode of teaching. This is because in almost all primary schools within Oyo State, there are two teachers in a class, although, they teach different subjects.* Therefore, it is a good method to be adopted at primary school (a head teacher in collaborative team teaching).

> *Team teaching is a good method of imparting knowledge to the pupils. It is a known fact that no two teachers are exactly the same. We are all like monkeys; we have our mountain of strengths and our valleys of weakness. With team teaching, teachers can complement each other thereby providing wide range of choices to the pupils and maximum understanding of any concept being taught in the class. Through team*

> *teaching, maximum attention is devoted to the pupils, individual differences of the learners are catered for and better academic performance is enhanced (a head teacher in alternative team teaching).*

However, one head teacher viewed team teaching as an inappropriate method to be used in primary school level as ascertained in this extract:

> *Each teacher in team teaching may not be comfortable o work in teams. The model has a tendency to hinder the flow of teacher. We should bear in mind that two teachers can not present a lesson the same way. Hence, adoption of team teaching in primary school can disrupt the thought-flow of some teachers. It will even encourage laziness on the part of some teachers. Then, since the present policy is not in line with team teaching, it should not be used at all. Also, the age and the level of maturity of pupils are other strong reasons team teaching should not be introduced at primary school level. Also, primary school teachers are expected to devise methods of teaching all subjects. In this regards, adoption of team teaching may not be necessary (head teacher three).*

The teachers and head teachers posited that if team teaching is introduced at the primary level of education in Oyo State; it should be made a policy issue. No school should be exempted from the implementation of the models. All primary schools in the state should be mandated and enforced to adopt it.

4.3.4 Research Question 1c: What are the stakeholders' (teachers and head teachers) perception of team teaching in terms of taking responsibilities for putting teachers in team?

On who should assume the responsibility for putting teachers in teams, ten teachers were of the opinion that pairing of teachers should be the sole duty of the supervising officer who is the head teacher. The reason given by this set of interviewees was that the head teacher is the direct boss of the teachers. The head teacher knows the temperaments, abilities, personalities, skills and other attributes of the teachers in the school. Hence, the head teacher should be given free hand to put teachers in teams. This is evident in this extract: *the head teacher is the one that is dealing directly with the teachers. He or She knows who can handle what. He or she should be able mix (put) teachers of different abilities in a team.* One teacher pointed out that although forming of teams should be the responsibility of the head teachers, the head teacher should be free to delegate any of the assistants (assistance head teachers) to carry out the assignment. One teacher perceived that pairing of teachers should be a shared responsibility between the head teachers and the secretaries of Local Government Universal Basic Education Authority (LGUBEA).

Moreover, all the six head teachers perceived that head teachers should be given the responsibility of putting teachers in teams. This is due to the fact that the head teacher has close relationship with the teachers, knows their abilities and qualifications. One of the head teachers said:

> *The pairing of teachers in teams should be the sole responsibility of the head teacher because if rat and cat are put together, it will lead to fight and witch hunt. The head teacher is the best person to put the round peg in a round hole but not a square hole (head teacher six)*

4.3.5 Research Question 1d: What are the stakeholders' (teachers and head teachers) perception of team teaching in terms of factors to be considered before putting teachers in teams?

Majority of the interviewees unanimously said that teachers must not be put in team haphazardly. They agreed that there are numbers of factors to be considered before pairing of teachers. Among the factors identified by the participants are:

1. Years of experience of the teacher: Those interviewed were of the opinion that year of experience of the teacher is one of the major factors to be considered before putting teachers in team. For instance, an experienced teacher can be paired with an inexperienced teacher. This will help the inexperienced teacher to gain more knowledge and acquire more skills in the subject area.
2. Educational background of the teacher: Interviewees emphasised that educational background in terms of qualifications and area of specialisation should also be of the major factors to be considered before putting teachers in teams. More qualified teachers should be paired with the less qualified teachers; both teachers will be able to gain from each other. For instance, a university graduate teacher can be paired with an NCE graduate teacher. One head teacher said:

> *Both university graduate and NCE graduate teachers will gain from each other. The university graduate teacher may be more knowledgeable in content area than the NCE graduate teacher whereas the NCE graduate teacher may be better in practical teaching than the university graduate teacher* (head teacher two).

Area of specialization should be looked into before putting teachers in teams. Two teachers of different specializations should not be put together. A science based teacher can be paired with another science based teacher to co-teach science related subjects while an art based teacher should be paired with another art based teacher to co-teach art related subjects. By doing so, both teachers will be able to co-teach subjects that are related to their area of specialization.

3. Strengths and weaknesses of teacher: Eighteen interviewees unanimously agreed that some teachers are lazy while some are hard working. They emphasized that two seemingly lazy teachers should not be put in a team. Likewise, two seemingly hardworking teachers should not be put in a team. This will help the seemingly lazy teacher. Also, teachers of different temperaments should be merged in a team and not the other way round.
4. Age or level of the pupils: Age or level of the pupils was another issue that the participants emphasised that it should be considered before putting teachers in teams. One of those interviewed even said that: *some teachers fare well at lower basic level, while some perform excellently at higher basic level. This should be considered in forming a team of teachers.*
5. Gender of the teacher: Although gender issue did not receive massive support from the interviewees, however, one interviewee identified gender as a factor to be considered when putting teachers in teams as shown in this extract:

> *Female teachers are somehow lazy. This is because they have a lot of responsibilities attached to them which may hinder them from performing optimally in their profession (a male teacher).*

According to the interviewee, teachers of different gender should be put in a team.

However, one of the interviewees was of the opinion that no factor should be considered before putting teachers in teams. He emphatically said that:

> *No factor should be considered in putting teachers in teams. It is stated in the appointment letter of the teacher that primary school teacher should be able to teach all primary subjects. Issue of individual differences in teachers should not be given consideration. As a teacher, you should be able to work with any other teacher because you are not staying in a school permanently. Definitely, you will be transferred and you will meet different people. Ability to tolerate others is a quality of a good teacher. A teacher should be able to work with any of his/her colleagues (a teacher in a collaborative team teaching)*

4.3.6 Research Question 1e: What are stakeholders' (teachers and head teachers) perception of team teaching in terms of preparation time/co-planning time?

All those interviewed unanimously said that co-planning is imperative for effective implementation of team teaching. One of them even pointed out as presented in this extract:

> *The teachers concerned, as a matter of compulsion must rub minds together before any meaningful lesson can be delivered. The area of planning should include: identification of statement of instructional objectives, writing of lesson note, points to be taught and appropriate instructional materials to be used during the lesson.*

Also, they perceived that teachers may feel that planning team teaching may be time consuming. One of the interviewees emphasised that: *if you take more time to think and plan, it will take lesser time to act or execute. Not only that, execution of such project will be easier compared with when there is no plan on ground.* There was unanimous agreement by the interviewees that co-planning by team teachers is inevitable if something meaningful will come out the team teaching exercise.

4.3.7 Research Question 1f: What are the stakeholders' (teachers and head teachers) perception of team teaching in terms of time management in class?

The stakeholders were of the opinion that time management during the class interaction should be taken care of during the preparation or planning session. They emphasised that the teachers should teach their subject within the specified period and they should not encroach into other subject's period. Also, if time is allotted to each part of the lesson, they should ensure that each teacher adhere strictly to the time allotted to him or her. The perception of the stakeholders about time management in class is also shown in the extract below:

> *The team teacher should not encroach into the time allocated to any other subject on the time table. The team teacher should work harmoniously within the specific period allotted to their subject (Teacher four).*

4.3.8 Research Question 1g: What are the stakeholders' (teachers and head teachers) perception of team teaching in terms of work relationship between the teachers?

Concerning working relationship between the teachers, the stakeholders admitted that the team will have both positive and negative experience at initial stage. As they learn to work as a team, the initial bottleneck will dissolve. The teachers should realize that they are partners in progress. They should see themselves as equal. No one is either superior or inferior to the other. They should also know that a part is not greater than a whole. The interest of the team supersedes their personal interest. Thus, outstanding work relationship is pertinent to the success of the team. Confirmation of this is evident in this extract: *The team teachers must have a good work relationship. If they are not in good term, it will have adverse effect on the lesson and by extension, on the pupils.* Further support to their perception on work relationship between the teachers is shown in this extract: *"cordiality should be the watchword of both teachers so that lesson would not be taught lopsidedly. Also, laziness on the part of any of the teachers involved should not be treated with kid gloves (head teacher four).*

4.3.9 Research Question 2: What are other challenges associated with team teaching?

The teachers and head teachers identified other challenges that are likely to affect team teaching. The challenges identified by them are:

1. Resistance to change: The stakeholders perceived resistance to change as a challenge that can affect team teaching most especially on the part of the teachers. They emphasised that majority of the teachers are used to old ways of doing things and they are not ready to change. Teachers may perceive new ideas as stressful and impossible. This is likely to have negative effect in implementation of team teaching if not properly handled.
2. Teachers' individual difference: Individual difference of the teachers is another factor identified by the stakeholders. It was perceived that no two individuals

are the same and ditto for the teachers. Teachers' differences can interfere with successful implementation of team teaching. Such differences as identified by them can be in terms of personality or temperament, year of experience, educational background (qualification and area of specialization). The stakeholders were of the opinion that these issues should be critically looked into for successful implementation of team teaching.

3. Superiority or inferiority complex: The interviewees viewed that a teacher in a team may feel superior to the other teacher, while the other feels inferior and vice versa. This may be because one of the teachers is versatile in most of the topics in a subject, while the other teacher is lagging in some topics. This has a tendency to pose a challenge to the success of team teaching if it is not properly considered.
4. Regular conflict between teachers: Regular conflict may be resultant effect of envy, ranchor, strife, jealousy, hatred and negligence of duties.
5. Shortage of qualified personnel: Dearth of qualified teachers in different disciplines is another factor that can pose challenge to the implementation of team teaching as identified by the stakeholders. Where there are limited number of teachers in a particular school, implementing team teaching in such school could be a challenge.
6. Additional Fund: In implementing team teaching, additional funds will be required to organize workshop, seminar and conference for stakeholders. More personnel may be needed to serve as external monitors in addition to the available head teachers and other relevant personnel. This is part of the identified challenges associated with team teaching by the stakeholders.

4.3.10 Research question 3: How can the challenges of team teaching be overcome?

Possible solutions to the challenges of implementing team teaching as advanced by the stakeholders are:

1. Adequate and effective planning
2. Orientation, Awareness and Enlightenment
3. Regular monitoring and supervision

4. Proper and mutual understanding of team teaching by teachers
5. Effective communication between team teachers
6. Evaluation or assessment of teachers, providing feedback and necessary correction
7. Willingness of government to release more fund to the educational sector

4.4 Discussion on Research Questions

The results of this study revealed that implementing team teaching as a mode of instruction in primary schools beneficial to both the pupils and the teachers. Team teaching makes learning easy meaningful and provides more understanding on the topics. In team teaching, the lesson is divided between two teachers and each teacher is at his/her best; pupils are not given opportunity to play because they are being monitored by one of the teachers. Close interaction between the pupils and the teachers are enhanced in team teaching leading to better pupil teacher relationship. Team teaching has capacity of taking care of individual learning rates of the learners and favours different categories of learners. Effective classroom management and improved pupils' involvement and participation are endangered in team teaching. Team teaching models help teachers to gain more knowledge in their respective areas of specialization which enriches effective lesson delivery. Effective class control, use of different methods of teaching and improvement of deficiencies of teachers are achieved in team teaching. Team teaching helps teachers to handle difficult topics and encourages innovation and creativity.

This finding agrees with the view of Friend and Cook (2010) that in team teaching, two heads are better that one. Team teaching helps in actively engaging students in hand-on tasks/learning, cater for individual differences of learners and helps individual students to receive help in a timely manner. In team teaching, both teachers are actively involved in instructional delivery, classroom organisation and management; each teacher has a clear teaching responsibility, co planning provides better instructional delivery. The finding of this study is in line with view of Peeler (2010) that specially designed instruction strategies being implemented and high level of students' engagement are evident in a team teaching instructional setting. In the same vein, Hanover, (2012), Mastropieri, et al (2005) and Peeler, (2010) stated that team teaching has a lot of benefits to the teachers due to the fact that it puts into consideration: time for co-planning, pupils' needs and characteristics, teachers' characteristics, expertise in the content area of the curriculum, outstanding work relationship and effective instructional skills. This finding is in consonance with the finding of Mastropieri et al (2005) who carried out investigations into co-teaching in science and social studies content-area classes, in which collaborating teachers, disabled students and normal students were observed and interviewed on the effectiveness and problems associated with inclusive education. The study showed that team teaching proved helpful for students' learning.

Moreover, the findings of the study revealed that team teaching is not without its challenges. Among these challenges are: stakeholders' disposition to its implementation, responsibility for pairing of teachers; factors for putting teachers in team, co-planning time, work relationship between team teachers, time management in class. Other challenges are resistance to change; teachers' individual difference; superiority or inferiority complex; regular conflict between teachers; shortage of qualified personnel and fund. This finding corroborates the view of Friend et al (2010) and Mastropieri et al (2005) that team teaching is complex activity that involves different issues. Some of the issues involved in team teaching as identified by these researches are building partnership, planning time, compatibility of team teachers and monitoring students' progress.

The finding of this study emphasised that building a strong partnership is a prerequisite for effective implementation of team teaching in schools. The process of building partnership in team requires time. As the partners work with each other, they build trust which will help them to interact or relate smoothly. It is based on this that Gately and Frank (2001) identified three stages that co-teachers experience in the process of building relationship as the beginning stage, the compromise stage and the collaborative stage.

At beginning stage, communication and interaction between the teachers was somehow restricted. One of the teachers may be seen as the leader, while the other is viewed as helper. This stage is associated with different challenges. At compromise stage, teachers interact, exchange and share opinions and views in an open way. The teachers work hand in hand to develop and implement rules and regulations in class and employ various methods of assessment to evaluate students' learning. At collaborative stage, team teachers coordinate use non-verbal communication during classroom activities.

This finding also agrees with the initial stages (forming, storming, norming and performing) of building effective and efficient team as identified by Tuckman (1965). According to Tuckman (1965), all teams go through a relatively unproductive initial stage before becoming a self-reliant unit. At forming stage, team members are uncertain about their role and therefore, they look outside for guidance and direction. Team members feel anxious and are unsure of their roles at this stage. At storming stage, team members grow confidence in team and reject outside authority. Members still feel uncertain but they try to express their individuality. At norming stage, members are eager to be part of the team. They exhibit open exchange of views and ideas in solving the team's problem, set up procedures to achieve tasks, ignore individual differences and accepting one another. At performing stage, members of the team are concerned with getting the job done. They allocate resources efficiently and put processes in place to achieve the objectives of the team.

In addition, the finding of this study shows that team teachers should work together in building a strong partnership for effective implementation of team teaching. That is why Gately and Frank (2001) recommended some steps in building a strong team relationship. Among the steps recommended by them are:

(i) both teachers should share views on students' achievement and collaboration

(ii) conversations about each teacher's preferences should be done. Teachers generally possess different teaching styles, aspirations, attitudes, expectations, and abilities to adapt to change. Teachers in a team come together to discuss and mutually decide how best to handle any area of disagreement

(iii) open communication and trust should be built

(iv) they should have a shared belief about team teaching

(v) create time for co-planning and ensure the judicious use of the time

(vi) decision to address specific needs of student during team teaching

(vii) resolution of conflicts during teaching

(viii) they should establish classroom routines and behavior management

(ix) sharing of teaching styles and preferences

(x) decision on assessment methods

(xi) they should have the understanding that they are a team and walk in that consciousness. They should be viewed as equal partners in progress during the class interaction

(xii) they should be introduced to the students as a team

Moreover, the finding of this study also supports the argument of Brandenburg (1997), Dieker (2006) and Goetz (2000) that planning for Instruction is a key factor in team teaching due to the fact that pre-instruction planning is a crucial subset of classroom interaction. It is during instructional planning that teachers determine the instructional objectives to be achieved as well as the instructional materials necessary for clear understanding of the concept to be taught. During planning, the part each teacher would play and his or her contributions to the instructional delivery are spelt out. Components of pre-instructional preparation include goals or objectives of the lesson; lesson activities; assessment techniques to be used for evaluating students' learning outcomes, instructional materials/supports needed. Also, variables needed for the success of students are identified, implemented and analysed on a regular basis. Based on this, pre-instructional planning by both teachers should be a continuous exercise which should be carried out in a designated place at a specific time. It is necessary that teachers for the same class meet daily or weekly as they deem it fit to take some important decisions on content of instruction, how lesson will be presented and in what order; assigning roles to each teacher and evaluation methods to be used to assess students' learning. Co planning helps both partners evaluate the efficacy of team teaching in terms of its successes and challenges and thereby helping the teachers to address any concerns.

In addition, the findings of the study align with that of Mastropieri et al (1998) that the success or otherwise of the team teaching is dependent on the compatibility of the team teachers. When team teachers get along well, there bounds to be students' success. Conversely, when there is rivalry, ranchor and conflicts between the teachers, learning experiences become challenging to the students. Also, Mastropieri *et al* (2005) carried out an observation study on two set of team teachers (general education teachers and special education teachers). One team team-taught a fourth-grade upper elementary– age class and the other team co-taught a seventh grade science class. The findings from the two teams yielded similar results. Each team indicated that they had outstanding work relationships, used their strengths as motivators. They had time for co-planning for effective instructional skills and delivery among others. The team members reported that there was a smooth interaction between the co-teachers which ended on a good note; they had sincere regards and trust for each other. They also had a right perception that the students in the class belong to both of them. Although, they claimed they had no allocated time due to administrative bottleneck. The discussion about the lesson and the roles and responsibilities of each teacher as well as students were spelt out before school, after school or during lunch.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter presents the summary of the findings, the educational implications and conclusion of the study as well as the recommendations. Also, limitations of the study and suggestions for further study are included.

5.1 Summary of Findings

The study examined team teaching models and primary pupils' learning outcomes in Mathematics in Oyo, Nigeria. Seven hypotheses were tested at 0.05 level of significance and three research questions were answered. The study reviewed conceptual and empirical literature in the related areas. This study used mixed methods approach. The study adopted explanatory sequential mixed methods design with dominant quantitative components (QUAN-dominant). A total number of 401 primary five pupils, 12 primary five Mathematics teachers and 6 head teachers selected from 9 primary schools in Oyo participated in the study. Three stimulus and seven response instrument were used for data collection. Data collected was analysed using ANCOVA and manual inductive approach of content analysis. The results of the research presented and discussed in chapter four are summarized as follows:

1. Team teaching models increase pupils' achievement and interest in Mathematics but did not affect pupils' dexterity in Mathematics.
2. Learning styles did not affect pupils' achievement, interest and dexterity in Mathematics
3. Self-efficacy did not affect pupils' achievement, interest and dexterity in Mathematics.

4. Two-way and three-way combined effects of team teaching models, learning styles and self-efficacy did not affect pupils' achievement, interest and dexterity in Mathematics
5. The head teachers, Mathematics teachers and pupils perceived that team teaching is beneficial to the pupils and teachers and it can be introduced at the primary level of education due its benefits to both pupils and teachers. They suggested that its introduction should be preceded by adequate orientation, awareness, enlightenment and proper planning.
6. The head teachers and Mathematics teachers viewed that putting teachers in teams should be done by the administrative head of the schools (head teachers). However, years of experience, age or level of pupils, educational background among others should be considered before putting teachers in teams.
7. The head teachers and Mathematics teachers emphasised that teachers in a team should work harmoniously with each other. Although this may not be easy at the initial stage but as they progress, their relationships will get better.
8. Other challenges of team teaching as identified by the stakeholders are resistance to change, teachers' individual differences, superiority/inferiority complex, regular conflict, additional qualified personnel and fund.
9. Solution to the challenges of team teaching as suggested by stakeholders are: adequate and effective planning; orientation, awareness and enlightenment; regular monitoring and supervision; proper and mutual understanding of team teaching by teachers; evaluation and assessment of teachers with proper feedback and remediation; willingness of government to release more fund to the educational sector.

5.2 Conclusion

The present study employed two team teaching models and observed their effect on pupils' achievement, interest and dexterity in Mathematics, taking learning styles and self-efficacy into consideration. The study also investigated stakeholders' perception of team teaching. The two team teaching models used in this study had shown their potentials to enhance better performance in Mathematics, while only alternative team teaching model aroused pupils' interest in the subject. Alternative team teaching group profited most, followed by collaborative team teaching group, while control group profited least in achievement in Mathematics. In improving pupils' interest in Mathematics, alternative group profited most, followed by the control group, while the collaborative group profited least. The treatment did not improve pupils' dexterity. Neither learning styles nor self-efficacy had significant influence on the learning outcomes. Also, none of the two way and three-way interaction effects of the variables of the study (treatment, learning styles and self-efficacy) had effect on the learning outcomes. Finally, since stakeholders perceived team teaching as an effective method of instruction and proved in the study that team teaching models had effect on pupils' achievement and interest in Mathematics, therefore, these models should be adopted by Mathematics teachers to improve pupils' learning outcomes in Mathematics.

5.3 Educational Implications of the Findings

5.3.1 Pupils

The two team teaching models used in this study had shown their potentials to improve pupils' learning in Mathematics. This implies that team teaching models should be used for teaching primary Mathematics in order to improve pupils' performance in the subject. This will also improve pupils' interest in the subject. Pupils should not view use of two teachers teaching the same subject at the same period in the class as rowdy and intimidating as they are used to having more than one teacher in a class (although, they are not teaching the same subject). Instead, they should view team teaching as an improvement of the present policy of having more than one teacher in a class. They should not be carried away with two teachers implementing instruction at the same time. It is pertinent to note that various team teaching models used in this study will enable pupils to be exposed to different teaching strategies through different teachers. Pupils should note that Mathematics can be done by any pupil irrespective of his/her self-efficacy and learning styles. They should therefore not develop inferiority complex in the process of learning Mathematics. This should be extended to other subjects as well as career choice.

5.3.2 Teachers

The findings of this study have numerous implications for the teachers. Teachers should not be resistant to implementing new approach to teaching Mathematics. They should not view team teaching as time and effort consuming strategy. The joy of any Mathematics teacher is to see his/her pupils performing excellently in the subject irrespective of what it takes to achieve this. The teachers should develop positive attitude towards team teaching and embrace it if introduced at the primary school level. They should avoid opposition to change and deviate from the old way doing things. They should not view the models as stressful and impossible. They should realise that the success or otherwise of team teaching lies heavily on them. Also, teachers should have proper understanding of team teaching. Teachers in a team should have a specific co-planning time before class interaction to discuss on the objectives of the lesson, methods of instruction, class management, instructional materials to be used, modes of assessment among others. They should be open and build trust during the planning time. The time allotted to co-planning should be used judiciously for adequate and effective planning. Also, the teachers should prepare their mind to face challenges at the beginning of team teaching and they should therefore not be discouraged. They should put in their best to whether those challenges for the success of implementing team teaching. Teachers in team should see themselves as equal and partners in progress and therefore, avoid rivalry and strife. They should realise that a part is not greater than a whole and that the interest of the team supersedes their personal interest.

5.3.3 Head Teachers

The findings of this study serve as eye opener to the school head teachers. The head teachers should have positive disposition towards team teaching. They should be eager to implement it when introduced at primary school level. When given the responsibility of pairing of teachers, the head teachers should do so without biases or prejudice. They should also consider factors like educational background of the teachers, years of experience of the teachers, age and level of pupils among others before putting teachers in team. Regular monitoring and supervision should be carried out by head teachers, while implementing team teaching in school. This also should be done without prejudice. The head teachers should note that regular assessment of teachers is inevitable for the success of team teaching and this is part of their roles. They should not shark in their responsibility to provide feedback and necessary corrections if need be.

5.3.4 Government / Policy makers

The finding of this study reveals that team teaching helps in improving pupils' achievement in Mathematics. The government should make effort to implement team teaching at the primary school level. Policy makers should realise that implementation of team teaching should not be done haphazardly. Effective planning should be put in place if implemented at primary schools. Orientation, awareness and enlightenment programme for the stakeholders should be carried out before implementing the models at the primary school level. Regular monitoring and supervision should be carried out when implementing team teaching. Government should be willing to release more funds to the education sector. Also, government should create a conducive atmosphere that will encourage pupils' interest in Mathematics.

5.4 Recommendations

1. Team teaching models should be adopted in teaching Mathematics at the primary school level.

2. Pupils should view team teaching as an improvement over the present mode of instruction

3. Teachers should not be resistant to implementing team teaching models in the teaching and learning of Mathematics.

4. Collaborative and alternative team teaching models should be emphasised by teachers in improving pupils' performance in Mathematics.

5. Only alternative team teaching should be employed by teachers in arousing pupils' interest in Mathematics.

6. Teachers in team should see themselves as equal and partners in progress; they should therefore avoid rivalry.

7. Teachers should put in their best to overcome challenges associated with team teaching models.

8. Head teachers should be saddled with the responsibility of paring teachers.

9. Head teachers should not be biased in pairing of teachers.

10. Effective monitoring and feedback should be carried out by the head teachers at the implementation stage of team teaching.

11. Orientation, awareness and enlightenment programme should be carried out by the government at the planning stage of team teaching.

12. Effective supervision should be carried out by the government at the implementation stage of team teaching.

13. More teachers should be employed for proper implementation of team teaching.

14. Special training should be organised for teachers, head teachers, staff of local inspectorate of education and local government universal basic education for effective implementation of team teaching.

5.5 Limitations of the Study

1. The scope of this study was limited to public primary schools in Oyo, Oyo state. The findings of the study cannot be generalized to private primary schools.

2. The subject used in the study was Mathematics. The subject area covered was limited to a term work which is very minimal to what is to be covered in the whole primary school Mathematics syllabus/curriculum. Other studies can be carried using other aspects of primary Mathematics curriculum.

3. The study was also limited to lower level of educational objective (knowledge, comprehension and application) while analysis, synthesis and evaluation were not considered in the study.

4. Only primary 5 pupils took part in the study, thus, the finding cannot be generalized to other classes of primary schools.

5. The stakeholders used in the study were pupils, teachers and head teachers. The perception of other stakeholders in education can be investigated.

5.6 Suggestions for Further Study

1. The present study determined the effect of collaborative and alternative team teaching models on pupils' learning outcomes in Mathematics in Oyo. The study also investigated the perception of pupils, Mathematics teachers and head teachers on team teaching, challenges associated with team teaching as

well as the possible solutions to those challenges. It is therefore, suggested that the study should be replicated in the learning of other primary school subjects.

2. Category A of team teaching was the focus of this study. Other study could be carried out on category B of team teaching.

3. The study focused on two models of category A of team teaching which are collaborative and alternative team teaching. Further research should look into other models of category A of team teaching.

4. The effect of two moderating variables (learning styles and self-efficacy) on team teaching was determined in the study. Further study using other variables as moderators could be carried out.

5. The participants of the study were selected mainly from public primary schools in Oyo, Oyo state. The study could be replicated in private primary schools or both public and private primary schools.

6. The focus of this study was Oyo, Oyo state. The study could be replicated in other towns or states of Federation to allow comparison, thereby, giving room for making more valid and strong appraisal of the findings for authentic generalisation.

5.7 Contributions to Knowledge

1. The six instruments that were constructed and validated in the course of this study provide basis for measuring the constructs (variables) used in the study. These instruments were

   (a) Achievement in Mathematics Test (AMT)

   (b) Interest in Mathematics Scale (IMS)

   (c) Dexterity in Mathematics Test (DMT)

   (d) Mathematics Self-efficacy Scale (MSS)

   (e) Pupils' Focus Discussion Guide (PFDG)

   (f) Interview Guide (IG)

2. The findings of the study had shown effectiveness of team teaching models in bringing about improvement in pupils' achievement and arousing pupils' interest in Mathematics. This could serve as basis for further studies due to the fact that the study had shown empirical information on the effect of team teaching models on pupils' cognitive, affective and psychomotor domains.

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APPENDIX I

UNIVERSITY OF IBADAN

INSTITUTE OF EDUCATION

INTERNATIONAL CENTRE FOR EDUCATIONAL EVALUATION (ICEE)

COLLABORATIVE TEAM TEACHING PACKAGE (CTTP)

Collaborative Teaching Package (CTTP) was developed by the researcher. CTTP was used for experimental group 1. Prior to the teaching with the use of this package, a team of two teachers were selected for each class. The two teachers were labeled as teacher A and teacher B. Teacher A is the first teacher that starts the lesson while teacher B is the other teacher. The teachers for each class met to plan and design the instructional activities for their class. Both teachers taught each of the lessons together by exchanging roles.

In a collaborative lesson,

(i) teacher A introduces the lesson

(ii) teacher B explains the lesson and give relevant examples

(iii) teacher A evaluates and conclude the lesson.

(iv) these roles were exchanged in subsequent lesson. For instance, a teacher that plays the role of teacher A during a lesson will play the role of teacher B in the subsequent lesson and vice versa.

(v) While one teacher is teaching, the other teacher ensures that pupils are actively involved in the teaching learning process. This was done by checking, discouraging and correcting pupils' negative behaviour. The teacher ensures pupils' attention, participation and right disposition to the lesson. The teacher also calls the attention of any pupil that is not concentrating on the lesson.

Before the lesson for each week, the teachers meet to preview the lesson for the week by

(h) Identifying the behavioural objectives of the weekly topic to be taught for the week and classify them based on the daily sub topic.

(ii) Identifying the instructional materials needed for the topic

(iii) Distributing roles

(iv) Identifying teacher demonstration activities related to the topic

(v) Identifying pupils' demonstration activities related to the topic

(vi) Deciding methods of assessment to be used for the week

Specific Steps involved in Collaborative Team Teaching Class

Step 1: Teacher A introduces the topic, Teacher A assesses the previous knowledge of the pupils that is related to the sub-topic to be taught.

Step 2: Teacher B also assesses any other previous knowledge that is relevant to the topic

Step 3: Teacher B explains the lesson by giving different examples on the topic being taught.

Step 4: While teacher B is teaching, teacher A moves around the class to ensure pupils' attention, participation and right disposition to the lesson.

Step 5: Teacher B asks oral questions to check pupils' learning. He/she also encourages pupils'to seek clarification on unclear aspect.

Step6: Teacher B clarifies unclear questions to the pupils.

Step7: Teacher A evaluates the lesson by writing questions on the chalkboard

Step8: Both teachers ensure that all pupils are engaged with the exercise.

Step9: Teacher A gives feedback and corrections while teacher B ensures pupils' participation.

Step 10: Teacher A writes the homework on the chalkboard while teacher B ensures that pupils copy it in their notes

Pupils' activities during the lesson are:

1. Copying of notes
2. Asking questions or seeking clarification on unclear aspect of the lesson
3. Responding to teachers' or mates' questions
4. Active participation during the lesson Practical discovery of some Mathematics concepts

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

TOPICS

Identification of Angles

Properties of lines, Triangles and Quadrilaterals

Circle

Solid Shapes

Binary Number System

TOPIC 1: IDENTIFICATION OF ANGLES

Both teachers meet to plan for the week. Specific decisions were taken on:

- Instructional objectives for the teaching
- Instructional materials needed for the lesson
- Which of the team teachers will teach what?
- Pupils' activities
- Methods of assessment

MONDAY

Topic: Angles

Sub-topic: Introduction to Angles

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s):A pair of compasses, straight sticks, books e.t.c

Entry Behaviour: Pupils have come across different objects that have angles e.g. a pair of compasses, chalkboard, books e.t.c.

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) give simple definition of an angle

(ii) state the unit of measurement of an angle

(iii) identify any given angle

(iv) identify vertex and arms of any given angle

Introduction: Teacher A introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step: Teacher B gives a simple definition of an angle. An angle is formed when two straight lines meet. Hence, the distance between two meeting lines is called an angle.

Step 2: Teacher B explains that when a straight line rotates in a plane about a fixed point on the line, the angle formed is the measure of the amount of rotation usually measured in degree (^{0}). The point of rotation is called a vertex. The two straight lines are called the arms of an angle.

Step 3: Teacher B illustrates steps A and B with more diagrams and calls on pupils to identify angle, vertex and arms of angles.

Step 4: The teacher B illustrates more with real materials like two straight sticks, a pair of compasses e.t.c

Step 5: Teacher B explains to the pupils that an angle is measured in degree. It is denoted as ^{0}.

Step 6: Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following question

(i) An angle is measured in …………… Which is denoted as ………………

(Degree denoted by ^{0})

(ii) Draw any angle of your choice and indicate the following

- the angle
- Vertex
- Arms of angle

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A round up the lesson.

Assignment: Teacher A writes home work on the chalkboard.

Read on types of angles

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

TUESDAY

Topic: Identification of Angles

Sub-topic: Types of angles – right angle, acute angle and obtuse angle

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s):A pair of compasses, straight sticks, books, the wall against the floor of the classroom e.t.c

Entry Behaviour: Pupils have come across different objects that have angles. The have been taught the meaning of an angle, vertex and arms of angle.

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) identify a right angle

(ii) draw a right angle

(iii) identify an acute angle

(iv) identify an obtuse angle

(v) differentiate between an acute angle and obtuse angle

Introduction: Teacher A assesses pupils' knowledge on the last lesson and introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B gives the definition of an angle that is formed when two straight lines meet at a corner is a right angle. The angle at the corner is called a right angle. A right angle is an angle 90^0. It is also an angle that is formed when a horizontal line and vertical line meet.

Step 2: Teacher B draws diagram to explain a right angle. Teacher B uses examples of objects in the classroom to explain a right angle.

Step 3: The teacher B defines an acute angle as an angle that is less than a right angle (90^0)

Step 4: Teacher B draws examples of an acute angle

Step 5: Teacher B gives examples of acute angle such as 48^0, 62^0, 87^0 and 8^0

Step 6: Teacher B defines an obtuse angle.

An obtuse angle is an angle that is more than 90^0 but less than 180^0. An angle that is between 91 and 179 is an obtuse angle

Step 7: teacher B draws and gives examples of an obtuse.

Examples of obtuse angles are 133^0, 98^0 and 169^0.

Step 9: Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following questions.

Identify the following as right angle, acute angle and obtuse angle

(i) 114^0
(ii) 49^0
(iii) 90^0
(iv) 156^0

Solution:

- 114^0 - obtuse angle
- 49^0 - acute angle
- 90^0 - right angle
- 156^0 - obtuse angle

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A rounds up the lesson and ask further questions.

Assignment: Teacher A writes home work on the chalkboard

1. Draw
   (i) A right angle
   (ii) An acute
   (iii) An obtuse angle
2. What is the difference between an acute angle and an obtuse angle

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

WEDNESDAY

Topic: Angles

Sub-topic: Complementary Angles

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): Cardboards

Entry Behaviour: The have been taught right angle

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) explain the condition for two angles to be complementary

(ii) solve any given question on complementary angle

Introduction: Teacher A assesses pupils' knowledge on right angle and introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B draws a right angle

Step 2: Teacher B divides the right angle into two to give angle a^0 and b^0

Step 3: Teacher B explains that the two angles formed are acute angles, that is a^0 and b^0

Step 4: The teacher B explains further that the sum of the two angles is 90^0 i.e $a^0 + b^0 = 90^0$. Therefore, the two angles are said to be complementary.

Step 5: Teacher B uses diagram to explain the concept

$x^o + 35^o = 90^o$

$x^o = 90^o - 35^o$

$x = 55^o$

Step 6: Teacher B gives examples on the application of complementary angles. What are the complements of the following angles (i) 23^0 (ii) 65^0

Solution: Let the complement of 23^0 be y

$y + 23^0 = 90^0$

$y = 90^0 – 23^0$

$y = 67^0$

Let the complement of 65^0 be x

$x + 65^0 = 90^0$

$x = 90^0 – 65^0$

$x = 25^0$

Step 6: Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following questions

1. What is the condition for which two angles are said to be complementary?
2. What are the complements of the following angles (i) 1^0 (ii) 76^0

Solution:

1. The condition for which two angles are said to be complementary is that their sum must be 90^0
2. (i) Let the complement of 1^0 be a

   $a + 1^0 = 90^0$

   $a = 90^0 – 1^0$

   $a = 89^0$

   (ii) Let the complement of 76^0 be b

   $b + 76^0 = 90^0$

   $b = 90^0 – 76^0$

   $b = 14^0$

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A rounds up the lesson.

Assignment: Teacher A writes home work on the chalkboard

1. Two angles are said to be complementary if …………………

2. Find the complements of the following angles

(i) 46^0

(ii) 9^0

(iii) 79^0

(iv) 61^0

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

THURSDAY

Topic: Angles

Sub-topic: Angle 180^0 and Supplementary Angles

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): two straight sticks, cover of books e.t.c

Entry Behaviour: The have been taught right angle

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) explain the condition for two angles to be supplementary

(ii) solve any given question on supplementary angle

Introduction: Teacher A assesses pupils' knowledge on right angle and introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B draws two right angles and joins them together.

90 + 90 = 180

Step 2: Teacher B explains that the angle formed is 2 right angles that is $90^0 \times 2 = 180^0$.

Step 3: Teacher B further explains with two straight sticks that angle 180^0 is formed when two straight lines meet on a plane surface.

Step 4: The teacher B that supplementary angles are got by dividing 180^0 into two. Therefore, supplementary angles are two angles whose sum is 180^0.

Step 5: Teacher B draws diagram to explain further

$$\mathbf{a^o + b^o = 180}$$

$\mathbf{a^o+b^o=180^o}$

Step 6: Teacher B gives examples on the application of supplementary angles.

What are the supplements of the following angles (i) 3^0 (ii) 75^0

Let the supplement of 3^0 be a

$a + 3^o = 180$

$a = 180^o – 3^o$

$a= 177^o$

Let the supplement of 75^0 be b

$75^o + b = 180$

$b = 180^o – 75^o$

$b = 105^o$

Step 7: Teacher B allows pupils to copy note

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following questions on the board

1. What is the condition for which two angles are said to be supplementary?
2. What are the supplements of the following angles (i) 179^0 (ii) 46^0

Solution:

1. The condition for which two angles are said to be complementary is that their sum must be 180^0
2. (i) Let the complement of 179^0 be x

   $x + 179^0 = 180^0$

   $x = 180^0 – 179^0$

   $x = 1^0$

   (ii) Let the complement of 46^0 be y

   $y + 46^0 = 180^0$

   $y = 180^0 – 46^0$

   $y = 144^0$

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A rounds up the lesson.

Assignment: Teacher A writes home work on the chalkboard

1. Two angles are said to be supplement if ....
2. Find the supplements of the following angles
   (i) 172^0
   (ii) 19^0
   (iii) 154^0

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

FRIDAY

Topic: Angles

Sub-topic: Estimation of angles with protractor (Practical section)

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): pencil, ruler, eraser, protractor

Entry Behaviour: The have been taught types of angles

Behavioral Objectives: At the end of the lesson, pupils should be able to measure any given angle with protractor using either clockwise or anticlockwise

Introduction: Teacher A assesses pupils' knowledge on angles and introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B states the use of protractor as an instrument for drawing and measuring angle

Step 2: Teacher B draws angles (i) 43^0 (ii) 98^0 with the use of protractor

Step 3: Teacher B draws different angles

Step 4: Teacher B demonstrates measuring angles with protractor using anti clockwise method.

Step 5: Teacher B demonstrates measuring angles with protractor using clockwise method.

Step 6: Teacher B leads pupils to draw different angles

Step 7: Teacher B leads the pupils to measure the angle drawn with protractor using anti clockwise method.

Step 8: Teacher B leads the pupils to measure the angle drawn with protractor using clockwise method.

Step 9: Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the question on the chalkboard

1. With the use of protractor, draw angles (i) 34^0 (ii) 111^0 (iii) 168^0

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A rounds up the lesson and ask further questions.

Assignment: Teacher A writes home work on the chalkboard

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

TOPIC 2: PROPERTIES OF LINES, TRIANGLES AND QUADRILATERALS

Both teachers meet to plan for the week. Specific decisions were taken on:

- Instructional objectives for the teaching
- Instructional materials needed for the lesson
- Which of the team teachers will teach what?
- Pupils' activities
- Methods of assessment

MONDAY

Topic: Properties of lines, triangles and quadrilaterals

Sub-topic: Properties of Lines

Duration: 50 minutes

Instructional Material(s): objects like flag pole, electric pole, tree, wall, table top

Entry Behaviour:

Behavioral Objectives: At the end of the lesson, pupils should be able to

•identify horizontal, vertical, perpendicular and parallel lines

•draw horizontal, vertical, perpendicular and parallel lines

•states the symbols of perpendicular lines and parallel lines

Introduction: Teacher A pre-assesses the pupils and introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B identifies different lines as horizontal line, vertical line, parallel line and perpendicular line.

Step 2: Teacher B explains and draws types of lines with diagrams

A horizontal line is a straight line parallel to the ground e.g table top, window pane, door

Two lines are said to be **parallel** if they have the same distance apart. The symbol of parallel lines is //

A vertical line is a line that makes angle 90^0 with the ground e. g flag pole, tree, legs of a table, pole of wall e.t.c

A horizontal line and a vertical line meet at right angle (90^0)

Two lines are said to be **perpendicular** if they meet at right angle (90^0). The symbol of perpendicular line is

Step 3: Teacher B uses objects within the school to explain the concept

Step 4: Teacher B emphasises more on the symbols of perpendicular and parallel lines

Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A evaluates with the following questions

(i) Identify the following lines

(ii) Draw a vertical line

(iii) The symbol of parallel lines is …………….

(iv) The symbol of perpendicular line is ………..

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher B round up the lesson and ask further questions.

Assignment: Teacher A writes home work on the chalkboard

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

TUESDAY

Topic: Properties of lines, triangles and quadrilaterals

Sub-topic: Properties of triangles

Duration: 50 minutes

Instructional Material(s): shapes of triangles and triangular objects

Entry Behaviour: pupils have been taught types of triangles, they are also familiar with triangular objects.

Behavioral Objectives: At the end of the lesson, pupils should be able to;

(i) state some properties of an equilateral triangle

(ii) identify equilateral triangle

(iii) state some properties of isosceles triangle

(iv) identify isosceles triangle

Introduction: Teacher A pre-assesses pupils and introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B defines a triangle as a 3 sided shape

Step 2: Teacher B draws an equilateral triangle

Step 2: Teacher B leads the pupils to identify properties of an equilateral triangle

•all sides are equal in length

line AB = line BC = Line AC

•all angles are equal

Angle A = Angle B = Angle C

Step 3: Teacher B draws an isosceles triangle

Step 4: Teacher B leads the pupils to identify properties of an isosceles triangle

•Two sides are equal

Line AB = Line AC

•2 base angles are equal

Angle B = Angle C

Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A evaluates the lesson with the following questions

1. Draw the following triangles (i) right angled triangle (ii) isosceles triangle

2. State the properties of an equilateral triangle

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A round up the lesson and ask further questions.

Assignment: Teacher A writes home work on the chalkboard.

Read on scalene triangle and right angled triangle

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

WEDNESDAY

Topic: Properties of lines, triangles and quadrilaterals

Sub-topic: Properties of triangles(continuation)

Duration: 50 minutes

Instructional Material(s): shapes of triangles and triangular objects

Entry Behaviour: pupils have been taught types of triangles, they are also familiar with triangular objects.

Behavioral Objectives: At the end of the lesson, pupils should be able to;

(i) state some properties of a scalene triangle

(ii) identify a scalene triangle

(iii) state some properties of a right angled triangle

(iv) identify a right angled triangle

Introduction: Teacher A pre-assesses pupils and introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B draws a scalene triangle

Step 2: Teacher B leads the pupils to identify properties of a scalene triangle

•None of sides are equal in length

line AB = line BC = Line AC

•None of the angles are equal

Angle A = Angle B = Angle C

Step 3: Teacher B draws a right angled triangle

Step 4: Teacher B leads the pupils to identify properties of a right angled triangle

•Two sides are perpendicular

AB is perpendicular to BC

- One of the angles is a right angle (90^0)

Angle B = 90^0

Step 5: Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con

- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A evaluates the lesson with the following questions

1. Draw the following triangles (i) right angled triangle (ii) scalene triangle

2. State the properties of a scalene triangle

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A round up the lesson and ask further questions.

Assignment: Teacher A writes home work on the chalkboard.

Read on quadrilaterals

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

THURSDAY

Topic: Properties of lines, triangles and quadrilaterals

Sub-topic: Properties of quadrilaterals

Duration: 50 minutes

Instructional Material(s): shapes of quadrilaterals

Entry Behaviour: pupils have been taught square and rectangle

Behavioral Objectives: At the end of the lesson, pupils should be able to;

(i) state some properties of a parallelogram

(ii) identify a parallelogram

(iii) state some properties of a trapezium

(iv) identify a trapezium

Introduction: Teacher A pre-assesses pupils and introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B revises the definition and examples of quadrilaterals with pupils

A quadrilateral is 4 a sided shape. Examples are square, rectangles, parallelogram, trapezium, rhombus.

Step 2: Teacher B revises properties of a square and rectangle

Step 3: Teacher B draws a parallelogram

Step 4: Teacher B leads the pupils to identify properties of a parallelogram

•its opposite sides are equal

•its opposite angle are equal

•opposite sides are parallel

Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A evaluates the lesson with the following questions

1. Draw a parallelogram
2. State the properties of a parallelogram

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A round up the lesson and ask further questions.

Assignment: Teacher A writes home work on the chalkboard.

Read on trapezium and rhombus

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

FRIDAY

Topic: Properties of lines, triangles and quadrilaterals

Sub-topic: Properties of quadrilaterals (continuation)

Duration: 50 minutes

Instructional Material(s): shapes of quadrilaterals

Entry Behaviour: pupils have been taught square and rectangle

Behavioral Objectives: At the end of the lesson, pupils should be able to;

(i) state some properties of a trapezium

(ii) identify a trapezium

(iii) state some properties of a rhombus

(iv) identify a rhombus

Introduction: Teacher A pre-assesses pupils and introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B draws different shapes of trapezia

Step 2: Teacher B leads the pupils to identify properties of a trapezium

•A pair of its opposite sides are parallel

•It has 0 or 1 line of symmetry

- An isosceles trapezium has 1 line of symmetry

Step 3: Teacher B draws a rhombus

Step 4: Teacher B leads the pupils to identify properties of a rhombus

•all sides are equal

•opposite angles are equal

•Opposite sides are parallel

•It is a parallelogram with four equal sides

•If a rhombus has 4 right angle, it is a square. Then it has 4 lines of symmetry. Itf not, it has 2 lines of symmetry

Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A evaluates the lesson with the following questions

1. Draw two forms of trapezia
2. State two properties of a rhombus
3. A rhombus with 4 right angle is a …..............

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A round up the lesson and ask further questions.

Assignment: Teacher A writes home work on the chalkboard.

State whether the following statement is true or false

- Every rhombus is a square (false)
- Every square is a rhombus (true)
- Every rhombus is a parallelogram (true)
- Every parallelogram is a rhombus(false)
- Every trapezium is a parallelogram (false)
- Every parallelogram is a trapezium (false)
- Every trapezium is a rhombus (false)

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

TOPIC 3: CIRCLE

Both teachers meet to plan for the week. Specific decisions were taken on:

- Instructional objectives for the teaching
- Instructional materials needed for the lesson
- Which of the team teachers will teach what
- Pupils' activities
- Methods of assessment

MONDAY

Topic: Circle

Sub-topic: Definition and drawing of a circle

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): A mathematical set containing a pair of compasses, ruler e.t.c

Entry Behaviour: Pupils have familiar with circular objects such as bottle covers, plates e.t.c

Behavioral Objectives: At the end of the lesson, pupils should be able to

•define a circle

•draw a circle with a pair of compasses

•draw a circle of a given radius with a pair of compasses

Introduction: Teacher A assesses and introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B gives a definition of an angle.

A circle is a flat shape formed by a set of points equidistant from a fixed point.

Radius is the distance from the fixed point to the circle. The fixed point is the centre of the circle.

Step 2: Teacher B explains the concept by drawing a free hand circle

Step 3: Teacher B gives the following steps in drawing a circle with a pair of compasses

•open the pair of compasses to any radius

•mark the centre that is a point at which you will place the pin end of the compass

•put the pin end of the compass at the centre

•turn the pencil end of the compass round to draw the circle with the pencil

Teacher B allows pupils to copy notes

Step 4: Teacher B lead pupils to demonstrate the steps 3 above by drawing a circle with a pair of compasses

Step 5: Teacher B leads the pupils to draw circles of the following radii

(a) 2cm (b) 4cm

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con

- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following question

•define a circle

•draw circles of the following radii (a) 2cm (b) 4cm

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A round up the lesson.

Assignment: Teacher A writes home work on the chalkboard.

Use a paper or cardboard to make a circle

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

TUESDAY

Topic: Circle

Sub-topic: Parts of a circle

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): Mathematics set containing a pair of compasses, ruler e.t.c

Entry Behaviour: Pupils have been taught the definition and how to draw a circle

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state parts of a circle

(ii) define parts of a circle

Introduction: Teacher A assesses and introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B states parts of a circle

Parts of a circle are circumference, diameter, radius, semicircle, arc, chord, segment, quadrant.

Step 2: Teacher B defines parts of a circle with diagram

•Circumference is the distance round the circle. Circumference of a circle is called the perimeter of a circle

•Diameter is a line that divides a circle into two equal parts. It usually passes through the centre of the circle

•Radius is the distance between the centre of the circle and the circumference of the circle. It is half of the diameter

•Semicircle is the half of a circle

•Arc is a portion of the circumference of a circle

•Chord is a line that passes through the two points on the circumference of a circle

•Segment is a region between the chord and the arc of the circle

•Quadrant is a quarter of a circle if the circle is divided into four equal part

Step 3: Teacher B shows parts of a circle with a circular cardboard

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following question

•state four part of circle

•define the following (a) diameter (b) semicircle (c) quadrant

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A round up the lesson.

Assignment: Teacher A writes home work on the chalkboard.

•Make a circle with a cardboard showing the following

(a) radius

(b) segment

(c) diameter

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

WEDNESDAY

Topic: Circle

Sub-topic: Perimeter of a circle

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): Mathematics set containing a pair of compasses, ruler e.t.c

Entry Behaviour: Pupils can define and identify circumference of a circle

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state the formula for calculating the perimeter of a circle

(ii) apply the formula for calculating the perimeter of a circle

Introduction: Teacher A assesses and introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B states the formula for calculating the perimeter/circumference of a circle

$C = 2\pi r$

$C = \pi d$

Where C is the perimeter/circumference of the circle

r is the radius of the circle

d is the diameter of the circle

π = pi = 22/7

Step 2: Teacher B gives the following examples

•Find the circumference of a circle whose radius is 7cm

$C = 2\pi r$

C = 2 x 7 x 22/7

C = 44cm

•The diameter a circle is 28cm. Find its circumference

$C = \pi d$

C = 22/7 x 28 cm

C = 88cm

Step 3: Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following question

•Calculate the perimeter of a circle whose radius is 14cm

•Calculate the perimeter of a circle whose diameter is 14cm

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A rounds up the lesson.

Assignment: Teacher A writes home work on the chalkboard.

•A circular track has a radius of 21cm. Find (a) its diameter (b) its circumference (c) divide its circumference by its diameter.

•A circle has a diameter of 35cm. Calculate (a) its circumference (b) divide its circumference by its diameter.

•If C = 132cm. What is r ?

•Teacher A ask pupils to come to the next class with models of circle

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

THURSDAY

Topic: Circle

Sub-topic: Practical section of the discovery of π

Duration: 50 minutes

Instructional Material(s): circular objects, models of circles, twain, thread or rope, ruler

Entry Behaviour: Pupils are familiar with circular objects around them. They have been taught the definition, parts and the circumference of the circle

Behavioral Objectives: At the end of the lesson, pupils should be able to explain why the value of π is 22/7 or 3.142

Introduction: Teacher A briefly revives the previous topic and introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B asks pupils to bring out models of circles they have made

Step 2: The teacher B leads the pupils to wind the twain/rope/thread around a circle and record the measurement as the perimeter of the circle

Step 3: Teacher A goes round to ensure that pupils are doing the right thing and correct where necessary.

Step 3: Teacher B leads the pupils to measure the diameter of the circle and record it

Step 4: Teacher A goes around to ensure that pupils are doing the right thing and correct where necessary.

Step 5: Teacher B leads the pupils to divide the circumference of a circle with its diameter and ask pupils to give answer (3.142)

Step 6: Teacher A goes around to ensure that pupils are doing the right thing and correct where necessary.

Step 7: Teacher B leads the pupils to convert 3.142 to a fraction (22/7)

Step 8: Teacher A goes around to ensure that pupils are doing the right thing and correct where necessary.

Step 9: teacher B relates the activities with the formula

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A gives an exercise on the activity

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A round up the lesson.

Assignment: Teacher A gives homework. Teacher A asks pupils to practice with different circular objects at home.

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

FRIDAY

Topic: Circle

Sub-topic: Area of a circle

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): Circular objects e.t.c

Entry Behaviour: Pupils have been taught different lessons of circle

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state the formula for calculating the area of a circle

(ii) apply the formula for calculating the area of a circle

Introduction: Teacher A assesses and introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B states the formula for calculating the area of a circle

$A = \pi r^2$

Step 2: Teacher B gives the following examples

1. Find the area of a circle whose radius is 7cm

   $A = \pi r^2$

   r = 7cm,

   A = 22/7 x 7 cm x 7cm

   A = 154cm2

2. The diameter a circle is 28cm. Find its area

   r = d/2 = 28/2 = 14cm

   $A = \pi r^2$

   A = 22/7 x 14cm x 14cm

   A = 196cm2

Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following question

•Calculate the area of a circle whose radius is 28cm

•Calculate the area of a circle whose diameter is 42cm

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A rounds up the lesson.

fAssignment: Teacher A writes home work on the chalkboard.

•Find the area of a circle whose radius is 20cm

•The area of a circular object is 2464cm2, Calculate its radius

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

WEEK 4: SOLID SHAPES

Both teachers meet to plan for the week. Specific decisions were taken on:

- Instructional objectives of the topic
- Instructional materials needed for the lesson
- Which of the team teachers will teach what
- Pupils' activities
- Methods of assessment

MONDAY

Topic: 3-Dimensional shapes (Solid shapes)

Sub-topic: Introduction to Solid shapes

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): different shapes like cartoons, tins e.t.c

Entry Behaviour: Pupils are familiar with solid shape objects. They have been taught plane shapes.

Behavioral Objectives: At the end of the lesson, pupils should be able to

•define three dimensional shapes

•list solid shapes that can be found at home and school

•state the general properties of solid shapes

Introduction: Teacher A introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B defines solid shapes as 3 dimensional objects

They are objects that have 3 dimensional which are length, breadth and height. They are also called solid shapes

Step 2: Teacher B leads the pupils to identify solid shapes around them

Step 3: Teacher B states general properties of 3 dimensional objects

•faces

•edges

•vertices/corners

Step 4: Teacher B explains each of the properties of solid shapes

A face is a flat or curve surface of a solid

An edge of a solid shape is where two faces meet

A vertex is where two or more edges meet. It is also called a corner. The plural form of a vertex is vertices

Step 5: Teacher B shows the properties of 3 dimensional shapes with different real objects

Step 6: Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following questions

(i) Solid shapes are called three dimensional objects because they have …………, ……….. and ……………

(ii) The three general properties of solid shapes are ……….., ………….. and ……….

Solution:

(i) Length, breadth and height
(ii) Faces, edges and vertices

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A round up the lesson

Assignment: Teacher A asks pupils to bring different solid shapes objects for the subsequent lesson

Post Instructional Planning: The teachers meet preview the subsequent lesson.

TUESDAY

Topic: 3-Dimensional shapes (Solid shapes)

Sub-topic: Properties and net of a cube

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): solids like maggi cube, choco milo, sugar cube made with cardboards e.t.c

Entry Behaviour: Pupils are familiar with solid shape objects. They have been taught general properties of solid shapes

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state the properties of a cube
(ii) draw the net of a cube

Introduction: Teacher A assesses pupils' knowledge on the previous lesson and thereafter introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B explains that a cube has faces, edges and vertices. He/she adds that each face of a cube has a square shape

Step2: Teacher B leads the pupils to identify the number of faces, edges and vertices of an open cube (5 faces, 8 vertices and 12 edges)

Step 3: Teacher B leads the pupils to identify the number of faces, edges and vertices of a closed cube (6 faces, 8 vertices and 12 edges)

Step 4: Teacher B draws net of a cube

Step 5: Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following questions

(i) An open cube has ……………. faces
(ii) A closed cube has …………… faces
(iii) draw a cube

Solution:

(i) 5
(ii) 6

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A round up the lesson

Assignment: Teacher A writes home on the chalkboard

Read on properties and net of cuboid and come to the next class with different cartoons

Post Instructional Planning: The teachers meet preview the subsequent lesson.

WEDNESDAY

Topic: 3-Dimensional shapes (Solid shapes)

Sub-topic: Properties and net of a cuboid

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): different cartoons, cuboid made with cardboards e.t.c

Entry Behaviour: Pupils are familiar with solid shape objects. They have been taught general properties of solid shapes

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state the properties of a cuboid

(ii) draw the net of a cuboid

Introduction: Teacher A assesses pupils' knowledge on the previous lesson and thereafter introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B explains that a cuboid has faces, edges and vertices. He/she adds that each face of a cube has a rectangular shape

Step 2: Teacher B leads the pupils to identify the number of faces, edges and vertices of an open cuboid (5 faces, 8 vertices and 12 edges).

Step 3: Teacher B leads the pupils to identify the number of faces, edges and vertices of a closed cuboid (6 faces, 8 vertices and 12 edges).

Step 4: Teacher B draws net of a cuboid

Step 5: Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following questions

(i) The face of cuboid is ……………… in shape
(ii) An open cuboid has …………… faces, ……….. edges and ……..vertices

Solution:

(i) rectangular
(ii) 6, 12 and 8

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A round up the lesson

Assignment: Teacher A writes homework on the chalkboard

Read on properties and net of cylinder and come to the next lesson with cylindrical objects like tins

Post Instructional Planning: The teachers meet preview the subsequent lesson.

THURSDAY

Topic: 3-Dimensional shapes (Solid shapes)

Sub-topic: Properties and net of a cylinder

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): cylindrical objects, cylinder made with cardboards e.t.c

Entry Behaviour: Pupils are familiar with solid shape objects. They have been taught general properties of solid shapes

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state the properties of a cylinder

(ii) draw the net of a cylinder

Introduction: Teacher A assesses pupils' knowledge on the previous lesson and thereafter introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B leads the pupils to identify the number of faces, edges and vertices of an open cylinder

Step 2: Teacher B leads the pupils to identify the number of faces, edges and vertices of a closed cylinder

Step 3: Teacher B draws net of open cylinder

Step 4: Teacher B draws net of closed cylinder

Step 5: Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following questions

(i) draw the net of an open cylinder
(ii) how many faces, edges and vertices does a closed cylinder has
Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A round up the lesson

Assignment: Teacher A writes home on the chalkboard

Read on properties and net of cone. Use cardboard to make cones

Post Instructional Planning: The teachers meet preview the subsequent lesson.

FRIDAY

Topic: 3-Dimensional shapes (Solid shapes)

Sub-topic: Properties and net of a Cone

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): funnels, cones made with cardboards e.t.c

Entry Behaviour: Pupils are familiar with solid shape objects. They have been taught general properties of solid shapes

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state the properties of a cone

(ii) draw the net of a cone

Introduction: Teacher A assesses pupils' knowledge on the previous lesson and thereafter introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B leads the pupils to identify the number of faces, edges and vertices of a cone

Step 2: Teacher B draws net of a cone

Step 3: Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following questions

(i) draw the net of a cone

(ii) A cone has ….......... faces, ….......... edges and …......... corners

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A round up the lesson

Assignment: Teacher A writes homework on the chalkboard

Post Instructional Planning: The teachers meet preview the subsequent lesson.

WEEK 7: BINARY NUMBER SYSTEM

Both teachers meet to plan for the week. Specific decisions were taken on:

(i) Instructional objectives for the teaching

(ii) Instructional materials needed for the lesson

(iii) Which of the team teachers will teach what?

(iv) Pupils' activities

(v) Methods of assessment

MONDAY

Topic: Binary Number System

Sub-topic: Counting in base 2

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): counters, pebbles, stones, sticks e.t.c

Entry Behaviour: Pupils have been taught even numbers and odd numbers

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) explain binary number system
(ii) Differentiate between even numbers and odd numbers
(iii) Convert numbers in base 10 to base 2
(iv) Convert numbers in base 2 to base 10

Introduction: Teacher A introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: The teacher B revises even and odd number

The numbers that are counted in groups of twos ad without a remainder are called even numbers while the numbers that are counted in group of two with remainders are odd numbers.

Step 2: The teacher B explains binary number system. Binary mean two. Binary number system involves counting number in groups of twos. 2 stands for a group of two. For example, 2 tubers of yam represent a bundle of yam.

Step 3: Teacher B emphasizes that when counting in twos, the remainder must not be greater than 1. That is any number in base 2 is a combination of 0 and 1

Step 4: Teacher B uses some examples to illustrate the concept

(i) 14 tins
(ii) 17 matches

Step 5: Teacher B explains how to convert number in base 10 to base two

(i) Convert 8 to base two

We have 1000_2

Step 6: Teacher B explains how to convert numbers in base 2 to base 10 using different example

(i) Convert 1101_2 to base 10
$1x2^3 + 1x2^2 + 0x2^1 + 1x2^0 = 8 + 4 + 0 + 1 = 13$

(ii) Convert 110111_2 to base 10
$1x2^5 + 1x2^4 + 0x2^3 + 1x2^2 + 1x2^1 + 1x2^0 = 32+16+0+4+2+1 = 45$

Step 4: Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following questions

(i) Represent 23 matches in base 2
(ii) Convert 21 to base 2
(iii) Convert 100111_2 to base 10

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher A round up the lesson

Assignment: Teacher A writes homework on the chalkboard

Post Instructional Planning: The teachers meet preview the subsequent lesson.

TUESDAY

Topic: Binary Number System

Sub-topic: Addition of numbers in base 2

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Entry Behaviour: Pupils have been taught even numbers and odd numbers

Behavioral Objectives: At the end of the lesson, pupils should be able to add numbers in base 2

Introduction: Teacher A introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B revises the concept of binary number

Step 2: Teacher B uses some examples to explain addition of numbers in base 2. He/she also leads the pupils to provide answers to the questions.

1. $101_2 + 111_2$

$$\begin{array}{r} 1\,0\,1 \\ +\,1\,1\,1 \\ \hline 1\,1\,0\,0_2 \\ \hline \end{array}$$

2. $1111_2 + 10000_2$

$$\begin{array}{r} 1\,1\,1\,1 \\ +\,1\,0\,0\,0\,0 \\ \hline 1\,1\,1\,1\,1_2 \\ \hline \end{array}$$

3. $100000_2 + 101_2 + 1000_2$

$$\begin{array}{r} 1\,0\,0\,0\,0\,0 \\ +\quad 1\,0\,1 \\ \hline 1\,0\,0\,1\,0\,1 \\ +\quad 1\,0\,0\,0 \\ \hline 1\,0\,1\,1\,0\,1_2 \\ \hline \end{array}$$

Step 4: Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following questions

(i) $10011_2 + 1111_2$

$$\begin{array}{r} 1\ 0\ 0\ 1\ 1 \\ +\ \ 1\ 1\ 1\ 1 \\ \hline 1\ 0\ 0\ 0\ 1\ 0 \\ \hline \end{array}$$

(ii) $111_2 + 101_2 + 1111_2$

$$\begin{array}{r} 1\ 1\ 1 \\ +\ 1\ 0\ 1 \\ \hline 1\ 1\ 0\ 0 \\ +\ 1\ 1\ 1\ 1 \\ \hline 1\ 1\ 0\ 1\ 1 \\ \hline \end{array}$$

Both teachers check pupils' work and give correction

Conclusion: Teacher B round up the lesson

Assignment: Teacher A writes homework on the chalkboard

(i) Find A if A $=1101111_2 + 10001_2$
(ii) $11110000_2 + 1000001_2$

Post Instructional Planning: The teachers meet preview the subsequent lesson.

WEDNESDAY

Topic: Binary Number System

Sub-topic: Subtraction of numbers in base 2

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Entry Behaviour: Pupils are have been taught addition of numbers in base 2

Behavioral Objectives: At the end of the lesson, pupils should be able to subtract numbers in base 2

Introduction: Teacher A introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B explains subtract of number in base 2

Step 2: Teacher B uses some examples to explain addition of numbers in base 2. He/she also leads the pupils to provide answers to the questios

1. $111_2 - 101_2$

$$\begin{array}{r} 1\,1\,1 \\ \underline{-1\,0\,1} \\ \underline{0\,1\,0_2} \end{array} = 1\,0_2$$

2. $1111_2 - 1000_2$

$$\begin{array}{r} 1\,1\,1\,1 \\ \underline{-\ 1\,0\,0\,0} \\ \underline{0\,1\,1\,1_2} \end{array} = 111_2$$

3. Find the value of X_2 if $X_2 – 111_2 = 101_2$

$X = 101_2 + 111_2$

$$\begin{array}{r} 1\,0\,1 \\ \underline{+1\,1\,1} \\ \underline{1\,1\,0\,0_2} \end{array}$$

Step 4: Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following questions

(i) 10011_2- 1111_2

(ii) 1111_2 - 1001_2

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher B round up the lesson

Assignment: Teacher A writes homework on the chalkboard

(i) 1101111_2 - 10001_2

(ii) 1110000_2 - 1001111_2

Post Instructional Planning: The teachers meet preview the subsequent lesson.

THURSDAY

Topic: Binary Number System

Sub-topic: Multiplication numbers in base 2

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Entry Behaviour: Pupils have been taught even numbers and odd numbers

Behavioral Objectives: At the end of the lesson, pupils should be able to multiply numbers in base 2

Introduction: Teacher A introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B revises the concept of binary number

Step 2: Teacher B uses some examples to explain multiplication of numbers in base 2. He/she also leads the pupils to provide answers to the questions.

1. $11_2 \times 11_2$

$$\begin{array}{r} 1\ 1_2 \\ \underline{\times 1\ 1_2} \\ 1\ 1 \\ \underline{+\ 1\ 1\ \ } \\ 1\ \underline{0\ 0\ 1_2} \end{array}$$

2. Multiply $111_2 + 101_2$

$$\begin{array}{r} 1\ 1\ 1_2 \\ \times\ \underline{1\ 0\ 1_2} \\ 1\ 1\ 1 \\ 0\ 0\ 0\ \ \\ \underline{1\ 1\ 1\ \ \ \ } \\ \underline{1\ 0\ 0\ 0\ 1\ 1_2} \end{array}$$

3. Find the product of 110_2 and 110_2

$$\begin{array}{r} 1\ 1\ 0_2 \\ \times\ \underline{1\ 1\ 0_2} \\ 000 \\ 111\ \ \\ \underline{1\ 1\ 1\ \ \ \ } \\ \underline{1\ 0\ 1\ 0\ 1\ 0_2} \end{array}$$

Step 4: Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following questions

(i) Multiply 10_2 by 10_2
(ii) 110_2 x 10_2

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher B round up the lesson

Assignment: Teacher A writes homework on the chalkboard

(i) Find the product of 111_2 and 1001_2
(ii) Solve 10001_2 X 100_2

Post Instructional Planning: The teachers meet preview the subsequent lesson.

FRIDAY

Topic: Binary Number System

Sub-topic: Division of numbers in base 2

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Entry Behaviour: Pupils have been taught addition of numbers in base 2

Behavioral Objectives: At the end of the lesson, pupils should be able to carry out division of numbers in base 2

Introduction: Teacher A introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B explains how to carry out division in base two using these steps.

(i) Convert the two numbers to base 10
(ii) Carry out the division
(iii) Convert your answer to base 2

Step 2: Teacher B uses some examples to explain division in base 2 using the three steps

(i) Divide 1100_2 by 11_2
Convert 1100_2 to base 10 = 12
Convert 11_2 to base 10 = 3
Divide 12 by 3 = 4
Convert 4 to base 2 = 100_2

(ii) Divide 100100_2 by 1001_2
Convert 100100_2 to base 10 = 36
Convert 1001_2 to base 10 = 9
Divide 36 by 9 = 4
Convert 4 to base 2 = 100_2

(iii) Divide 1000011_2 by 1011_2
Convert 1000010_2 to base 10 = 66
Convert 1011_2 to base 10 = 11
Divide 66 by 11 = 6
Covert 6 to base 2 = 110_2

Step 4: Teacher B allows pupils to copy notes

Note:

- During the lesson presentation, teacher B encourages pupils to ask questions. He/she also asks pupils oral questions and clarifies unclear con
- The teacher that is not teaching moves round class to ensure pupils' attention and active participation.

Evaluation: Teacher A writes the following questions

(i) Divide 1001101_2 by 111_2
(ii) Divide 101101_2 by 1111_2

Both teachers mark pupils' work while teacher A gives correction

Conclusion: Teacher B round up the lesson

Assignment: Teacher A writes homework on the chalkboard

(i) Divide $1101111_2$by 10001_2

(ii) Divide 1110000_2 by 1001111_2

Post Instructional Planning: The teachers meet preview the subsequent lesson.

APPENDIX II

UNIVERSITY OF IBADAN

INSTITUTE OF EDUCATION

INTERNATIONAL CENTRE FOR EDUCATIONAL EVALUATION (ICEE)

ALTERNATIVE TEAM TEACHING PACKAGE (ATTP)

Alternative Teaching Package (ATTP) was developed by the researcher. ATTP was used for experimental group 2. Prior to the teaching with the use of this package, a team of two teachers (A and B) was selected for each class. The lesson was divided two sections (A and B). Section A was handled by teacher A while section B was handled by teacher B and vice versa. For instance, if teacher A handles section A during a lesson, teacher A handles section B in the subsequent lesson and vice versa.

In Section A of alternative teaching lesson,

(i) teacher A teaches the entire class.
(ii) oral assessment is carried out as the lesson progresses.
(iii) written assessment is carried out at the end of the lesson
(iv) While teacher A is teaching the lesson, teacher B
  - takes note of the aspect of the lesson that teacher A does not explain well.
  - takes note of the aspect of the lesson that the pupils do not perform well through the class assessment as well as the pupils that do not perform well in those areas.

In Section B of alternative teaching lesson,

(i) teacher B re-teaches the same topic to the entire class using different examples where applicable.
(ii) observation carried out during section A will inform the direction of re-teaching. Such observations include the aspect of the lesson that teacher A did

not explain well as well as the aspect of the lesson that the pupils do not perform well during the class assessment.

(iii) while teacher B is re-teaching, teacher A ensures pupils' attention and active participation.

The teachers meet to preview the lesson for the week by

1. Identifying the behavioural objectives of the weekly topic to be taught for the week.
2. Identifying the instructional materials needed for the topic
3. Distribution of roles between the teachers
4. Teacher demonstration activities related to the topic
5. Pupils' demonstration activities related to the topic
6. Methods of assessment to be used for the week

Steps involves in Alternative Team Teaching Class

Section A

Step 1: Teacher A assesses the previous knowledge of the pupils that is related to the sub-topic to be taught and introduces the lesson.

Step 2: Teacher A presents the lesson by giving different examples on the topic being taught.

Step 3: Teacher A asks oral questions to check pupils' learning as lesson progresses. He/she also encourages pupils to seek clarification on unclear aspect.

Step 4: Teacher B takes note of the aspect of the lesson that teacher A does not explain well

Step 5: Teacher A gives written assessment

Step 6: Teacher A asks pupils to exchange their notes for marking.

Step 7: Teacher A allows pupils to mark the exercise. Teacher A encourages pupils to be truthful in the marking and emphasises that the scores obtained will not be used for grading but for the purpose of re-teaching.

Step 8: Teacher A identifies the pupils that do not perform well as well as the area they do not perform well

Section B

Based on the observations and assessment carried out during section A

Step 1: Teacher B re-teaches the lesson using different examples where applicable focusing more on the aspect of the lesson that teacher A does not explain well as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

Step 2: While teacher B is teaching, teacher A moves round the class to ensure pupils' attention and active participation.

Step 3: Teacher B asks oral questions to check pupils' learning as the lesson progresses. He/she also encourages pupils to seek clarification on unclear aspect.

Step 4: Teacher B re-assesses the entire class.

Step 5: Both teachers mark the pupils' books

Step 6: Teacher B gives feedback and corrections to the pupils

Step 7: teacher B concludes the lesson

Pupils' activities during the lesson are:

1. Copying of notes
2. Asking questions or seeking clarification on unclear aspect of the lesson
3. Responding to teachers' or mates' questions
4. Active participation during the lesson

5. Practical discovery of some Mathematics concepts

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

TOPICS

Identification of Angles

Properties of lines, Triangles and Quadrilaterals

Circle

Solid Shapes

Binary Number System

TOPIC 1: IDENTIFICATION OF ANGLES

Both teachers meet to plan for the week. Specific decisions were taken on:

- Instructional objectives for the teaching
- Instructional materials needed for the lesson
- Which of the team teachers will teach what?
- Pupils' activities
- Methods of assessment

MONDAY

Topic: Angles

Sub-topic: Introduction to Angles

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s):A pair of compasses, straight sticks, books e.t.c

Entry Behaviour: Pupils have come across different objects that have angles e.g. a pair of compasses, chalkboard, books e.t.c.

Behavioral Objectives: At the end of the lesson, pupils should be able to

(j) give simple definition of an angle

(ii) state the unit of measurement of an angle

(iii) identify any given angle

(iv) identify vertex and arms of any given angle

Section A

Introduction: Teacher A assesses entry behaviour and introduces the lesson

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A gives a simple definition of an angle. An angle is formed when two straight lines meet. The distance between the two lines is called an angle,

Step 2: Teacher A explains that a straight line rotates in a plane about a fixed point on the line, the angle formed is the measure of the amount of rotation usually measured in degree (^{0}). The point of rotation is called a vertex. The two straight lines are called the arms of an angle.

Step 3: Teacher A illustrates steps 1 and 2 with diagrams.

Step 4: The teacher A illustrates more with real materials like two straight sticks, a pair of compasses e.t.c

Step 5: Teacher A allows pupils to copy notes

Step 6: Teacher A gives written assessment

Solution

A = angle

B = vertex

C = arm of an angle

D = arm of an angle

Step 7: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B:

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more explanation/clarifications and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept
3. During teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections to the pupils
7. Teacher B concludes the lesson.

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

TUESDAY

Topic: Identification of Angles

Sub-topic: Types of angles – right angle, acute angle and obtuse angle

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s):A pair of compasses, straight sticks, books, the wall against the floor of the classroom e.t.c

Entry Behaviour: Pupils have come across different objects that have angles. The have been taught the meaning of an angle, vertex and arms of angle.

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) identify a right angle

(ii) draw a right angle

(iii) identify an acute angle

(iv) identify an obtuse angle

(v) differentiate between an acute angle and obtuse angle

Section A

Introduction: Teacher A assesses pupils' knowledge on the last lesson and introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A gives the definition of an angle that is formed when two straight lines meet at a corner as a right angle. The angle at the corner is called a right angle. A right angle is angle 90^0

Step 2: Teacher A draws diagram to explain a right angle. Teacher A uses examples of objects in the classroom to explain a right angle.

Step 3: The teacher A defines an acute angle.

An angle that is less than a right angle (90^0)

Step 4: Teacher A draws examples of an acute angle

Step 5: Teacher A gives examples of acute angle like 48^0, 62^0, 08^0

Step 6: Teacher A asks oral questions to check pupils' learning

Step 7: Teacher A defines an obtuse angle.

An obtuse angle is an angle that is more than 90^0 but less than 180^0. Any angle that is between 91^0 and 179^0.

Step 8: teacher A draws and gives examples of an obtuse

Examples are 133^0, 98^0, 169^0

Step 9: Teacher A allows pupils to copy notes

Step 10: Teacher A gives written assessment

(i) An angle that greater than 90^0 but less than 180^0 is ……………. angle
(ii) 150^0 is an acute angle (Yes or No)
(iii) State the angle that each of the diagrams represents

Diagram A

Diagram B

Diagram C

Step 11: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B:

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson

that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more explanation/clarifications and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept
3. During teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.

Identify the following angles

(i) 21^0

(ii) 101^0

(iii) 90^0

(iv) 77^0

5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections to the pupils
7. Teacher B concludes the lesson/

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

WEDNESDAY

Topic: Angles

Sub-topic: Complementary Angles

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): Cardboards

Entry Behaviour: The have been taught right angle

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) explain the condition for two angles to be complementary

(ii) solve any given question on complementary angle

Section A

Introduction: Teacher A assesses pupils' knowledge on right angle and introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A draws a right angle

Step 2: Teacher A divides the right angle into two to give angle a^0 and b^0

Step 3: Teacher A explains that the two angles formed are acute angles, that is a^0 and b^0

Step 4: The teacher A explains further that the sum of the two angles is 90^0 i.e $a^0 + b^0 = 90^0$. Therefore, the two angles are said to be complementary.

Step 5: Teacher A uses diagram to explain the concept

$x^o + 35^o = 90^o$

$x^o = 90^o - 35^o$

$x = 55^o$

Step 6: Teacher A gives examples on the application of complementary angles. What are the complements of the following angles (i) 23^0 (ii) 65^0

Solution:

Let the complement of 23^0 be y

$y + 23^0 = 90^0$

$y = 90^0 – 23^0$

$y = 67^0$

Let the complement of 65^0 be x

$x + 65^0 = \quad 90^0$

$x = 90^0 – 65^0$

$x = 25^0$

In other word, to get the complement of any given angle, you subtract the angle from 90^0

i.e complement of 23^0 is $90^0 – 23^0 = 67^0$

Step 7: Teacher A gives written assessment.

State the complements of the following angles

(i) 43^0
(ii) 82^0

Step 8: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B:

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more explanation/clarifications and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept
3. During teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.

(i) State the condition for which two angles are said to be complementary

(ii) Find the complements of the (i) 1^0 (ii) 45^0

Solution:

(i) The sum of the angles must be 90^0

(ii) Let the complement of 1^0 be y

$y + 1^0 = 90^0$

$y = 90^0 - 1^0$

$y = 89^0$

Let the complement of 45^0 be x

$x + 45^0 = 90^0$

$x = 90^0 - 45^0$

$x = 45^0$

5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections to the pupils
7. Teacher B concludes the lesson.

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

THURSDAY

Topic: Angles

Sub-topic: Angle 180^0 and Supplementary Angles

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): two straight sticks, cover of books e.t.c

Entry Behaviour: The have been taught right angle

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) explain the condition for two angles to be supplementary

(ii) solve any given question on supplementary angle

Section A

Introduction: Teacher A assesses pupils' knowledge on right angle and introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A draws two right angles and joins them together.

90 + 90 = 180

Step 2: Teacher A explains that the angle formed is 2 right angles that is 90^0 x 2 = 180^0.

Step 3: Teacher A further explains with two straight sticks that angle 180^0 is formed when two straight lines meet on a plane surface.

Step 4: The teacher A that supplementary angles are got by dividing 180^0 into two. Therefore, supplementary angles are two angles whose sum is 180^0.

Step 5: Teacher A asks an oral question to check pupils' learning

Step 6: Teacher A draws diagram to explain further

$a^o + b^o = 180$ **$a^o + b^o = 180^o$**

Step 7: Teacher A gives examples on the application of supplementary angles.

What are the supplements of the following angles (i) 3^0 (ii) 75^0

$a + 3^o = 180$ $75^o + b = 180$

$a = 180^o - 3^o$ $b = 180^o - 75^o$

$a = 177^o$ $b = 105^o$

In other word, to get the supplement of a given angle, you will subtract the angle from 180^0.

For instance, to get the supplement of 3^0, $180^0 - 3^0 = 177^0$ (confirmation of example (i) in step 6)

Step 8: Teacher A written assessment

1. The sum of supplementary angles is ………………
2. Find the supplement of angle 165^0

Step 9: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more explanation/clarifications and pupils who do not understand the lesson well during section A.

2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept
3. During teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.

(i) State the condition for which two angles are said to be supplementary

(ii) Find the supplements of the (a) 56^0 (bi) 187^0

Solution:

(i) The sum of the angles must be 180^0

(ii) Let the supplement of 56^0 be y

$y + 56^0 = 180^0$

$y = 180^0 - 56^0$

$y = 124^0$

Let the supplement of 45^0 be x

$x + 45^0 = 180^0$

$x = 180^0 - 45^0$

$x = 135^0$

5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections to the pupils
7. Teacher B concludes the lesson

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

FRIDAY

Topic: Angles

Sub-topic: Estimation of angles with protractor (Practical section)

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): pencil, ruler, eraser, protractor

Entry Behaviour: The have been taught types of angles

Behavioral Objectives: At the end of the lesson, pupils should be able to measure any given angle with protractor using either clockwise or anticlockwise

Section A:

Introduction: Teacher A assesses pupils' knowledge on angles and introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A states the use of protractor as an instrument for drawing and measuring angle

Step 2: Teacher A draws angles (i) 54^0 (ii) 136^0 with the use of protractor

Step 3: Teacher A draws different angles

Step 4: Teacher A demonstrates measuring angles with protractor using anti clockwise method.

Step 5: Teacher A demonstrates measuring angles with protractor using clockwise method.

Step 6: Teacher A leads pupils to draw different angles

Step 7: Teacher A leads the pupils to measure the angle with protractor using anti clockwise method.

Step 8: Teacher A leads the pupils to measure the angle with protractor using clockwise method.

Step 9: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.

2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more demonstration and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher **B** asks pupils oral questions and clarify unclear concept
3. During teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections to the pupils
7. Teacher B concludes the lesson

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

TOPIC 2: PROPERTIES OF LINES, TRIANGLES AND QUADRILATERALS

Both teachers meet to plan for the week. Specific decisions were taken on:

- Instructional objectives for the teaching
- Instructional materials needed for the lesson
- Which of the team teachers will teach what?
- Pupils' activities
- Methods of assessment

MONDAY

Topic: Properties of lines, triangles and quadrilaterals

Sub-topic: Properties of Lines

Duration: 50 minutes

Instructional Material(s): objects like flag pole, electric pole, tree, wall, table top

Entry Behaviour:

Behavioral Objectives: At the end of the lesson, pupils should be able to

- identify horizontal, vertical, perpendicular and parallel lines
- draw horizontal, vertical, perpendicular and parallel lines
- state symbols for perpendicular lines and parallel lines

Section A

Introduction: Teacher A pre-assesses the pupils and introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A identifies different lines as horizontal line, vertical line, parallel line and perpendicular line.

Step 2: Teacher A explains and draws types of lines with diagrams

A horizontal line is a straight line parallel to the ground e.g table top, window pane, door

Two lines are said to be **parallel** if they have the same distance apart. The symbol of parallel lines is //

A vertical line is a line that makes angle 90^0 with the ground e. g flag pole, tree, legs of a table, pole of wall e.t.c

A horizontal line and a vertical line meet at right angle (90^0)

Two lines are said to be **perpendicular** if they meet at right angle (90^0). The symbol of perpendicular line is

Step 3: Teacher A uses objects within the school to explain the concept

Step 4: Teacher A emphasises more on the symbols of perpendicular and parallel lines

Step 5: Teacher A allows pupils to copy notes

Step 6: Teacher A gives written evaluation

(i) Identify the following lines

(ii) The symbol of parallel lines is …………….

(iii) The symbol of perpendicular line is ………..

Step 5: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more demonstration and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher **B** asks pupils oral questions and clarify unclear concept
3. During teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class
5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections to the pupils
7. Teacher B concludes the lesson

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

TUESDAY

Topic: Properties of lines, triangles and quadrilaterals

Sub-topic: Properties of triangles

Duration: 50 minutes

Instructional Material(s): shapes of triangles and triangular objects

Entry Behaviour: pupils have been taught types of triangles, they are also familiar with triangular objects.

Behavioral Objectives: At the end of the lesson, pupils should be able to;

(i) state some properties of an equilateral triangle

(ii) identify equilateral triangle

(iii) state some properties of isosceles triangle

(iv) identify isosceles triangle

Section A

Introduction: Teacher A pre-assesses pupils and introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A defines a triangle as a 3 sided shape

Step 2: Teacher A draws an equilateral triangle

Step 2: Teacher A leads the pupils to identify properties of an equilateral triangle

- all sides are equal in length

  line AB = line BC = Line AC

- all angles are equal

  Angle A = Angle B = Angle C

Step 3: Teacher A draws an isosceles triangle

Step 4: Teacher A leads the pupils to identify properties of an isosceles triangle

- Two sides are equal

  Line AB = Line AC

- 2 included angles are equal

  Angle B = Angle C

Step 5: Teacher A allows pupils to copy notes

Step 6: Teacher A gives written assessment

1. Identify these triangle

2. State the properties of an equilateral triangle

Step 7: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils’ learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more demonstration and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept
3. During teaching, teacher A moves round the class to ensure pupils’ attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils’ books
6. Teacher B gives feedback and corrections to the pupils
7. Teacher B concludes the lesson

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

WEDNESDAY

Topic: Properties of lines, triangles and quadrilaterals

Sub-topic: Properties of triangles(continuation)

Duration: 50 minutes

Instructional Material(s): shapes of triangles and triangular objects

Entry Behaviour: pupils have been taught types of triangles, they are also familiar with triangular objects.

Behavioral Objectives: At the end of the lesson, pupils should be able to;

(i) state some properties of an scalene triangle

(ii) identify a scalene triangle

(iii) state some properties of a right angled triangle

(iv) identify a right angled triangle

Section A

Introduction: Teacher A pre-assesses pupils and introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A draws a scalene triangle

Step 2: Teacher A leads the pupils to identify properties of a scalene triangle

- None of sides are equal in length

  line AB = line BC = Line AC

- None of the angles are equal

  Angle A = Angle B = Angle C

Step 3: Teacher A draws a right angled triangle

Step 4: Teacher A leads the pupils to identify properties of a right angled triangle

- Two sides are perpendicular

AB is perpendicular to BC

- One of the angles is a right angle (90^0)

Angle B = 90^0

Step 5: Teacher A allows pupils to copy notes

Step 6: Teacher A gives written assessment

1. Identify the diagram below.

2. State the properties of a scalene triangle

Step 5: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.

2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more demonstration and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher **B** asks pupils oral questions and clarify unclear concept
3. During teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections to the pupils
7. Teacher B concludes the lesson.

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

THURSDAY

Topic: Properties of lines, triangles and quadrilaterals

Sub-topic: Properties of quadrilaterals

Duration: 50 minutes

Instructional Material(s): shapes of quadrilaterals

Entry Behaviour: pupils have been taught square and rectangle

Behavioral Objectives: At the end of the lesson, pupils should be able to;

(i) state some properties of a parallelogram

(ii) identify a parallelogram

(iii) state some properties of a trapezium

(iv) identify a trapezium

Section A

Introduction: Teacher A pre-assesses pupils and introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A revises the definition and examples of quadrilaterals with pupils

A quadrilateral is 4 sided shape. Examples are square, rectangles, parallelogram, trapezium, rhombus.

Step 2: Teacher A revises properties of a square and rectangle

Step 3: Teacher A draws a parallelogram

Step 4: Teacher A leads the pupils to identify properties of a parallelogram

- its opposite sides are equal
- its opposite angle are equal
- opposite sides are parallel

Step 5: Teacher A allows pupils to copy notes

Step 6: Teacher A written assessment

1.

The shape above is called ……………………………

2. State the properties of a parallelogram

Step 7: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.

2. Teacher A encourages pupils to ask questions.

3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.

4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more demonstration and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept
3. During teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections to the pupils
7. Teacher B concludes the lesson.

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

FRIDAY

Topic: Properties of lines, triangles and quadrilaterals

Sub-topic: Properties of quadrilaterals (continuation)

Duration: 50 minutes

Instructional Material(s): shapes of quadrilaterals

Entry Behaviour: pupils have been taught square and rectangle

Behavioral Objectives: At the end of the lesson, pupils should be able to;

(i) state some properties of a trapezium

(ii) identify a trapezium

(iii) state some properties of a rhombus

(iv) identify a rhombus

Section A:

Introduction: Teacher A pre-assesses pupils and introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A draws different shapes of trapezia

Step 2: Teacher A leads the pupils to identify properties of a trapezium

- A pair of its opposite sides are parallel
- It has 0 or 1 line of symmetry

\- An isosceles trapezium has 1 line of symmetry

Step 3: Teacher A draws a rhombus

Step 4: Teacher A leads the pupils to identify properties of a rhombus

- all sides are equal
- opposite angles are equal
- Opposite sides are parallel
- It is a parallelogram with four equal sides
- If a rhombus has 4 right angle, it is a square. Then it has 4 lines of symmetry. It not, it has 2 lines of symmetry

Teacher A allows pupils to copy notes

Evaluation: Teacher A evaluates the lesson with the following questions

1. Identify the following shapes

2. State two properties of a rhombus
3. A rhombus with 4 right angle is a …..............

Step 5: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more demonstration and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher **B** asks pupils oral questions and clarify unclear concept
3. During teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books

6. Teacher B gives feedback and corrections to the pupils
7. Teacher B concludes the lesson

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

TOPIC 3: CIRCLE

Both teachers meet to plan for the week. Specific decisions were taken on:

- Instructional objectives for the teaching
- Instructional materials needed for the lesson
- Which of the team teachers will teach what
- Pupils' activities
- Methods of assessment

MONDAY

Topic: Circle

Sub-topic: Definition and drawing of a circle

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): A mathematical set containing a pair of compasses, ruler e.t.c

Entry Behaviour: Pupils have familiar with circular objects such as bottle covers, plates e.t.c

Behavioral Objectives: At the end of the lesson, pupils should be able to

- define a circle
- draw a circle with a pair of compasses
- draw a circle of a given radius with a pair of compasses

Section A

Introduction: Teacher A assesses and introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A gives a definition of an angle.

A circle is a flat shape formed by a set of points equidistant from a fixed point.

Radius is the distance from the fixed point to the circle. The fixed point is the centre of the circle.

Step 2: Teacher A explains the concept by drawing a free hand circle

Step 3: Teacher A gives the following steps in drawing a circle with a pair of compasses

- open the pair of compasses to any radius
- mark the centre; that is a point at which you will place the pin end of the compass
- the pin end of the compass at the centre
- turn the pencil end of the compass round to draw the circle with the pencil

Step 4: Teacher A allows pupils to copy notes

Step 5: Teacher A lead pupils to demonstrate the steps 3 above by drawing a circle with a pair of compasses

Step 6: Teacher A leads the pupils to draw circles of the following radii

(a) 2cm (b) 4cm

Step 7: Teacher A gives written assessment

- define a circle
- Use a pair of compass and pencil to draw two different circles

Step 8: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.

3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more demonstration and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher **B** asks pupils oral questions and clarify unclear concept
3. During teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections to the pupils
7. Teacher B concludes the lesson.

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

TUESDAY

Topic: Circle

Sub-topic: Parts of a circle

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): Mathematics set containing a pair of compasses, ruler e.t.c

Entry Behaviour: Pupils have been taught the definition and how to draw a circle

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state parts of a circle

(ii) define parts of a circle

Section A

Introduction: Teacher A assesses and introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A states parts of a circle

Parts of a circle are circumference, diameter, radius, semicircle, arc, chord, segment, quadrant.

Step 2: Teacher A defines parts of a circle with diagram

- Circumference is the distance round the circle. Circumference of a circle is called the perimeter of a circle
- Diameter is a line that divides a circle into two equal parts. It usually passes through the centre of the circle
- Radius is the distance between the centre of the circle and the circumference of the circle. It is half of the diameter
- Semicircle is the half of a circle
- Arc is a portion of the circumference of a circle
- Chord is a line that passes through the two points on the circumference of a circle
- Segment is a region between the chord and the arc of the circle
- Quadrant is a quarter of a circle if the circle is divided into four equal part

Step 3: Teacher A shows parts of a circle with a circular cardboard

Step 4: Teacher A allows pupils to copy notes

Step 5: Teacher A gives written assessment

- State any 3 parts of circle
- Draw a segment
- A line that divides a circle into two equal parts is called …

Step 6: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more demonstration and pupils who do not understand the lesson well during section A.

2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept
3. During teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections to the pupils
7. Teacher B concludes the lesson.

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

WEDNESDAY

Topic: Circle

Sub-topic: Perimeter of a circle

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): Mathematics set containing a pair of compasses, ruler e.t.c

Entry Behaviour: Pupils can define and identify circumference of a circle

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state the formula for calculating the perimeter of a circle

(ii) apply the formula for calculating the perimeter of a circle

Section A

Introduction: Teacher A assesses and introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A states the formula for calculating the perimeter/circumference of a circle

$C = 2\pi r$

$C = \pi d$

Where C is the perimeter/circumference of the circle

r is the radius of the circle

d is the diameter of the circle

π = pi = 22/7

Step 2: Teacher A gives the following examples

- Find the circumference of a circle whose radius is 7cm

  $C = 2\pi r$

  C = 2 x 7 x 22/7

  C = 44cm

- The diameter a circle is 28cm. Find its circumference

  $C = \pi d$

  C = 22/7 x 28 cm

  C = 88cm

Step 3: Teacher A allows pupils to copy notes

Step 4: Teacher A gives written assessment

- Calculate the perimeter of a circle whose radius is 14cm
- Calculate the perimeter of a circle whose diameter is 14cm

Step 5: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encouragesthe pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.

3. Teacher Aallows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more demonstration and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept
3. During teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections to the pupils
7. Teacher B concludes the lesson

Assignment: Teacher A writes home work on the chalkboard.

- A circular track has a radius of 21cm. Find (a) its diameter (b) its circumference (c) divide its circumference by its diameter.
- A circle has a diameter of 35cm. Calculate (a) its circumference (b) divide its circumference by its diameter.
- If C = 132cm. What is r?

- Teacher A ask pupils to come to the next class with models of circle

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

THURSDAY

Topic: Circle

Sub-topic: Practical section of the discovery of π

Duration: 50 minutes

Instructional Material(s): circular objects, models of circles, twain, thread or rope, ruler

Entry Behaviour: Pupils are familiar with circular objects around them. They have been taught the definition, parts and the circumference of the circle

Behavioral Objectives: At the end of the lesson, pupils should be able to explain why the value of π is 22/7 or 3.142

Section A

Introduction: Teacher A briefly revives the previous topic and introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A asks pupils to bring out models of circles they have made

Step 2: The teacher A leads the pupils to wind the twain/rope/thread around a circle and record the measurement as the perimeter of the circle

Step 3: Teacher A leads the pupils to measure the diameter of the circle and record it

Step 4: Teacher A leads the pupils to divide the circumference of a circle with its diameter and ask pupils to give answer (3.142)

Step 5: Teacher A leads the pupils to convert 3.142 to a fraction (22/7)

Step 6: teacher A relates the activities with the formula

Evaluation: Teacher A gives an exercise on the activity

Step 7: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more demonstration and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher **B** asks pupils oral questions and clarify unclear concept
3. During teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books

6. Teacher B gives feedback and corrections to the pupils
7. Teacher B concludes the lesson

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

FRIDAY

Topic: Circle

Sub-topic: Area of a circle

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): Circular objects e.t.c

Entry Behaviour: Pupils have been taught different lessons of circle

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state the formula for calculating the area of a circle

(ii) apply the formula for calculating the area of a circle

Section A

Introduction: Teacher A assesses and introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A states the formula for calculating the area of a circle

$A = \pi r^2$

Step 2: Teacher A gives the following examples

1. Find the area of a circle whose radius is 7cm

$A = \pi r^2$

r = 7cm,

A = 22/7 x 7 cm x 7cm

A = 154cm2

2. The diameter a circle is 28cm. Find its area

$r = d/2 = 28/2 = 14cm$

$A = \pi r^2$

$A = 22/7 \times 14cm \times 14cm$

A = 196cm2

Step 3: Teacher A allows pupils to copy notes

Step 4: Teacher A gives written assessment

- Calculate the area of a circle whose radius is 28cm
- Calculate the area of a circle whose diameter is 42cm

Step 3: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more demonstration and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher **B** asks pupils oral questions and clarify unclear concept
3. During teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections to the pupils
7. Teacher B gives concludes.

Post Instructional Planning: The teachers meet to preview the subsequent lesson.

WEEK 4: SOLID SHAPES

Both teachers meet to plan for the week. Specific decisions were taken on:

- Instructional objectives of the topic
- Instructional materials needed for the lesson
- Which of the team teachers will teach what
- Pupils' activities
- Methods of assessment

MONDAY

Topic: 3-Dimensional shapes (Solid shapes)

Sub-topic: Introduction to Solid shapes

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): different shapes like cartoons, tins e.t.c

Entry Behaviour: Pupils are familiar with solid shape objects. They have been taught plane shapes.

Behavioral Objectives: At the end of the lesson, pupils should be able to

•define three dimensional shapes

•list solid shapes that can be found at home and school

•state the general properties of solid shapes

Section A

Introduction: Teacher A introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: The teacher A defines solid shapes as 3 dimensional objects

They are objects that have 3 dimensional which are length, breadth and height. They are also called solid shapes

Step 2: Teacher A leads the pupils to identify solid shapes around them

Step 3: Teacher A states the general properties of 3 dimensional objects

•faces

•edges

•vertices/corners

Step 4: Teacher A explains each of the properties of solid shapes

A face is a flat or curve surface of a solid

An edge of a solid shape is where two faces meet

A vertex is where two or more edges meet. It is also called a corner. The plural form of a vertex is vertices

Step 5: Teacher A shows the properties of 3 dimensional shapes with different real objects

Step 6: Teacher A allows pupils to copy notes

Step 7: Teacher A gives written assessment

(iii) Solid shapes are called three dimensional objects because they have …………, ……….. and ……………

(iv) The three general properties of solid shapes are ……….., ………….. and ……….

Solution:

(iii) Length, breadth and height
(iv) Faces, edges and vertices

Step 8: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more explanation/clarifications and pupils who do not understand the lesson well during section A.

2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept
3. During re-teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections
7. Teacher B concludes the lesson

Post Instructional Planning: The teachers meet preview the subsequent lesson.

TUESDAY

Topic: 3-Dimensional shapes (Solid shapes)

Sub-topic: Properties and net of a cube

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): solids like maggi cube, choco milo, sugar cube made with cardboards e.t.c

Entry Behaviour: Pupils are familiar with solid shape objects. They have been taught general properties of solid shapes

Behavioral Objectives: At the end of the lesson, pupils should be able to

(iii) state the properties of a cube
(iv) draw the net of a cube

Section A

Introduction: Teacher A assesses pupils' knowledge on the previous lesson and thereafter introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A explains that a cube has faces, edges and vertices. He/she adds that each face of a cube has a square shape

Step2: Teacher A leads the pupils to identify the number of faces, edges and vertices of an open cube (5 faces, 8 vertices and 12 edges)

Step 3: Teacher A leads the pupils to identify the number of faces, edges and vertices of a closed cube (6 faces, 8 vertices and 12 edges)

Step 4: Teacher A draws net of a cube

Step 5: Teacher A allows pupils to copy notes

Step 6: Teacher A gives written assessment

(vii) An open cube has ……………. faces
(viii) A closed cube has …………… faces
(ix) draw a cube

Solution:

(i) 5
(iii) 6

Step 6: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more explanation/clarifications and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept
3. During re-teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections
7. Teacher B concludes the lesson

Post Instructional Planning: The teachers meet preview the subsequent lesson.

WEDNESDAY

Topic: 3-Dimensional shapes (Solid shapes)

Sub-topic: Properties and net of a cuboid

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): different cartoons, cuboid made with cardboards e.t.c

Entry Behaviour: Pupils are familiar with solid shape objects. They have been taught general properties of solid shapes

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state the properties of a cuboid

(ii) draw the net of a cuboid

Section A

Introduction: Teacher A assesses pupils' knowledge on the previous lesson and thereafter introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A explains that a cuboid has faces, edges and vertices. He/she adds that each face of a cube has a rectangular shape

Step 2: Teacher A explains the difference between a cube and a cuboid.

Step 3: Teacher A leads the pupils to identify the number of faces, edges and vertices of an open cuboid (5 faces, 8 vertices and 12 edges).

Step 4: Teacher A leads the pupils to identify the number of faces, edges and vertices of a closed cuboid (6 faces, 8 vertices and 12 edges).

Step 5: Teacher A draws net of a cuboid

Step 6 Teacher A allows pupils to copy notes

Step 7: Teacher A gives written assessment

(i) The face of cuboid is ……………… in shape
(ii) An open cuboid has …………… faces, ……….. edges and ……..vertices

Solution:

(i) Rectangular

(ii) 6, 12 and 8

Step 8: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more explanation/clarifications and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept
3. During re-teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections
7. Teacher B concludes the lesson

Post Instructional Planning: The teachers meet preview the subsequent lesson.

THURSDAY

Topic: 3-Dimensional shapes (Solid shapes)

Sub-topic: Properties and net of a cylinder

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): cylindrical objects, cylinder made with cardboards e.t.c

Entry Behaviour: Pupils are familiar with solid shape objects. They have been taught general properties of solid shapes

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state the properties of a cylinder

(ii) draw the net of a cylinder

Section A

Introduction: Teacher A assesses pupils' knowledge on the previous lesson and thereafter introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A leads the pupils to identify the number of faces, edges and vertices of an open cylinder

Step 2: Teacher A leads the pupils to identify the number of faces, edges and vertices of a closed cylinder

Step 3: Teacher A draws net of open cylinder

Step 4: Teacher A draws net of closed cylinder

Step 5: Teacher A allows pupils to copy notes

Step 6: Teacher A gives written assessment

(i) draw the net of an open cylinder
(ii) how many faces, edges and vertices does a closed cylinder has

Step 7: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more explanation/clarifications and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept
3. During re-teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books

6. Teacher B gives feedback and corrections
7. Teacher B concludes the lesson

Post Instructional Planning: The teachers meet preview the subsequent lesson.

FRIDAY

Topic: 3-Dimensional shapes (Solid shapes)

Sub-topic: Properties and net of a Cone

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): funnels, cones made with cardboards e.t.c

Entry Behaviour: Pupils are familiar with solid shape objects. They have been taught general properties of solid shapes

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state the properties of a cone

(ii) draw the net of a cone

Section A

Introduction: Teacher A assesses pupils' knowledge on the previous lesson and thereafter introduces the topic

Presentation: Teacher B presents the lesson using the following steps

Step 1: Teacher B leads the pupils to identify the number of faces, edges and vertices of a cone

Step 2: Teacher B draws net of a cone

Step3: Teacher B allows pupils to copy notes

Step 4: Teacher A given written assessment

(i) draw the net of a cone
(ii) A cone has ….......... faces, …........... edges and …......... corners

Step 7: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more explanation/clarifications and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept
3. During re-teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books

6. Teacher B gives feedback and corrections
7. Teacher B concludes the lesson

Post Instructional Planning: The teachers meet preview the subsequent lesson.

WEEK 7: BINARY NUMBER SYSTEM

Both teachers meet to plan for the week. Specific decisions were taken on:

- Instructional objectives for the teaching
- Instructional materials needed for the lesson
- Which of the team teachers will teach what?
- Pupils' activities
- Methods of assessment

MONDAY

Topic: Binary Number System

Sub-topic: Counting in base 2

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): counters, pebbles, stones, sticks e.t.c

Entry Behaviour: Pupils have been taught even numbers and odd numbers

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) explain binary number system
(ii) Differentiate between even numbers and odd numbers
(iii) Convert numbers in base 10 to base 2
(iv) Convert numbers in base 2 to base 10

Section A

Introduction: Teacher A introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: The teacher A revises even and odd number

The numbers that are counted in groups of twos ad without a remainder are called even numbers while the numbers that are counted in group of two with remainders are odd numbers.

Step 2: The teacher A explains binary number system. Binary mean two. Binary number system involves counting number in groups of twos. 2 stands for a group of two. For example, 2 tubers of yam represent a bundle of yam.

Step 3: Teacher A emphasizes that when counting in twos, the remainder must not be greater than 1. That is any number in base 2 is a combination of 0 and 1

Step 4: Teacher A uses some examples to illustrate the concept

(iii) 14 tins
(iv) 17 matches

Step 5: Teacher A explains how to convert number in base 10 to base two

(ii) Convert 8 to base two

The answer is 1000_2

Step 6: Teacher B explains how to convert numbers in base 2 to base 10 using different example

(iii) Convert 1101_2 to base 10
$1x2^3 + 1x2^2 + 0x2^1 + 1x2^0 = 8 + 4 + 0 + 1 = 13$

(iv) Convert 110111_2 to base 10
$1x2^5 + 1x2^4 + 0x2^3 + 1x2^2 + 1x2^1 + 1x2^0 = 32 + 16 + 0 + 4 + 2 + 1 = 45$

Step 4: Teacher A allows pupils to copy notes

Step 5: Teacher A gives written assessment

(i) Represent 23 matches in base 2
(ii) Convert 21 to base 2
(iii) Convert 100111_2 to base 10

Step 6: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more explanation/clarifications and pupils who do not understand the lesson well during section A.

2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept
3. During re-teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections
7. Teacher B concludes the lesson

Post Instructional Planning: The teachers meet preview the subsequent lesson.

TUESDAY

Topic: Binary Number System

Sub-topic: Addition of numbers in base 2

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Entry Behaviour: Pupils have been taught even numbers and odd numbers

Behavioral Objectives: At the end of the lesson, pupils should be able to add numbers in base 2

Section A

Introduction: Teacher A introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A revises the concept of binary number

Step 2: Teacher A uses some examples to explain addition of numbers in base 2. He/she also leads the pupils to provide answers to the questions

4. $101_2 + 111_2$

$$\begin{array}{r} 1\,0\,1 \\ +\,1\,1\,1 \\ \hline 1\,1\,0\,0_2 \\ \hline \end{array}$$

5. $1111_2 + 10000_2$

$$\begin{array}{r} 2\ \ 1\,1\,1 \\ +\,1\,0\ \ 0\,0\,0 \\ \hline 1\,1\ \ 1\,1\,1_2 \\ \hline \end{array}$$

6. $100000_2 + 101_2 + 1000_2$

$$\begin{array}{r} 2\ \ 0\,0\,0\,0\,0 \\ +\qquad 1\,0\,1 \\ \hline 2\ \ 0\,0\,1\,0\,1 \\ +\quad 1\,0\,0\,0 \\ \hline 1\ \ 0\ \ 1\ \ 1\,0\,1_2 \\ \hline \end{array}$$

Step 3: Teacher A allows pupils to copy notes

Step 4: Teacher A gives written assessment

(i) $10011_2 + 1111_2$

$$\begin{array}{r} 2\ \ 0\,0\,1\,1 \\ +\quad 1\,1\,1\,1 \\ \hline 1\ \ \ 0\,0\,0\,1\,0 \\ \end{array}$$

(ii) $111_2 + 101_2 + 1111_2$

$$\begin{array}{r} 1\,1\,1 \\ +\,1\,0\,1 \\ \hline 1\,1\,0\,0 \\ +\,1\,1\,1\,1 \\ \hline 1\,1\,0\,1\,1 \\ \hline \end{array}$$

Step 5: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.

2. Teacher A encourages pupils to ask questions.

3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.

4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well

5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more explanation/clarifications and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept
3. During re-teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.

5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections
7. Teacher B concludes the lesson

Post Instructional Planning: The teachers meet preview the subsequent lesson.

WEDNESDAY

Topic: Binary Number System

Sub-topic: Subtraction of numbers in base 2

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Entry Behaviour: Pupils are have been taught addition of numbers in base 2

Behavioral Objectives: At the end of the lesson, pupils should be able to subtract numbers in base 2

Section A

Introduction: Teacher A introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A explains subtract of number in base 2

Step 2: Teacher A uses some examples to explain addition of numbers in base 2. He/she also leads the pupils to provide answers to the questios

1. $111_2 - 101_2$

$$\begin{array}{r} 1\ 1\ 1 \\ \underline{-1\ 0\ 1} \\ 0\ \ \underline{1\ 0}_2 \end{array} = 1\ 0_2$$

2. $1111_2 - 1000_2$

$$\begin{array}{r} 1\ 1\ 1\ 1 \\ \underline{-\ \ 1\ 0\ 0\ 0} \\ 0\ \ \underline{1\ 1\ 1}_2 \end{array} = 111_2$$

3. Find the value of X_2 if $X_2 - 111_2 = 101_2$
   $X = 101_2 + 111_2$

$$\begin{array}{r} 1\ 0\ 1 \\ +\ 1\ 1\ 1 \\ \hline 1\ 1\ 0\ 0_2 \\ \hline \end{array}$$

Step 4: Teacher A allows pupils to copy notes

Step 5: Teacher A gives written assessment

(i) $10011_2 - 1111_2$
(ii) $1111_2 - 1001_2$

Step 6: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson

that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more explanation/clarifications and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept
3. During re-teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections
7. Teacher B concludes the lesson

Post Instructional Planning: The teachers meet preview the subsequent lesson.

THURSDAY

Topic: Binary Number System

Sub-topic: Multiplication numbers in base 2

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Entry Behaviour: Pupils are have been taught even numbers and odd numbers

Behavioral Objectives: At the end of the lesson, pupils should be able to multiply numbers in base 2

Section A

Introduction: Teacher A introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A revises the concept of binary number

Step 2: Teacher A uses some examples to explain multiplication of numbers in base 2. He/she also leads the pupils to provide answers to the questions

1. $11_2 \times 11_2$

$$\begin{array}{r} 1\ 1_2 \\ \underline{\times 1\ 1_2} \\ 1\ 1 \\ \underline{+\ 1\ 1\ \ } \\ 2\quad \underline{0\ 0\ 1_2} \end{array}$$

2. Multiply $111_2 + 101_2$

$$\begin{array}{r} 1\ 1\ 1_2 \\ X\ \ \underline{1\ 0\ 1_2} \\ 1\ 1\ 1 \\ 0\ 0\ 0\ \ \\ \underline{1\ 1\ 1\ \ \ \ } \\ \underline{1\ 0\ 0\ 0\ 1\ 1_2} \end{array}$$

3. Find the product of 110_2 and 110_2

$$\begin{array}{r} 2\quad 1\ 0_2 \\ X\ \ \underline{1\ 1\ 0_2} \\ 000 \\ 111\ \ \ \ \\ \underline{1\ 1\ 1\ \ \ \ } \\ \underline{1\ 0\ 1\ 0\ 1\ 0_2} \end{array}$$

Step 4: Teacher A allows pupils to copy notes

Step 5: Teacher A gives written assessment

(i) Multiply 10_2 by 10_2
(ii) $110_2 \times 10_2$

Step 5: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more explanation/clarifications and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept

3. During re-teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections
7. Teacher B concludes the lesson

Post Instructional Planning: The teachers meet preview the subsequent lesson.

FRIDAY

Topic: Binary Number System

Sub-topic: Division of numbers in base 2

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Entry Behaviour: Pupils have been taught addition of numbers in base 2

Behavioral Objectives: At the end of the lesson, pupils should be able to carry out division of numbers in base 2

Section A

Introduction: Teacher A introduces the topic

Presentation: Teacher A presents the lesson using the following steps

Step 1: Teacher A explains how to carry out division in base two using these steps.

(i) Convert the two numbers to base 10
(ii) Carry out the division
(iii) Convert your answer to base 2

Step 2: Teacher A uses some examples to explain division in base 2 using the three steps

1. Divide 1100_2 by 11_2
   Convert 1100_2 to base 10 = 12

Convert 11_2 to base 10 = 3
Divide 12 by 3 = 4
Convert 4 to base 2 = 100_2

2. Divide 100100_2 by 1001_2
Convert 100100_2 to base 10 = 36
Convert 1001_2 to base 10 = 9
Divide 36 by 9 = 4
Convert 4 to base 2 = 100_2

3. Divide 1000011_2 by 1011_2
Convert 1000010_2 to base 10 = 66
Convert 1011_2 to base 10 = 11
Divide 66 by 11 = 6
Covert 6 to base 2 = 110_2

Step 4: Teacher A allows pupils to copy notes
Step 5: Teacher A gives written assessment
(iii) Divide 1001101_2 by 111_2
(iv) Divide 101101_2 by 1111_2
Step 6: Teacher A allows pupils to mark the exercise by exchange of note books. Teacher A encourages the pupils to be truthful in the marking as the scores obtained will not be used for grading but for the purpose of re-teaching.

Note: During lesson presentation in section A;

1. Teacher A asks oral questions to check pupils' learning as lesson progresses.
2. Teacher A encourages pupils to ask questions.
3. Teacher A allows pupils to answer the questions asked by pupils or the teacher.
4. Teacher B takes note of the aspect of the lesson that teacher A does not explain well
5. Teacher B takes note of any aspect of the lesson that the pupils do not get well.

Section B

Based on the observations and assessment carried out during section A. Teacher B re-teaches the lesson using different examples focusing more on the aspect of the lesson

that teacher A does not stress (explain well) as well as the aspect of the lesson that pupils do not perform well in the assessment carried out during section A.

1. Teacher B re-teaches the same concept focusing on the aspects that need more explanation/clarifications and pupils who do not understand the lesson well during section A.
2. While re-teaching, teacher B encourages pupils to ask questions. He/she focuses more on weak pupils. Also, teacher B asks pupils oral questions and clarify unclear concept
3. During re-teaching, teacher A moves round the class to ensure pupils' attention and active participation.
4. Teacher B re-assesses the entire class.
5. Both teachers mark the pupils' books
6. Teacher B gives feedback and corrections
7. Teacher B concludes the lesson

Post Instructional Planning: The teachers meet preview the subsequent lesson.

APPENDIX III

UNIVERSITY OF IBADAN

INSTITUTE OF EDUCATION

INTERNATIONAL CENTRE FOR EDUCATIONAL EVALUATION (ICEE)

CONVENTIONAL TEACHING PACKAGE (CTP)

Conventional Teaching Package (CTP) was developed by the researcher. CTTP was used for control group (group 3). In control group, two teachers were in class but they teach different subjects. One teacher teaches Mathematics while the other teacher teaches any other subject. The major steps in conventional teaching are introduction, presentation, evaluation and conclusion.

TOPICS

1. Identification of angles
2. Lines and plane shapes
3. Circle
4. 3- Dimensional shapes (Solid shapes)
5. Binary number system

TOPIC 1: IDENTIFICATION OF ANGLES

MOND AY

Topic: Angles

Sub-topic: Introduction to Angles

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s):A pair of compasses, straight sticks, books e.t.c

Entry Behaviour: Pupils have come across different objects that have angles e.g. a pair of compasses, chalkboard, books e.t.c.

Behavioral Objectives: At the end of the lesson, pupils should be able to

(k) give simple definition of an angle

(ii) state the unit of measurement of an angle

(iii) identify any given angle

(iv) identify vertex and arms of any given angle

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

TUESDAY

Topic: Identification of Angles

Sub-topic: Types of angles – right angle, acute angle and obtuse angle

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s):A pair of compasses, straight sticks, books, the wall against the floor of the classroom e.t.c

Entry Behaviour: Pupils have come across different objects that have angles. The have been taught the meaning of an angle, vertex and arms of angle.

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) identify a right angle

(ii) draw a right angle

(iii) identify an acute angle

(iv) identify an obtuse angle

(v) differentiate between an acute angle and obtuse angle

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

WEDNESDAY

Topic: Angles

Sub-topic: Complementary Angles

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): Cardboards

Entry Behaviour: Pupils have been taught right angle

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) explain the condition for two angles to be complementary

(ii) solve any given question on complementary angle

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

THURSDAY

Topic: Angles

Sub-topic: Angle 180^0 and Supplementary Angles

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): two straight sticks, cover of books e.t.c

Entry Behaviour: The have been taught right angle

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) explain the condition for two angles to be supplementary

(ii) solve any given question on supplementary angle

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

FRIDAY

Topic: Angles

Sub-topic: Estimation of angles with protractor (Practical section)

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): pencil, ruler, eraser, protractor

Entry Behaviour: Pupils have been taught types of angles

Behavioral Objectives: At the end of the lesson, pupils should be able to measure any given angle with protractor using either clockwise or anticlockwise

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

TOPIC 2: PROPERTIES OF LINES, TRIANGLES AND QUADRILATERALS

MONDAY

Topic: Properties of lines, triangles and quadrilaterals

Sub-topic: Properties of Lines

Duration: 50 minutes

Instructional Material(s): objects like flag pole, electric pole, tree, wall, table top

Entry Behaviour:

Behavioral Objectives: At the end of the lesson, pupils should be able to

(iv) identify horizontal, vertical, perpendicular and parallel lines

(v) draw horizontal, vertical, perpendicular and parallel lines

(vi) state symbols of perpendicular lines and parallel lines

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

TUESDAY

Topic: Properties of lines, triangles and quadrilaterals

Sub-topic: Properties of triangles

Duration: 50 minutes

Instructional Material(s): shapes of triangles and triangular objects

Entry Behaviour: pupils have been taught types of triangles, they are also familiar with triangular objects.

Behavioral Objectives: At the end of the lesson, pupils should be able to;

(i) state some properties of an equilateral triangle

(ii) identify equilateral triangle

(iii) state some properties of isosceles triangle

(iv) identify isosceles triangle

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

WEDNESDAY

Topic: Properties of lines, triangles and quadrilaterals

Sub-topic: Properties of triangles(continuation)

Duration: 50 minutes

Instructional Material(s): shapes of triangles and triangular objects

Entry Behaviour: pupils have been taught types of triangles, they are also familiar with   triangular objects.

Behavioral Objectives: At the end of the lesson, pupils should be able to;

(i) state some properties of a scalene triangle

(ii) identify a scalene triangle

(iii) state some properties of a right angled triangle

(iv) identify a right angled triangle

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

THURSDAY

Topic: Properties of lines, triangles and quadrilaterals

Sub-topic: Properties of quadrilaterals

Duration: 50 minutes

Instructional Material(s): shapes of quadrilaterals

Entry Behaviour: pupils have been taught square and rectangle

Behavioral Objectives: At the end of the lesson, pupils should be able to;

(i) state some properties of a parallelogram

(ii) identify a parallelogram

(iii) state some properties of a trapezium

(iv) identify a trapezium

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

FRIDAY

Topic: Properties of lines, triangles and quadrilaterals

Sub-topic: Properties of quadrilaterals (continuation)

Duration: 50 minutes

Instructional Material(s): shapes of quadrilaterals

Entry Behaviour: pupils have been taught square and rectangle

Behavioral Objectives: At the end of the lesson, pupils should be able to;

(i) state some properties of a trapezium

(ii) identify a trapezium

(iii) state some properties of a rhombus

(iv) identify a rhombus

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

TOPIC 3: CIRCLE

MONDAY

Topic: Circle

Sub-topic: Definition and drawing of a circle

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): A mathematical set containing a pair of compasses, ruler e.t.c

Entry Behaviour: Pupils have familiar with circular objects such as bottle covers, plates e.t.c

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) define a circle
(ii) draw a circle with a pair of compasses
(iii) draw a circle of a given radius with a pair of compasses

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

TUESDAY

Topic: Circle

Sub-topic: Parts of a circle

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): Mathematics set containing a pair of compasses, ruler e.t.c

Entry Behaviour: Pupils have been taught the definition and how to draw a circle

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state parts of a circle

(ii) define parts of a circle

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

WEDNESDAY

Topic: Circle

Sub-topic: Perimeter of a circle

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): Mathematics set containing a pair of compasses, ruler e.t.c

Entry Behaviour: Pupils can define and identify circumference of a circle

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state the formula for calculating the perimeter of a circle

(ii) apply the formula for calculating the perimeter of a circle

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

THURSDAY

Topic: Circle

Sub-topic: Practical section of the discovery of π

Duration: 50 minutes

Instructional Material(s): circular objects, models of circles, twain, thread or rope, ruler

Entry Behaviour: Pupils are familiar with circular objects around them. They have been taught the definition, parts and the circumference of the circle

Behavioral Objectives: At the end of the lesson, pupils should be able to explain why the value of π is 22/7 or 3.142

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

FRIDAY

Topic: Circle

Sub-topic: Area of a circle

Duration: 50 minutes

Reference Book: Ogunwumi et al (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited.

Instructional Material(s): Circular objects e.t.c

Entry Behaviour: Pupils have been taught different lessons of circle

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state the formula for calculating the area of a circle

(ii) apply the formula for calculating the area of a circle

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

WEEK 4: SOLID SHAPES

MONDAY

Topic: 3-Dimensional shapes (Solid shapes)

Sub-topic: Introduction to Solid shapes

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): different shapes like cartoons, tins e.t.c

Entry Behaviour: Pupils are familiar with solid shape objects. They have been taught plane shapes.

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) define three dimensional shapes
(ii) list solid shapes that can be found at home and school
(iii) state the general properties of solid shapes

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

TUESDAY

Topic: 3-Dimensional shapes (Solid shapes)

Sub-topic: Properties and net of a cube

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): solids like maggi cube, choco milo, sugar cube made with cardboards e.t.c

Entry Behaviour: Pupils are familiar with solid shape objects. They have been taught general properties of solid shapes

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state the properties of a cube

(ii) draw the net of a cube

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

WEDNESDAY

Topic: 3-Dimensional shapes (Solid shapes)

Sub-topic: Properties and net of a cuboid

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): different cartoons, cuboid made with cardboards e.t.c

Entry Behaviour: Pupils are familiar with solid shape objects. They have been taught general properties of solid shapes

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state the properties of a cuboid

(ii) draw the net of a cuboid

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

THURSDAY

Topic: 3-Dimensional shapes (Solid shapes)

Sub-topic: Properties and net of a cylinder

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): cylindrical objects, cylinder made with cardboards e.t.c

Entry Behaviour: Pupils are familiar with solid shape objects. They have been taught general properties of solid shapes

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state the properties of a cylinder

(ii) draw the net of a cylinder

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

FRIDAY

Topic: 3-Dimensional shapes (Solid shapes)

Sub-topic: Properties and net of a Cone

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): funnels, cones made with cardboards e.t.c

Entry Behaviour: Pupils are familiar with solid shape objects. They have been taught general properties of solid shapes

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) state the properties of a cone

(ii) draw the net of a cone

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

WEEK 7: BINARY NUMBER SYSTEM

MONDAY

Topic: Binary Number System

Sub-topic: Counting in base 2

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Instructional Material(s): counters, pebbles, stones, sticks e.t.c

Entry Behaviour: Pupils have been taught even numbers and odd numbers

Behavioral Objectives: At the end of the lesson, pupils should be able to

(i) explain binary number system

(ii) Differentiate between even numbers and odd numbers

(iii) Convert numbers in base 10 to base 2

(iv) Convert numbers in base 2 to base 10

TUESDAY

Topic: Binary Number System

Sub-topic: Addition of numbers in base 2

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Entry Behaviour: Pupils have been taught even numbers and odd numbers

Behavioral Objectives: At the end of the lesson, pupils should be able to add numbers in base 2

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

WEDNESDAY

Topic: Binary Number System

Sub-topic: Subtraction of numbers in base 2

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Entry Behaviour: Pupils have been taught addition of numbers in base 2

Behavioral Objectives: At the end of the lesson, pupils should be able to subtract numbers in base 2

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

FRIDAY

Topic: Binary Number System

Sub-topic: Division of numbers in base 2

Duration: 50 minutes

Reference Book: Ogunwumi *et al* (2016). Modular Mathematics for Primary Schools. Ibadan: Evans Brothers Limited

Entry Behaviour: Pupils have been taught addition of numbers in base 2

Behavioral Objectives: At the end of the lesson, pupils should be able to carry out division of numbers in base 2

Step 1: The Mathematics teacher introduces the lesson

Step 2: The Mathematics teacher presents the lesson

Step 3: The Mathematics teacher concludes the lesson

Step 4: The Mathematics teacher concludes the lesson

APPENDIX IV

UNIVERSITY OF IBADAN

INTERNATIONAL CENTRE FOR EDUCATIONAL EVALUATION (ICEE)

INSTITUTE OF EDUCATION

ACHIEVEMENT IN MATHEMATICS TEST (AMT)

Preamble

Dear Respondent,

This test is design to measure pupils' achievement in Mathematics. Kindly tick the correct option. Be assured that the result of this test will be used for research purpose only.

Thank you

Section A

Sex: Male [ ] Female [ ]

Section B

Instruction: Tick the correct answer

1. Angle 90^0 is also known as
   (a) An acute angle
   (b) a left angle
   (c) a right angle
   (d) An obtuse
2. An angle that is less than 90^0 is called

(a) An obtuse angle (b) An acute angle (c) A right angle (d) A parallel angle

3. An angle that is greater than 90^0 but less than 180^0 is

   (a) An obtuse angle (b) An acute angle (c) A right angle (d)A left angle

4. The angles A and B are called complementary angles if their sum is

   (a) 360^0 (b) 0^0 (c) 180^0 (d) 90^0

5. If $x + 116^0 = 180^0$. Find x

   (a) 116^0 (b) 19^0 (c) 56^0(d) 64^0

6. Angle y^0 is

   (a) A acute angle x

   (b) A parallel

   (c) An obtuse angle

   (d) A right angle y z

7. Angle b^0 is

   (a) 67^0

   (b) 23^0

   (c) 157^0 b^0

   (d) $337^0 23^0$

C^0

8. Angle C^0 is

   (a) 180^0 (b) 45^0 (c) 360^0 (d) 90^0

9. An obtuse angle between two hands of a clock at 5' o clock is

   (a) 120^0 (b) 150^0 (c) 130^0 (d) 175^0

10. Two lines that stay the same distance apart are said to be

(a) Perpendicular (b) Adjacent (c) Parallel (d) Horizontal

11. Lines above are …………… lines

(a) Vertical (b) Horizontal (c) Adjacent (d) Perpendicular

12. Lines above are …………… lines

(a) Vertical (b) Horizontal (c) Perpendicular (d) adjacent

A B C

D

13. Diagram A is

(a) Scalene triangle (b) Equilateral triangle (c) Isosceles triangle (d) Right angled triangle

14. Diagram B is

(a) Scalene triangle (b) Equilateral triangle (c) Isosceles triangle (d) Right angled triangle

15. Diagram D is

(a) Scalene triangle (b) Equilateral triangle (c) Isosceles triangle (d) Right angled triangle

16. A quadrilateral is a ……………….. sides plane shape

(a) 6 (b) 7 (c) 4 (d) 3

17. A parallelogram has the following properties except

    (a) Opposite sides are equal (b) Opposite angle are equal (c) All angles are parallel (d) Opposite sides are parallel

18. A flat shape formed by a set of points equidistant from a fixed point

    (a) Circle (b) Diameter (c) Sector (d) radius

19. A line that divides a circle into two equal parts is

    (a) A radius (b) A segment (c) A chord (d)A diameter

20. Half of a diameter is

    (a) Radius (b) Segment (c) Chord (d) circle

21. The perimeter of a circle with radius 14cm is

    (a) 44 cm (b) 88 cm (c) 22 cm (d) 99 cm

22. The circumference of a circle is the same as ……………… of a circle

    (a) Area (b) Diameter (c) Perimeter (d) sector

23. The perimeter of a circle is 44 cm. Find its diameter

    (a) 14cm (b) 7cm (c) 21 cm (d)4 cm

24. The circumference of a circle is 44cm. Find its radius

    (a) 14cm (b) 7cm (c) 21cm (d) 4 cm

25. The area of a circle with diameter 14cm is

    (a) 22 cm^2 (b) 308 cm^2 (c) 616cm^2 (d) 154 cm^2

26. Diameter is twice the ……………….. of a circle

    (a) Area (b) Radius (c) Sector (d) perimeter

27. The area of a tyre is 154cm^2. Find its diameter.

    (a) 7cm (b) 14cm (c) 21cm (d) 28cm

28. Solid shapes have

    (a) Length, width and breadth (b) Length, long and height (c) Breadth, height and width (d) Length, breadth and height

29. The …………….of a solid shape may be flat or curved

    (a) Edge (b) Vertex (c) Face (d)side

30. A place where two faces of a solid shape meet is

(a) edge (b) Vertex (c) Face (d) side

31. A place where two edge meet is

(a) Edges (b) Vertex (c) Face (d) side

32. The above diagram is a the net of a

(a) Open cone (b) Closed cone (c) Open cylinder (d) Closed cylinder

33. A cone has ………..faces, ………….vertex and …………edge

(a) 2, 1 and 0 (b) 1, 2 and 0 (c) 0, 2 and 1 (d) 1, 0 and 2

34. Represent 15 pencils in binary number

(a) 1101_2 (b) 1110_2 (c) 1001_2 (d) 1111_2

35. Add 111_2 and 101_2

(a) 1001_2 (b) 1000_2 (c) 1110_2 (d) 1100_2

36. $111_2 + 100_2$

(a) 1111_2 (b) 1011_2 (c) 1101_2 (d) 1000_2

37. $111_2 – 101_2$

(a) 101_2 (b) 10_2 (c) 11_2 (d) 100_2

38. If $X_2 – 101_2 = 111_2$. Find the value of X

(a) 1100_2 (b) 1101_2 (c) 1111_2 (d) 1001_2

39. Convert 1110_2 to base 10

(a) 13 (b) 15 (c) 16 (d) 14

40. Multiply 100_2 by 100_2

(a) 10001_2 (b) 10011_2 (c) 10000_2 (d) 11000_2

KEY

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

32.B
33.D
34.A
35.D
36.D
37.B
38.A
39.D
40.C

APPENDIX V

UNIVERSITY OF IBADAN

INSTITUTE OF EDUCATION

INTERNATIONAL CENTRE FOR EDUCATIONAL EVALUATION (ICEE)

INTEREST IN MATHEMATICS SCALE (IMS)

Preamble

Dear Respondent,

The statements below are to find out pupils' interest in Mathematics. For each of the statement, choose the option that best describes you. Try as much as possible to be honest. The information obtained will be treated with utmost confidentiality and will be strictly used for research purpose.

Thank you.

Section A

Sex: Male [ ] Female [ ]

Section B

		Always	Often	Rarely
1.	I like staying in Mathematics class			
2.	I see Mathematics as one of my best subjects			
3.	I enjoy reading Mathematics textbooks			
4.	I attempt Mathematics questions			
5.	I like answering questions in Mathematics class			

6.	I think I can be good at Mathematics			
7.	I prefer having other textbooks to Mathematics textbook			
8.	I discourage my friends from solving Mathematics questions			
9.	I feel happy when I hear an information relating Mathematics concept			
10.	Mathematics questions are difficult for me.			
11.	I excited about Mathematics			
12.	I am eager to take part in any Mathematics competition			
13.	I do not like home work in Mathematics			
14.	I think Mathematics should not be part of primary school subjects			
15.	I am eager to teach Mathematics concepts to other pupils			
16.	I discourage other pupils to attend lesson on Mathematics			
17.	I take part in leading other pupils to answering questions on Mathematics in the class			
18.	I beg other pupils to teach me any area I do not understand in Mathematic			
19.	I am excited about solving Mathematics questions			
20.	I answer difficult Mathematics questions			

APPENDIX VI

UNIVERSITY OF IBADAN

INSTITUTE OF EDUCATION

INTERNATIONAL CENTRE FOR EDUCATIONAL EVALUATION (ICEE)

DEXTERITY IN MATHEMATICS TEST (DMT)

Preamble

Dear Respondent,

The questions below are to measure pupils' dexterity in drawing and labeling some Mathematics concepts. The information obtained will be treated with utmost confidentiality and will be strictly used for research purpose.

Thank you.

Section A

Sex: Male [ ] Female [ ]

Section B

Time: 1hr

1. Draw a circle indicating the following
   (a) Radius (b) Diameter (c) Sector
2. Draw an isosceles triangle
3. Draw a rectangle showing its length and breadth
4. Draw a cuboid indicating the following
   (a) A Face (b) an Edge (c)A Vertix

Marking Guide for Dexterity Test

Amount of time used by the pupil during the test:

0 – 20 minutes	-	12 marks
21 – 40 minutes	-	8marks
41 – 60 minutes:	-	4 marks

1.	Drawing of a circle:	1 mark
	Showing of radius	1 mark
	Showing of diameter	1 mark
	Showing of sector	1 mark
	Neatness	1 mark
	Thinness of lines	1 marks
2.	Drawing of an isosceles triangle indicating	
	Two equal sizes	1 mark
	Two equal angles	1 mark
	Neatness	1 mark
	Thinness of lines	1 mark
3.	Drawing of a rectangle showing	1 mark
	Showing its length	1 mark
	Showing its breadth	1 mark
	Neatness	1 mark
	Thinness of line	1 marks
4.	Drawing of cuboid	3 marks
	Indicating a face	1 mark
	Indicating an edge	1 mark
	Indicating a vertex	1 mark
	Neatness	1 mark
	Thinness of lines	1 mark

Maximum marks obtainable is 35

APPENDIX VII

UNIVERSITY OF IBADAN

INSTITUTE OF EDUCATION

INTERNATIONAL CENTRE FOR EDUCATIONAL EVALUATION (ICEE)

PUPILS' LEARNINIG STYLE SCALE (PLSS)

Preamble

Dear Respondent,

The statements below are to find out pupils' learning style. For each of the statement, choose the option that best describes you. Try as much as possible to be honest. The information obtained will be treated with utmost confidentiality and will be strictly used for research purpose.

Thank you.

Section A

Sex: Male [ ] Female [ ]

Section B

Instruction: Read the statements below and the tick appropriate option that best describes you

1. A learn a new topic easily from a teacher who
   (a) writes always on a blackboard
   (b) talks a lot
   (c) demonstrates with something that I can touch while teaching
2. When I am preparing for an examination
   (a)I write a lot notes and diagrams on what I am reading
   (b) I talk to my notes either alone or with other people

(c) I move some parts of my body while reading

3. Anytime I am reading

   (a) I don’t like people to be moving around

   (b) I don’t like people to be making noise

   (c) I don’t like sitting down for a long time

4. When I am thinking about something

   (a) I like drawing diagram

   (b) I like talking to myself

   (c) I like moving my body or any object around me

5. I learn new topic by

   (a) looking at what the teacher is doing

   (b) talking to the teacher on what I’m supposed to do

   (c) trying what the teacher is doing myself

6. Anytime I am reading

   (a) I see what I read in my mind

   (b) I read out to hear what I am reading

   (c) I feel like touching what I am reading

7. I remember people by

   (a) their faces

   (b) their names

   (c) things they have done

8. I describe a place for somebody by

   (a) drawing the description

   (b) saying the description

   (c) using body movement to describe it

9. Anytime I meet a new person

   (a) I easily take note of how he/she dresses

   (b) I easily take note of how he/she talks

   (c) I easily take note of how he/she walks

10. During my free time

(a) I enjoy watching television

(b) I enjoy listening to music

(c) I enjoy playing around

APPENDIX VIII

UNIVERSITY OF IBADAN

INSTITUTE OF EDUCATION

INTERNATIONAL CENTRE FOR EDUCATIONAL EVALUATION (ICEE)

MATHEMATICS SELF-EFFICACY SCALE (MSS)

Preamble

Dear respondent,

The statements below are to find out pupils' self-efficacy in Mathematics. For each of the statement, choose the option that best describes you. Try as much as possible to be honest. The information obtained will be treated with utmost confidentiality and will be strictly used for research purpose.

Thank you.

Section A

Sex: Male [ ] Female [ ]

Section B

Instruction: Read the statements below and the tick appropriate option that best describe you

S/N	ITEMS	More like me	Like me	Not like me
1.	I believe I can understand any difficult question in Mathematics textbook			
2.	I believe I can be good at Mathematics if I study well			

3.	I work harder to correct the mistake I make in solving Mathematics questions			
4.	I cannot be good at Mathematics no matter how I try			
5.	I believe I can understand any Mathematics question given to me during a test			
6.	I am afraid of Mathematics test/examinations			
7.	I leave any Mathematics question I am not able to solve			
8.	I cannot fail Mathematics assignment			
9.	I can solve difficult Mathematics questions if someone explains to me			
10.	I do not need any improvement on my Mathematics results			
11.	I have confident that I will pass any Mathematics examination given to me			
12.	I can explain any Mathematics topics to my friend			
13.	If I read well, I can pass Mathematics examinations very well			
14.	When I find it difficult to solve a Mathematics question, I think of different ways of getting answer to the question			
15.	I cannot be a mathematician			
16.	I can solve difficult Mathematics questions if I give more time to it			
17.	I cannot fail Mathematics examinations			

18.	I am confident that I understand Mathematics topics taught in my class			
19.	I keep trying if I find it difficult to solve any Mathematics question for the first time			
20.	I can get a good mark in Mathematics without the assistance of my friends			

APPENDIX IX

UNIVERSITY OF IBADAN

INSTITUTE OF EDUCATION

INTERNATIONAL CENTRE FOR EDUCATIONAL EVALUATION (ICEE)

FOCUS GROUP DISCUSSION GUIDE (FGDG)

1. What are the things you like when you were taught (Mathematics concepts like angles, line and plane shapes, circle and solid shapes) by two teachers?
2. What are those things that you do not like when you were taught (Mathematics concepts like angles, line and plane shapes, circle and solid shapes) by two teachers?
3. Do you learn Mathematic concepts like lines and shapes, circles, angles e.t.c better because you were taught by two teachers?
4. (a) Do you think using two teachers to teach Mathematics is good for primary school pupils?

   (b) Why do you think using two teachers to teach is good for primary schools?

   (c) Why do you think using two teachers to teach is not good for primary schools?

APPENDIX X

UNIVERSITY OF IBADAN

INSTITUTE OF EDUCATION

INTERNATIONAL CENTRE FOR EDUCATIONAL EVALUATION (ICEE)

INTERVIEW GUIDE (IG)

Section A

Sex:	Male	[ ]
	Female	[ ]
Category of the stakeholders:	Teacher	[ ]
	Head teacher	[ ]

Section B

1. To your understanding, what are the benefits of team teaching to primary schools'
   (a) pupils
   (b) teachers?
2. (a) Do you think team teaching should be introduced at primary schools?
   (b) What are your reason(s)
3. What do you perceive will be the general attitude of primary school teachers if team teaching is introduced at primary schools?
4. Should team teaching be a voluntary participation?
5. Assuming team teaching is adopted at primary schools, in your own opinion, who should be responsible for pairing teachers for team teaching?

Probes: teachers themselves
Head teachers
Government at Local level
Government at state level

6. Do you think there are factors/issues to be considered before putting teachers in team?
7. What is your view on the following issues in team teaching?
   (a) Preparation time or co planning time
   (b) Time management in class by team teachers
   (c) Working relationship between team teachers
8. What do you think will be the likely challenges of team teaching at primary school?
9. To the best of your knowledge, how do you think the challenges can be overcome?