EFFECTS OF OUT- OF- CLASS- ACTIVITY AND COUNSELLING STRATEGIES ON LEARNING OUTCOMES IN GEOMETRY AMONG LOW-ACHIEVING SECONDARY SCHOOL STUDENTS IN IBADAN

BY

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ABSTRACT

Literature in mathematics education shows that the teaching methods being applied by many mathematics teachers are teacher-centered. Furthermore, the methods do not relate classroom activities to out of class real life experiences. Most often, low-achieving secondary school students (LASSS) do not gain from the method of instruction and consequently develop poor attitude towards mathematics, particularly in the area of Geometry. It is on the basis of this that the study examined the extent to which Out-of-Class-Activity (OCA) and Group Counselling Strategies (GCS) enhance learning outcomes in Geometry among LASSS in Ibadan, with students' mathematics self-efficacy (MSE) and gender as moderator variables.

A pretest, posttest control group experimental design with 3x2x2 factorial matrix was adopted for the study. Multistage random sampling technique was used to select 110 LASSS from six Junior Secondary Schools in three Local Government Areas in Ibadan. These students were distributed into three groups viz: Group I (OCA), Group II (GCS) and Group III (Control). Four validated instruments: Students' Selection Test (r = 0.70); Achievement Test in Geometry (ATG) (r = 0.81); Mathematics Self-Efficacy Scale (r = 0.85); and Geometry Attitude Scale (GAS) (r = 0.73) were used to collect data. Seven hypotheses were tested at 0.05 level of significance. Data were analysed using Mean, Standard Deviation, and Analysis of Covariance.

There was a significant main effect of treatment on achievement in Geometry ($F_{(2, 97)} = 35.77, p < 0.05$) and attitude towards Geometry ($F_{(2, 97)} = 108.21, p < 0.05$). In ATG, OCA Group performed best ($\bar{x}$ = 19.10; SD =3.99) followed by GCS ($\bar{x}$ = 19.03; SD = 3.57), while Control Group performed worst ($\bar{x}$ = 12.58; SD = 3.75). In Geometry Attitude Scale, Out-of-Class-Activity group performed best ($\bar{x}$=220.20; SD =28.58) followed by GCS ($\bar{x}$=205.87; SD = 21.86), while Control Group performed worst ($\bar{x}$ = 157.92; SD = 27.40). Mathematics Self-Efficacy had statistically significant effect on achievement in Geometry ($F_{(1, 97)} = 4.07, p < 0.05$), but no significant effect on attitude towards Geometry. Students who held strong beliefs in their abilities performed better ($\bar{x}$= 17.27; SD = 5.13) than those who did not believe in their abilities ($\bar{x}$= 16.05; SD = 4.58.). There was no significant difference between the male and female students in their achievement in and attitude towards Geometry. There were no significant 2 and 3-way interaction effects of treatment, gender and MSE on learning outcomes in Geometry. This implies that the effects of treatments on learning outcomes in Geometry can be generalised across male and female and students with low and high levels of mathematics self-efficacy.

Both Out-of-Class-Activity and Group Counselling strategies were effective in enhancing learning outcomes in Geometry among low-achieving secondary students. Based on the efficacy of the interventions, mathematics teachers, counsellors and school administrators should employ these strategies in enhancing learning outcomes in Geometry among students.

Key words: Out-of-Class-activity, Cognitive behaviour therapy, Mathematics self-efficacy, Low-achieving secondary school students, Learning outcomes in Geometry

Word count: 473

CERTIFICATION

I certify that this work was carried out by Mary Okwuchukwu AKUJIEZE in the International Centre for Educational Evaluation (ICEE), Institute of Education, University of Ibadan.

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I dedicate this thesis to

The Beginning and the End. The First and the Last. The lion of the tribe of Judah. The God of Abraham, Isaac and Jacob. The Alpha and Omega. I am that I am. The Sovereign ruler of the kingdom of heaven and earth. The God of gods. The king of kings. The only wise God, The Omnipotent, the Omniscient and Omnipresent God. The one who was, who is and who will ever be world without end, Amen. Holy is your name. I sincerely thank you Lord for your faithfulness in my life.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Geometry, a branch of Mathematics, has received a substantial attention since 2000BC. The importance of geometry in the lives of people cannot be overemphasized. This is because geometry is used by engineers and architects in planning building and other structures such as bridges and tunnels. In addition, it helps people to acquire abilities such as making new discoveries, analyzing problems and making connections between mathematics and real life situations (Bindak, 2004). Moreover, the National Council of Teachers of Mathematics (NCTM, 2000), the largest organisation for teachers of Mathematics in the world, attests to the importance of geometry in school Mathematics by stating "geometry is a natural place for the development of students' reasoning and justification skills (p. 40). Surveyors, artists and other professional men and women use geometry in their work (Adegoke, 2002) as it is being used by human beings to specify quantities and to measure figures and lands. The widely known quote of Plato," Let no man ignorant of geometry enter here" over the door of his academy (Burton, 1999; p79) and the fact that 'Elements', the famous geometry book written by Euclid around 300 BC, has more editions than any other book except for Bible (Malkevitch,1998) attests to the importance given to geometry. Geometry maintains its importance in Mathematics curriculum (Adegoke; 2002, Duatepe, 2004) as it helps to develop spatial perception. Learning geometry prepares students for higher Mathematics courses and sciences and for a variety of occupations requiring mathematical skills and general thinking skills as well as problem-solving abilities are facilitated by geometry. It is used to represent and solve problems in other topics of mathematics, and daily life situations. Geometry is found to be useful in other disciplines such as arts and science.

Every human being from a housewife to an engineer needs some geometry intuition to understand and interpret the world (Adegoke, 2002; Duatepe, 2004). This is because geometry as a branch of mathematics is an intellectually stimulating subject that affects every facet of human activity such as economy, politics, science and technology. Sherrard (1981) as cited by Duatepe (2004) labeled geometry as a basic skill in Mathematics that is significant for every student since it is an important help for communication, as geometry terms are used in speaking. Adegoke (2002) and Duatepe (2004) noted that geometry can enhance cultural and aesthetic values as Artists use various geometric forms are used in making attractive patterns for textiles, household items, advertising and in box designs.

It is interesting to note that in spite of the importance of geometry, numerous researches (Clements & Battistssa, 1992; Mitchelmore, 1997; NCTM, 1989; Senk,1985; Thirumurthy,2003; Ubuz & Ustun,2002) make it clear that students are not learning geometry as they are expected to learn. TIMSS (1999) has also reported that students' geometry achievement have been found to be lower than the other areas of mathematics (Mullis, Martin, Gonzalez, Gregory,Garden, O'Cannor, Chrostowski, & Smith, 2000). Duatepe (2004) and Uwadiae (2010) noted that analysis of school certificate mathematics examination results show that students have consistently low performance in geometry, as less than 42% of registered candidates obtain credit pass. West African Examinations Council (WAEC) Chief Examiners' Reports (2005,2006, 2007), indicated that students areas of deficiency in school certificate examinations showed that, students least understood geometry concepts, as shown by their achievement. It was further reported that most students avoid geometry questions or haphazardly attempt them. Adegoke (2002) and Adeleke (2007) noted that students find geometry difficult to learn and teachers find it difficult to teach. This probably might have accounted for the general poor performance of students in Mathematics and hence, the research on it. A need for increasing geometry achievement of students has been realized by Mathematics educators (NCTM, 1989, NCTM, 2000).

The achievement of students in Geometry could be influenced by learners' characteristics such as gender. However, researchers (for instance, Etukudo, 2002; Ezeugo & Agwagah, 2000) have divergent views on gender in relation to roles, ability, attitude, and achievement in specific tasks. In fact, findings on gender difference in Geometry vary significantly. Some scholars claim that males perform better than females (Adeyegbe, 2000; Olatundun, 2008); while others such as Olowojaiye (2001) and Yinyinola (2008) claim that no difference exists in the achievement of male and female students in Mathematics. Abiam and Odok (2006) found that there is no significant relationship between gender and achievement in number and numeration, statistics, algebra but a weak relationship between gender and achievement in geometry and trigonometry. Amelink (2009) noted that male students performed better in geometry and measurement among 8^{th} graders, while numbers and operation were better performed by female students.

Another factor that is found to affect achievement is attitude. Nkwe (1985) argues that pupils who are positively inclined towards a subject tends to do well in that subject. Melihan, Seher and Ramazan (2010) noted that attitudes play an important role in geometry achievement. Ma and Kishor (1997) indicated that there is a general belief that children learn more effectively when they are interested in what they learn and that they will achieve better in mathematics if they like mathematics. Similarly, if students have positive attitude towards geometry, they are expected to like geometry, participate in the classroom activities and to be high achievers in geometry (Bindak, 2004). According to Adebowale (2000), a student's attitude could relate to all the facets of his or her education. The researcher opines that, the attitude of a student towards Mathematics and Mathematics-related subjects will determine the measure of the student's attractiveness or repulsiveness to Mathematics. This tends to influence the learner's choice and achievement (Adetunji, 2000; Ayedun, 2000; Mohd, Mahmood & Ismail, 2011; Osborn & Simon, 2003). Studies on the relationship between students' attitude and the students' academic performance show a positive relationship (Mohd, Mahmood & Ismail, 2011; Bramlett & Herron, 2009; Nicolaidou & Philippou, 2003). However, Mogari (2012) remarks that it cannot be concluded that positive attitude will always affect good performance. Kiely (1990) reports that on average, a small number of pupils who were not good enough in mathematics obtained high score in the attitude test.

Aiken (1970) as cited by Mogari (2012) opined that assessment of attitude would be of less concern if attitudes were not thought to affect performance in some way. Kulm (1980) concluded that achievement depends on attitudes, hence the ongoing search for a relationship between the two variables. The needs and interest of today's children are far more different than the children of the past decades. The traditional instructional methods do not seem to be responsive to the potential of today's children (Battista & Clement 1999; Garrity, 1998).

Research report indicated that poor teaching approach accounts for students' poor achievement in geometry (WAEC, 2007; Olunloye, 2010). Uloko and Usman (2008) reported that there is a positive correlation between good teaching approach and students' achievement in mathematics. Also Iji (2005) stated that good strategy improves both low and high ability students in geometry at the upper basic education class. That is good teaching approach produces high achievement among learners while poor teaching approach will lead to poor learning and low achievement. Generally, instruction in geometry has been teacher-centered, procedure-based, and prescriptive (Baynes, 1998; Keiser, 1997). This method is lacking in creativity, visualization, and conceptual development (Keiser, 1997; NCTM, 2000). Schoenfeld (1983) as cited by Duatepe (2004) noted that students cannot be creative enough in a traditional class. Furthermore, this approach was problematic for many students and teachers, and both groups considered geometry to be the most frightening subject (Malloy & Friel, 1999). This might have resulted in students losing interest in geometry. Schoenfeld (1983) as cited by Duatepe (2004) associated the limitations of traditional teaching in geometry with the teacher-oriented instruction and "ready-made" mathematical knowledge presented to the students. Most formal school experience never gives students the opportunity to do anything with Mathematics except for lean back and listen. Students are not given a chance to be involved in the teaching and learning process to learn meaningfully. According to Olunloye (2010), teachers should improve their teaching methods in order to enhance better understanding and application of geometry among the students so that their interest could be aroused. Thus, there is need to explore approaches that will improve students' achievement as current results (WAEC, 2010) indicate that the conventional teaching approach is deficient in meeting the needs of majority of learners. The conventional teaching approach is described as teacher centered and didactic with learners simply listening, copying notes, doing class work and doing assignments. Furthermore, with conventional teaching approach, gap between high and low ability students is very wide.

According to Clements and Battissa (1992), effort should be made to conduct teaching/learning research that leads students to get geometry concepts meaningfully and excitingly. During the last decade, researchers have studied on how geometry topics should be presented so that students' difficulties can be overcome. Many researchers (Arcavi & Hadas, 2000; Baharvand, 2001; Bobango,1988; Borrow, 2000; Chazan,1998; Choi-Koh,1999; Flanagan,2001; Furinghetti & Paola, 2000; Healy, 2000; Hodanbosi, 2001; Holzi, 2001; Ives, 2003; Jones,1998; Johnson, 2002; July, 2001; Laborde, 2002; Marrades & Guiterrez, 2000; Moses, 2000; Scher, 2002; Ustun, 2003; Washington-Myers,2001) have studied the use of technology on geometry. Some of them (Din & Whitson, 2001; Round, 1998; & Velo, 2001) studied the effect of computer programmes in geometry and some researchers (Dixon, 1997; Duatepe & Ersoy, 2002; Ryan, 1999) conducted studies on usage of calculators in geometry. These studies revealed that the use of technology is beneficial to students in developing their understanding of geometric concepts.

A different aid for geometry teaching other than technology is barely seen in the literature. Nichols and Hall (1996) studied the effects of cooperative learning method in geometry lessons and found that it has positive effects. The effects of manipulative besides cooperative learning were investigated by Garrity (1998). The result indicated that it improved the students' attitudes towards Mathematics and achievement.

There still occurs a need to find different teaching methods in geometry instruction that can meet the students' needs and make them engage in geometry to provide meaningful learning. Constructivist learning theory basically claims that in order for learning to be meaningful, learners should actively construct knowledge. The teacher should assist learning by creating a stimulating learning environment for students, asking questions that require students to think critically, and allowing them to investigate, discover and question the concepts they are learning. Researchers in Mathematics education such as Folk and Dierking (1992) and NCLB (2002), suggest the use of Out-of-Class-Activity (OCA) and Counselling strategies to improve the learning outcomes of the low-achieving students. Considering these facts, this study investigated an alternative teaching method in geometry; Out-of-Class-Activity based instruction.

Out-of-Class-Activity Strategy (OCA) encompasses Mathematics learning that takes place outside the traditional classroom walls, for example, on the field, in the garden, market, in the community and in the laboratory. OCA is a therapeutic strategy by which students are taught Mathematical knowledge systematically through connectivity to the real life situation. In this study, the Out-of-Class-Activity strategy was based on constructivist ideas. The constructivist learning theory (Piaget, 1963; Vygotsky, 1987) holds that learning should build upon the knowledge that a student already has acquired; this prior knowledge is called schema. The theory suggests that learning is more effective when a student is actively engaged in the construction of knowledge rather than passively receiving it. The goal of using Out-of-Class-Activity strategy is the development of Mathematics (geometry included) teaching innovations in which students and teachers engage in mathematically rich situations through the creation of learning modules that capitalize on students' knowledge and experiences in their everyday life experiences. OCA is characterized by the following:

- The learners are actively involved;
- The environment is democratic;
- The activities are interactive and student-centered; and
- The teacher guides, directs and facilitates the process of learning in which the students are encouraged (Gray, 1999).

Mathematics is hierarchical in nature. That is, complex concepts are built cumulatively on simple ones. For this reason, Kemeny (2006) advocates that Geometry should be taught systematically, relating the classroom concepts to the real life experiences of the learners. Traverse, John and Garth (1971) state that teachers of low-achieving students should be well experienced in the teaching of Mathematics. According to Traverse et al, the teachers should be acquainted with what students are doing in their industrial arts (local environments) and use the knowledge acquired in their local environment as sources of application of learning Mathematics. Similarly, Weil and Calhain (2004) assert that teachers must not only be knowledgeable about the content they teach, but should also know and be committed to making decisions that involve the use of variety of instructional strategies and approaches appropriate to the students' diverse learning needs.

Travers, John and Garth (1971) stated that the geometry teacher of low-achieving students should systematically organise the instruction in such a way that it will be like a building block of linkage from known to unknown (cultural environment of the learners to the classroom situation). For example, the researcher used the teaching of the concept of area of cylinder to illustrate the Travers et al s' suggestion. This should involve:

- Collection of real life solid shapes that is cylindrical in nature (for example, empty cans of milk) within the students' local environment.
- Identification of the cylindrical shapes,
- Observation, touching and feeling of cylindrical shapes,
- Differentiation of cylindrical shapes from other shapes and other symbols,
- Drawing of the cylindrical shapes on the chalkboard and on their paper.
- Exploration of properties of a cylinder,
- Formation of the formula of area of the cylinder; and
- Calculation of the area of cylinder which culminates all the above concepts.

By so doing, there will be a link between geometry and real life situations. Kemeny (2006) explains that making the relationship between geometry and the real life experience of students is a way to reduce anxiety. When students gain confidence in Mathematics, they could become more successful in it (increase in Mathematics achievement and positive attitude towards the subject) and be better equipped to be successful in the world that is highly technologically and mathematically oriented.

In addition to the above, research studies have shown the importance of counselling to the academic achievement of students (Graham, 2005; Kendall,1994). Stressing the importance of counselling in educational system, Fakunle (2007) acknowledges the influence of counselling on students' achievement, explaining that the poor achievement of students in Mathematics as well as students avoidance of its learning is attributed to unavailability of career counselling. Adeyoju (1989) argues that the roles of the school counsellors include provision of services for specific support for students with both academic and non-academic problems. According to Obanya (2000) and Atkinson (2004), counselling programme would be able to care for both the psychosocial and academic lives of the learners. Fakunle (2007) stresses that failure of students in Mathematics, negative attitude towards it and hatred, are as a result of the inability of the students to receive proper counselling in Mathematics. He noted that the roles of a good counsellor are to:

- help students explore self;
- help students make informed decision;
- help students correct misconceptions especially in the area of Mathematics;
- promote students' positive behavioural change; and
- Promote students' healthy living.

Ford (1992, 1996) considered the characteristics of low-achieving students as follows: the students have negative attitude towards school; they have low self-concept; exerts little effort on school tasks, perform poorly academically and feel alienated both at home and in school. Therefore, having identified the characteristic of low-achieving students, (Paisley & Millson, 2007) reported that the problems of the low-achieving students could be addressed using group counselling strategy. Similarly, Gibson and Mitchel (1981) as cited by Oladele (2001) explain that humans are group-oriented. People are meant to complement, assist and enjoy each other. Humans seek to meet most of their basic and personal–social needs through groups, including the need to know and grow mentally. Thus, group counselling serves both preventive and remedial purposes. Through group counselling, there might be some behavioural changes in terms of student attitude towards Mathematics, achievement among low-achieving students subsets can be promoted Mathematics performance and their personal characters (Gesinde, 1991; Paisley & Millson, 2007)).

In view of counselling, Sink (2005) suggests that school counsellors can directly impact student learning through small group counselling. Sink (2005) emphasised that Cognitive Behavioural Therapy (CBT) interventions utilized within classroom small group meetings are the most logical and educationally applicable interventions school counsellors can use to impact academic achievement.

Ellis (2003) defined CBT as a learning-based approach that encourages students to modify their thinking and behaviour. Ellis described problems such as fear of mathematics, poor achievement, negative attitude and low self-efficacy by the low-achieving students as being triggered by how students analyse events in their lives. When people develop irrational beliefs and unrealistic goals, it could lead them to unattainable expectations. Considering the interrelationship between beliefs, values, thoughts and attitude underlining human behaviour and emotions, Ellis believed that the CBT could be used as a counselling technique to aid the low–achieving students in enhancing their academic performance. Cognitive behavioural therapies can as well be defined as those interventions with the core assumptions that what individuals think directly impacts how they feel and what they do (Graham, 2005). Graham further suggests that if a school counsellor can re-educate students to confront their dysfunctional thoughts, then consequently symptoms of emotional distress and dysfunctional behaviours can be reduced. School counsellors utilizing CBT give strong significance to the conscious thought processes of their students, place emphasis on the present, give homework for the students to work on between sessions or groups, and assess the efficacy of the intervention to make changes as the relationship progresses (Graham, 2005).

The CBT holds that most of our emotions and behaviours are the results of what we think or believe about ourselves, other people and the world (Binggeli, 2010). These cognitions shape the interpretation and evaluation of what an individual experienced, influence how he feels about it and provide a guide to how he should respond.

Unfortunately, sometimes these interpretations, evaluations and underlying beliefs, and thoughts contain distortions, errors or biases that are not very useful or helpful. This results in unnecessary suffering and causes one to react in ways that are not in one's best interest. Among the reasons students identified for not performing well in Mathematics is that the subject is difficult (Udousoro, 2000). According to Ellis (2003), such thought is an irrational one or wrong conception which can be modified by the use of Cognitive Behavioural Therapy. For example, a low-achieving student who says "I hate Mathematics", I don't think I will ever know Mathematics in my life" has internalized such a thought. The CBT counsellor would model more healthy and productive thoughts for the learners, such as "Mathematics is for all", "you can love Mathematics as your best subject if more time is devoted for it." The CBT counsellor can help learners to internalize a rational philosophy of life, just as he or she originally learned and internalized the irrational ones through a manner of ways and methodologies to replace the rational thoughts.

Research reports indicated that many reasons accounted for students' poor achievement in geometry. Among this is lack of confidence in the subject (Basturk & Yavuz, 2010). With the trend of poor performance in Mathematics, educators (Campbell & Hackett, 1986; Pajares & Kronzler, 1995; Pintrich & De Groot, 2000) have advocated that perceived abilities are key elements for success in Mathematics. According to Bandura (1986), self -efficacy is defined as people's judgment of their capabilities to organize and execute the course of action required to attain designated type of performance and task. Yinyinola (2008) opines that self-efficacy beliefs act as a determinant of behaviour by, influencing the choice that students make, the effort they expend, the perseverance they exert in the face of adversities, the thought patterns as well as mental and emotional reactions they experience. A high sense of efficacy may serve students well when solving mathematical problems not because it "makes" them to be better problem solvers, but because it engenders great interest in and attention to work the problems. With increased effort and greater perseverance in the face of adversity, such students are also likely to feel less apprehensive about mathematical capabilities. Self-efficacy encourages perseverance and provides the confidence to try different strategies. Students who doubt their ability to succeed may tend to give up a learning process if the early efforts do not result in perceived success (Brown & Inouye, 1978; Schunk, 1984). This is probably why people achieve readily even in the face of adversity. When they believe they will be successful, they work harder towards achieving their goals. Those who are confident about their abilities tend to succeed, while those who doubt their abilities to succeed tend to fail. In a similar view, Pajares (2001) asserts that the higher the students' mathematics self-efficacy, the more confidence they have.

Researchers (Young, 1997; Roeser, Strobel & Quihuis, 2002) have linked cognitive processes with motivation, a major building block for student academic achievement as well as the level of anxiety (Barabasz & Barabasz, 1981; Ergene, 2003; Fisher, Masia-Warner & Klein, 2004; Keogh, Bond, French, Richards, & Davis, 2004) students' experience at school. Zyromski and Joseph (2012) noted that using Cognitive Behavioral Intervention to intervene and help students control cognitive thought processes would directly impact these metacognitive influences on student learning; therefore, positively imparting academic achievement. Ausubel (1973) stated that young children are capable of understanding abstract ideas if they are provided with sufficient materials and concrete experiences with phenomenon that they are to understand. Kumar et al (2004) as cited by Bashir (2012) remarks that co-curricular activities hold a place of great importance in the field of education for the all round development of children. Furthermore, some researchers examined the effects of computer instruction on geometry achievement (Arcavi & Hadas, 2000; Baharvand, 2001; Choi-Kok, 1999), however, the previous studies on students' learning of geometry mainly focused on all the students generally and not specifically on the low-achieving students. It is against this background, that this study investigated the effect of Out-of-Class-Activities (OCA) and Cognitive Behaviour Therapy (CBT) a mode of Group Counselling Strategy (GCS) on achievement in and attitude towards geometry among low-achieving junior secondary school students in Ibadan.

1.2 Statement of the Problem

Geometry plays an important role in human activities. Secondary school students dread Mathematics, especially in the area of geometry. Many students who are low-achieving face a lot of challenges in the learning of Mathematics in general, and geometry, in particular. The problem of poor performance is of great concern to parents, teachers and school administrators. The result of poor performance has often resulted in low-achieving students developing negative attitudes towards Mathematics and having low performance. The bodies of research on geometry instruction for secondary school students have focused on experimental studies that engage students only in academic activities inside the classroom which could improve the students' academic performance and enhance their mathematics concepts. However, these methods, as laudable as they might be, do not create situations in which students examine the connections between Geometry and life outside the classroom and apply what they are learning.

Secondly, most of these studies have not considered the needs of low-achieving students who are performing below the academic standard. Therefore, in order to improve academic performance of low-achieving students in geometry, the present study investigated the effects of out of class activity and counselling strategies on learning outcomes in geometry among low-achieving secondary school students in Ibadan.

1.3 Hypotheses

The following hypotheses were tested in this study at.05 level of significance.

Hypothesis 1: There is no significant main effect of treatment

on participants'

(a) Achievement in geometry

(b) Attitude towards geometry

Hypothesis 2: There is no significant main effect of self-efficacy

on participants'

(a) Achievement in geometry

(b) Attitude towards geometry

Hypothesis 3: There is no significant main effect of gender

On participants'

(a) Achievement in geometry

(b) Attitude towards geometry

Hypothesis 4: There is no significant 2-way interaction effect of treatment

by self-efficacy

on participants'

(a) Achievement in geometry

(b) Attitude towards geometry.

Hypothesis 5: There is no significant 2-way interaction effect of treatment

by gender

on participants'

(a) Achievement in geometry

(b) Attitude towards geometry.

Hypothesis 6: There is no significant 2-way interaction effect of

Self-efficacy by gender

On participants'

(a) Achievement in geometry

(b) Attitude towards Geometry

Hypothesis 7: There is no significant 3-way interaction effect of

Treatment, self-efficacy and gender

On participants'

(a) Achievement in Geometry

(b) Attitude towards geometry.

1.4 Scope of the Study

The study involved Junior Secondary two (JS2) students. It was designed to provide information on the effectiveness or otherwise of out-of-class-activity and counselling strategies in enhancing learning outcomes of secondary school students in geometry. The study incorporates student's self-efficacy and gender as moderator variables. It involved achievement in geometry and attitude as dependent variables. The study was carried out in Ibadan, Oyo State, Nigeria. The participants were selected from Junior Secondary two (JS 2) students within Ibadan metropolis.

1.5 Significance of the Study

The results of the study will provide students with a strategy for developing positive attitude towards geometry which can enhance their performance in mathematics generally. Findings can be significant in validating the use of Out-of-class-activity based instruction in geometry. A growing body of evidence indicates that in helping students to acquire proper geometric concepts, activity based approach to teaching geometry are more effective than conventional methods in producing a wide range of desirable student outcomes.

Furthermore, the significance of this study would be the development of a therapeutic programme for readjusting the negative effects of poor performance in Geometry. The response of the participants to therapy would enable the researcher to determine the suitability of the treatment.

It is equally hoped that the study will generate problems for further research. It will be useful to researchers who may intend to replicate the study or work in related fields of study.

1.6 Operational Definition of Terms

Low–achieving students: In this study, low-achieving students refer to the participants in the study who scored below the first quartile in students' selection test (SST) which was constructed by the researcher and was administered to the participants in the selected schools.

Out-of-Class-Activity Strategy: This refers to activity delivered outside the classroom whereby the participants were taken outside the classroom to carry out some mathematical operations after which geometry instruction was taught in the classroom.

Attitude: This refers to the students' scores on the Geometry Attitude scale (GAS).

Counselling strategy: (Cognitive Behaviour Therapy). Counselling strategy refers to the intervention programme designed by the researcher through which participants acquired appropriate information to enable them develop positive attitude towards Geometry so as to enhance their performance

Learning outcomes: Learning outcomes refer to the participants' scores obtained from Achievement Test in Geometry (ATG) and Geometry Attitude Scale (GAS).

Mathematics self-efficacy: This refers to the belief, which the participants hold about their abilities to solve mathematics or mathematics related tasks.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a synthesis of related literature on all the variables involved in the study. The chapter also contains the conceptual framework for the study.

2.2 Theoretical framework

2.2.1 Constructivist theory

2.2.2 Ausubel's Theory of Organization of Knowledge

2.2.3 Theory of Causation

2.2.4 Theories of counselling

2.2.5 Operant Conditioning

2.2.6 Social Learning theory

2.2.7. Cognitive behaviour Therapy

2.3 Low-Achieving Students

2.4 Teaching and Learning of Geometry in Secondary School

2.5 Out –of- Class- Activity Strategy

2.5.1 Strategy for Linking School Mathematics and Out of Class Activity

2.5.2 Out- of -Class -Activity Strategy and Achievement

2.5.3 Out –of- Class- Activity strategy and Attitude

2.6 Group Counseling Strategy

2.6.1 Counselling Strategy and Achievement

2.7 Mathematics Self-Efficacy

2.7.1 Mathematics Self-Efficacy and Achievement

2.7.2 Mathematics Self-Efficacy and Attitude towards geometry

2.8 Theory of Gender

2.8.1 Gender and Mathematics Achievement

2.8.2 Gender and Attitude towards Geometry

2.9 The Concept of Attitude

2.10 Appraisal of the literature.

2.2 Theoretical Framework

The theoretical framework for this study was built on :(1) Constructivist theory; (2) Ausubel's theory of Organization of Knowledge; (3) Ellis Theory of Causation (4) Theories of Counselling (5)Operant Conditioning (6) Social Learning Theory (7) Cognitive Behaviour Therapy.

2.2.1 Constructivists' Theory

The constructivist believes that learners can help construct their knowledge based on their previous experiences and that they understand and learn better through interaction with their industral world (environment). The theory also predicts that knowledge encoded from data by learner themselves will be more motivating, flexible, transferable and useful than the one encoded and transmitted to them by the delivery agents like teachers (Cobb, Wood, Yackel, Nicholls, Wheatley, Trigatti & Pertwitz, 1991). The theory postulates that knowledge is active rather than passive. That is to say that learning mathematics must be an active process. Learning of mathematics requires a change in the learner, which can only be brought about by what the learner does and what activities he or she engages in. Constructivists focus on learners' abilities to mentally construct meaning on their own environment and create their own learning. According to Bybee, Buakwalat, Luero, Matsu and Mclinery (1989), the constructivists' view of learning is linked to three (3) related ideas. These include prior knowledge, student learning styles and concentration of teaching on depth and understanding rather than on breadth of coverage and knowledge of vocabulary. To constructivists, all humans have the ability to construct knowledge in their own minds through the process of discovery and problem solving. They argued that as far as learning is concerned, the teacher who is the instructor should try to encourage students to discover principles by themselves. This involves collaborative learning where groups of students interact and help each other to learn.

Piaget (1965) as cited by Yinyinola (2008) offered a constructivist view of mathematical learning saying that children have a natural curiosity. According to him, children have an inherent desire to find patterns and resolve problems which according to Piaget (1965) is the essence of mathematics. Piaget further explained that the construction of mathematics understanding was the heart of real development of mathematical knowledge by interacting with their physical and social world.

As an example of this, (Cobb, Wood, Yackel, Nicholls, Wheatley, Trigatti & Pertwitz, 1991) describe an effort to teach second graders to count by tens. Rather than telling the students the principle directly, the task of counting objects bundled in sets of ten was assigned to the groups of students. The groups discovered that counting by tens is more efficient than counting by ones. Building mathematical curriculum around such techniques could help students transfer knowledge and express better attitudes about mathematics. The Vygotsky (1978) states that learning occurs during actual problem solving, joint activity or shared task definition with others. When adult or well experienced teacher enhances learning, scaffolding occurs. This has been found not only to produce immediate knowledge of results, but also to instill the skill necessary for independent problem solving in the future.

2.2.2 Ausubel's Theory of Organisation of Knowledge

Theories about how students learn are concerned with the justification of the way a teacher develops, selects materials, chooses instructional techniques and presents the given task (Emeke, 2002). The study was on Ausubel theory of organization of knowledge. Ausubel (1978) states that knowledge is hierarchically organized that new information is meaningful to the extent it can be related (attached, anchored) to what is already known. The theories of constructivist and Ausubel were employed by the researcher of this study since the instructional strategy used in the study is in line with constructivists' theories. It is in systematic stage and one stage links or relates and anchors to the other as advocated by the Ausubel's theory. A flow chart in chapter three illustrates the relationship between Ausubel's theory of organization and researchers' instructional strategy. In the study, the learner's prior knowledge is the knowledge acquired within the learner's real world experience, gathered through collection of instructional materials within school environment, home and community. In teaching, the prior knowledge experience is linked up with the teaching process and then the outcome, which is the achievement or the result of prior-knowledge and instruction. The instruction is organized in a spiral connection, spanning from one level to another. Ausubel (1973) distinguishes between meaningful learning and rote learning and how the previous knowledge or experiences of the learner affect the retention of the learned mathematics concepts (Ausubel, 1960). To Ausubel, the learner's prior knowledge serves as an organizational framework within which new ideas and facts are situated. He explains that the new knowledge to be learnt can only be meaningful to the learner if there are relevant concepts in his memory to which the new material can relate. He refers to knowledge as what the learner knows or should know and advocates that this should be systematically arranged in an hierarchical order in such a way that it will be presented from known to unknown.

On structural presentation of knowledge, Ausubel (1963) identified two types of concepts called Superordinate and Subordinate. Superordinate concept refers to building block of ideas to which subordinate ideas are closely linked. The implication of Ausubel's theory in this study is that Mathematics teacher should organize and present mathematics instruction in a systematic and hierarchical manner bearing in mind the individual differences among learners in the classroom situation.

It is believed that mathematics is one of the hierarchically structured subjects which range from the most elementary level to the highest one and it is in a vertical spiral connections. Therefore, a well organized mathematics instruction may lead to positive attitude and which in turn increased performance. It is necessary for the teacher of mathematics to employ this theory in the classroom situation for benefits of our students.

2.2.3 Theory of Causation (REBT)

In the early 1950s, Ellis, a clinical psychologist, became disillusioned with the slow progress of his students. He observed that his students tend to get better when they change their ways of thinking about themselves, their problems and the world. To him, an instruction that focuses directly on the students' beliefs would facilitate learning. On the process of thought, Ellis describes Rational Emotive Behavioural Therapy (REBT) as the theory of causation which he refers to as a comprehensive theory of human behaviour. It is a combination of biological, psychological and social factors that are involved in the way human beings feel and behave. Ellis believes that almost all human emotions and behaviours are as a result of what people think, assume or believe about themselves, other people and the world in general. To Ellis, it is what the students believe about situations they face not the situations themselves that determine how they feel and behave.

Ellis advocates that the students' belief system is seen to be a product of both biological inheritance and learning throughout life. A useful way to illustrate the role of cognition in this theory is by using Ellis 'ABC model. In this framework, 'A' represents an actual event or experience, and the student's inferences or interpretations as to what is happening. 'B' represents the 'evaluative' beliefs that follow from these inferences. 'C' represents the emotions and behaviours that follow from those evaluative beliefs. Here is an example of an emotional episode experienced by a low-achieving student who tends to misinterpret the actions of his/her teacher. (This example is from the researcher's previous school. It was an incidence that happened between a student and the mathematics teacher)

A^1 activating event-what happened?

Teacher passed me at the school premises without responding to my greetings.

A^2 Inferences about what happened:

He does not respond to my greetings because I fail his mathematics test.

B: Beliefs about A:

I am a failure as a student-so I must be worthless.

C: Reaction

Emotions: depressed

Behaviours: avoiding mathematics class- resulting to poor performance.

It is noted that ‘A’ alone does not cause ‘C’, ‘A’ triggers off ‘B’, and ‘B’ then causes ‘C’.

The implication of Ellis to mathematics teachers is that students should be counselled on the consequences of negative thoughts about mathematics instruction letting them know that the way each individual thinks concerning any issue affects the way he/she responds to the issue. The mathematics teacher ought to know that students could interpret the same life event differently, leading to many and varied emotional and behavioural consequences. Such consequences could lead either to positive or negative attitude, which invariably can either lead to enhanced mathematics performance or poor performance.

Furthermore, the implication of Ellis’ theory in this study is that the mathematics teachers should make instruction delivery eclectic by bearing in mind individual differences among the students in the classroom situation. Ellis viewed knowledge as a consequence of thinking patterns which he advocated should be improved through a well structured counselling training skills (Ellis, 2003). In view of the objective of this study, the researcher employed the Ellis’ theory as a theoretical framework for this study to counsel the low-achieving students on the importance of mathematics and its related discipline using Cognitive Behavioural Therapy (CBT). Counselling is a comprehensive system for ensuring that all students receive academic and psychological support needed for their intellectual development, success in school and capacity to move onto postsecondary education or a career path Asuru (2006). Research on counselling, reports that both components (academic and psychological needs of students) are necessary to achieve high–level academic achievement as stipulated by Ellis’ (2003) theory- biopsychosis. Students who often believe that mathematics is bored and unimportant need to be motivated through appropriate counselling training, which can lead to academic performance, especially in the area of mathematics. Therefore, adequate counselling skill is a necessary focus in developing positive attitude in students towards mathematics. This is necessary because mathematics is the gateway to all scientific and technological development of any nation (Awofala, 2002).

2.2.4 Operant Conditioning

Operant conditioning theory is based upon the idea that learning is a function of change in overt behaviour. Changes in behaviour are the result of an individual's response to events (stimuli) that follow the emission of the behaviour. This, in turn, will determine the reoccurrence or otherwise of such behaviour. Skinner (1938) and Thorndike (1932) as cited by Yinyinola (2008) are at the forefront of this proposition. Woolfolk (1998) in Yinyinola (2008) reports that Thorndike established the basis for operant conditioning while Skinner developed the concept. A response produces a consequence such as defining a word or solving a mathematics problem. When a particular Stimulus-Response (S-R) pattern is reinforced (rewarded), the individual is conditioned to respond. The learner will repeat the desired behaviour, if the behaviour is followed by positive reinforcement. A positive reinforcer is anything that strengthens the desired response. Positive reinforcement or reward could be verbal praise such as 'very good', 'a good grade' or a feeling of increased accomplishment or satisfaction.

A behaviour that is followed by pleasant consequence (reinforcement) tends to be repeated, while a behaviour that is followed by an unpleasant experience (punishment) tends to be discarded. The poor performance of students in a learning task from the operant point of view therefore might be as a result of the fact that students' response to classroom activities are not followed by pleasant consequences (reinforcement) but rather by unpleasant consequences. For example, when a student does not respond to teacher's mathematics questions correctly, the teacher calls him 'olodo' (giving a negative label to the student). In a situation, where good performance of students in class activities is not rewarded or punishment is meted out for making a trial, the rate of participation in the classroom activities can be diminished.

2.2.5 Modelling or Social Learning Theory

Social observational learning refers to changes in behaviour, thinking, or emotions that occur through observing another person (Woolfolk, 1998). Bandura (1975) as cited by Yinyinola (2008) who developed the theory and viewed modelling in learning as being made up of both initiating and identifying with the stimulus figure being modelled. This means that a change in behaviour or thinking is brought about through the process of observing the way and manner a model exhibits it. The observation of such would lead to later performance by the observer. The observer behaviour in this context may be desirable or undesirable.

The poor performance of students in Mathematics from the observational learning theory point of view is as a result of student's exposure to undesirable role models. That is, students who perform poorly in mathematics have observed the performance from others. Hence, the multiplying effects. Oden (1999) sees mothers as resource persons in language learning for girls who are always at home with their mothers. If the mother does not develop positive attitude towards mathematics and has been failing the subject while in the school, the child may do the same. This evidently shows that exposure to undesirable role model is responsible for poor performance.

Exposure to a role model can affect the behaviour of observer in at least three ways (Gage & Berliner, 1979) as cited by Gesinde (2004). These include learning new behaviour, having already learned behaviour facilitated, and having already learned behaviour inhibited or disinhibited. This therefore, implies that exposure to wrong role model may influence poor performance of students in Mathematics.

2.2.6 Cognitive Behaviour Therapy (CBT)

Cognitive Behaviour Therapy is a psychotherapy based on modifying cognitions, assumptions, beliefs and behaviours, with the aim of influencing disturbed emotions. The general approach developed out of behaviour modification, cognitive therapy and Rational emotive Behaviour Therapy, and has become widely used to treat various kinds of neurosis and psychopathology, including mood disorders and anxiety disorders. Cognitive Behaviour Therapy was developed from the ideas of Albert Ellis, the founder of Rational Emotive Behaviour Therapy, and Aaron Beck, the founder of Cognitive Therapy. The techniques and ideas it uses involve identifying distorted or erroneous thinking patterns and learning new ways of thinking which correct the distortions and lead to a more balanced life. The Words of a Greek Philosopher, Epictetus further states that: "Men are disturbed not by things, but by the view which they take of them" (Carter, 2012). Despite the male-dominated language, this is one aspect in which women and men seem to be similar. Whatever one's gender, one may discover that if one draws negative conclusions from situations, about oneself, the world in general or one's future, one feels bad and finds it hard to take constructive positive steps to resolve the problems.

Cognitive BehaviouralTherapists opined that maladaptive behaviours such as anxiety, fears, stress, depression, worry, anger, complexies, cognitive distortions, negative thought patterns and dysfunctional attitude can be eliminated in individuals and rational thinking, positive thoughts patterns, effective living and learning new ways of thinking which correct the distortions and lead to a more balanced life can be employed. Cogntive Behaviour Therapy (CBT) is a way of talking about: how you think about yourself, the world and other people, how what you do affects your thoughts and feelings, is a technique that relies on the use of logic and reason. Carter (2012) pointed out that negative and distorted thinking patterns are some other peculiar problems identified in individuals. One of the notable characteristics of the client (low-achieving students) is distorted Cognition. Examples of such distortions include: self–defeating verbalization, irrational thinking, wrong interpretation, misconceptions, wrong attributions, overgeneralization and catastrophization (Carter, 2012)

CBT is described as a form of intervention that people have demonstrated to produce positive effects on individuals by effectively addressing the distortions. Psychologists refer to CBT as the way in which people interpret events, perceive themselves and judge their abilities (Ellis, 2003). Ellis argues that thousands of people live unhappy life because of irrational beliefs that 'cloud' their interpretation of events. Cognitive Behaviour Therapy interventions would be concerned with helping students realize three things: how the students' thought patterns affect behaviour, how they can take control of these thought patterns and how they can apply interventions to effect behaviour change (Brigman & Campbell, 2003). Another approach that comes under CBT by Miechenbaum is self-instructional training. He teaches individuals how to think logical and positive thoughts in stressful situations, instead of plunging themselves into self-defeating verbalization monologues (Worthman, Loftus & Weaver, 1999) in Faloye (2009). The elements of this approach to treatment include:

- Cognitive rehearsal and validity testing
- Writing in a journal and Guided discovery
- Modelling of appropriate behaviour and Homework therapy.
- Systematic positive reinforcement (Nakate, 2011)

In addition, cognitive skills –based therapies seek to help individuals understand that they can control their behaviour- and their lives-by learning more effective, less antisocial ways of thinking in a process known as "cognitive behavioural therapy". Knowledge about social skills, problem-solving and other behavioural control may teach individuals to control their anger, adjust their negative attitudes to difficult situations and understand how some of their thinking patterns may be distorted.

Cognitive Behaviour Therapy can either be short-term or long-term depending on the intensibility of the problem. The session can also be run between 6 to 18 sessions. The CBT process begins with identification of self-defeating verbalization and irrational thought patterns and cognitions that remain problematic for the clients through record keeping by the clients, therapist or both. CBT identified some illogical ways of thinking which include: mind reading, overgeneralization, wrong attribution, name-calling (Carter, 2012). The CBT therapist uses several approaches such as Cognitive rehearsal and validity testing, Writing in a journal and Guided discovery, Modelling of appropriate behaviour and Homework techniques, Systematic positive reinforcement to modify behaviour (Nakate,2011).

The particular therapeutic techniques vary within the different approaches of CBT according to the particular kind of problem issues, but the common ones may include keeping a diary of significant events and associated feelings, thoughts and behaviours; questioning and testing cognitions (validity testing), assumptions, evaluations and beliefs that might be unhelpful and unrealistic, gradually facing activities which may have been avoided; and trying out new ways of behaving and reacting. CBT concentrates on clients' present problems in contrast to the emphasis on past history that is a prominent feature of psychoanalyst Freud oriented therapies. Reinecke, Dattilio and Freeman(2003) averse that Cognitive Behaviour Therapy has been successfully applied in the treatment of obsessive compulsive Disorder using classical conditioning through extinction (a type of conditioning) and habituation. The use of CBT has also extended to children and adolescents with positive results. It has been applied to the treatment of major depressive disorder, anxiety disorder and symptoms related to trauma and posttraumatic, stress disorder and social phobia. Effectiveness of CBT has been validated in a group setting for the treatment of youth and child anxiety. The CBT has been used with children and adolescents to treat a variety of conditions with good success (Reinecke, Dattilio & Freeman, 2003). CBT has a good evidence base in terms of it's effectiveness to the treatment of variety of conditions, complex posttraumatic stress disorder and chronic maltreatment in children and adolescents.

The CBT is applicable to the present study in the sense that maladjustment /anxiety is seen as resultant from wrong perceptions/misconceptions, feelings, beliefs and poor performance in mathematics which the clients (low-achieving students) have registered in their cognition about mathematics(geometry included) through interactive experiences within their social environment. To bring about adjustment, it is required that the client would need a reorientation, re-ordered perceptions and views about self, others and the society (Graham, 2005). It is pertinent to note therefore that for students to be fully internalized, positive self-verbalization, develop positive attitude and enhance performance in mathematics, there is the need for restructuring of distorted cognitive perception and views of the clients (Reinecke, Dattilio & Freeman, 2003) about mathematics generally and geometry in particular. Hence, this theory (Cognitive Behavioural Theory) is pertinent to the present study.

2.3 Low-Achieving Secondary Students (LASS)

The students who are performing below academic standard are described as low-achieving students (Ford, 1996). They are students whose achievement lagged behind their intellectual potential, present a serious problem to the parents, society and finally to the nation. Instead of being the contributing members they turn out to be social problem and get involved in the most common social malaise-students unrest ((Riley, 2000). Low-achieving students tend to have poor basic skills, low academic self-concepts, poor auditory and less than average school attendance rates (Delisle & Berger, 1990).

In schools, low-achieving students may be isolated. They usually receive much criticism from teachers, peer mates and parents at home. They feel that their academic freedom is restricted and that they cannot cope with the academic environment. For such children, active emotional education in addition to teaching may be necessary and teachers need to seek the service of counsellors. Delisle and Berger (1990) averse that low-achieving students could perform significantly better if they receive instruction that capitalizes on their learning style preferences.

2.4 Teaching and Learning of Geometry in Secondary School using Out-of-Class-Activity (OCA) Strategy

Geometry is a branch of mathematics that deals with the measure and properties of points, lines, curves and surfaces. Students can solve problems from other fields easily when they represent the problems geometrically. In our daily life, we indulge in thinking, reasoning, debating, convincing and analyzing. Geometry teaches us the basic skill of logical thinking and reasons. It is true that the concept such as point, line, bisect, angle, parallel lines can not be encountered in everyday living, but through these concepts, the power of reasoning and logical thinking is presented. By going through the process of reasoning and proving, we could tackle numerous everyday activities that require us to be critical person that could not be swayed by opinions of men no matter how many hold such opinions. Geometry still seems to be a dreaded subject among the students because the students have the impression that geometry does not become real but it is an abstract subject (NCTM, 2000). This dreading of the subject probably leads to poor performance in geometry.

Some of the causes of problems encountered by students in geometry can be attributed to the teaching methods employed by the teacher (Almeida, 2000; Baynes, 1998; Gfeller, 2005). Most teachers prefer the traditional method because it gives them opportunity of completing the prescribed syllabus at the end of the session. In traditional educational systems, the students are assigned a passive role. They listen to the teacher, absorb what the teacher says, and regurgitate what the teacher has said at a later time. Teacher is the presenter of information and he/she is in the centre of the classroom. There is a clear boundary between the teacher and students and the interaction between them is highly limited. Geometry is a branch of mathematics that deals with the measure and properties of points, lines, curves and surfaces. Geometry forms the building blocks of engineering and technical graphs. It affords students opportunity of developing their deductive thinking through formal axiomatic systems, which is applied in other fields of learning. Geometrical skills are important requisites for technologically inclined careers that a developing country like Nigeria needs. For students to acquire a sound reasoning, logical thinking capacity, the teacher has to employ acceptable and appropriate teaching methods, which according to Constructivist theory of learning will make students active, creative and critical in problem- solving. This method should empower the students by ensuring that there is proper acquisition of appropriate knowledge and skills. That is to say, that the teacher should refrain from the type of method that makes the students passive listeners. Instead, the geometry teacher should resort to more constructive approach.

Previous research findings have shown that teachers affect students' learning and that the classroom learning environment and teacher differences also affect students' achievement (Fraser, 1994; Rawnsley, 1998). It has also been established that effectiveness in learning geometry is the result of the classroom learning environment, teacher influence on students' learning, and the quality of the teacher (Wetzel, 2009). Effectiveness in the teaching of geometry has been the subject of considerable theorizing. Many studies attempted to make connection between mathematics and the real world using several methods and several treatments. For example, Duatepe-Paksu (2009) as cited by Abdelfatah (2010) carried out a research to investigate the effects of drama-based instruction on students' geometry. The results showed, in comparison to the traditional teaching, that drama-based instruction on students' geometry, geometry thinking levels and attitudes toward mathematics and geometry made learning easier and provided students with more opportunities to experience geometric concepts and problems in a social contex, collaborative learning environment and motivations to learn the included new geometric knowledge. Duatepe-Paksu stated that in terms of Vygotsky's ideas, learning is shaped both by internal processes and social interaction. Drama method provides active communication among students and between students and teachers.

Yet, it seems that it is not enough to use everyday mathematics simply as a source of motivation in the beginning of geometry class. Civil (2002) argued that by going deeper into mathematizing everyday situations, students may be losing what made them motivated in the first place. That was one of the motives of the present study. The study was aimed at examining the effectiveness of out-of-class-activity plus instruction in enabling students to gain a better understanding of geometrical concepts, enhance performance and develop positive attitude towards geometry. The goals of geometry, according to Kerr (1979), should be to have students develop useful intuition and knowledge about shapes and their relationships. And for this intuition and knowledge to be useful, it should be strongly tied to the real world. This is why the subject should be taught in a way that stresses its relationship with the real world. This could be done through the use of various materials like Akpan (1987) suggests the use of visual representation of concepts and relations. This he says seems to have a stronger and more enduring impact than mere verbal explanation. Various methods could also be used to achieve this objective of geometry, that is, it is being taught to stress its relationship with the real world.

2.4.1 The Concept of Out-of-Class-Activity (OCA) Strategy:

One of the main objectives of teaching and learning geometry is to prepare students for practical life. Students could develop their logical and analytical reasoning while learning geometry. And all these could help them to develop ability to solve problems in other fields of life. It is believed that elementary geometry should be the study of objects, motions and relationships in a spatial environment (Clements & Battista, 1986). Therefore, the students' first experiences with geometry should emphasize informational study of physical shapes and their properties and have as their primary goal the development of students' intuition and knowledge about their spatial environment. Subsequent experiences should involve analyzing and abstracting geometric concepts and relationships in increasing formal settings. This is necessary to equip them adequately with prior experience of the students which is needed in the learning of geometrical concepts in order to achieve a holistic and meaningful learning in mathematics generally.

Therefore, Out-of-Class-Activity (the model of Outdoor Educational Activities (OEA) has been defined by different researchers based on their individual perspectives. Brookes and Richard (2004) as cited by Olatundun (2008) proposed that the measuring of outdoor educational activities is relative to time and place. Hattie, Marsh, Neil and Richards (1997) posited that Outdoor Educational Activities(OEA) (model of out of class Activity) is when small groups of people participate in organized adventurous activities in natural settings and primarily use themselves as the resource for solving problems. Edward (2002) as cited by Ford (2003) defines OEA as means of curriculum enrichment whereby the process of learning takes place out of doors. Kuh (2003) defines students' engagement as the time and energy students devote to educationally sound activities inside and outside the classroom, the policies and practices that institutions use to induce students to take a part in these activities.

Out -of -Class -Activity Strategy is therefore an experiential method of teaching and learning geometry with the use of hierarchical levels (recognition, analysis, ordering, deduction and rigor). According to van Hiele (1984) in Abdelfatah (2010), he claims that when students learn geometry, they face difficulties in progressing from one of the five sequential and hierarchical levels (recognition, analysis, ordering, deduction and rigor) of geometrical thinking to a higher one if they do not have appropriate experience at the lower level. The relevance of this OCA to the present study can be summarized in the assumption that skipping one level in the teaching and learning processes might lead the students to enter a vicious circle of negative attitudes and difficulties in geometry class. The Strategy is student-centered instructional approach which is based on the assumption that learning is a process of knowledge construction that occurs through interaction with the social world, which situates the child (Van Glassenfeld, 1986) as cited by Erinosho (2004). The present study used OCA strategy to teach low-achieving students geometry concepts in order to keep the students at or above performance. The strategy employed makes the students very active because they learn by doing whereby the students were actively engaged in searching for knowledge. The value of the strategy is its potential to appeal to students' instinctive interest and curiosity through the use of activities that involved measuring real life geometrical concrete objects, construction of geometrical shapes, solving problems and asking questions. The activity calls for cooperation of various kinds, the strategy (OCA) appeals to the students' self assertion. Creative work was encouraged which fostered self-expression and friendly environment. The experiences gained through these activities form the basis of sound reasoning at all stages in development.

Each situation provides opportunities for dialogue, discussion and the expression of ideas in both practical and written form. At all levels of education, the range of intelligence is wide. It therefore means that methods used should be varied enough to give scope to both low-achieving as well as high achieving students. They must be varied to provide for academically as well as practically minded students. Out-of-Class-Activity gives opportunities to the low-achieving students and can also be used by the high achieving ones. OCA allows for more teacher student contact and interaction which provides a base for social contact. Low-achieving students developed self-confidence and improved attitudes through their own participation. It engages the students through participation, social interaction and enrichment; allowing students to experience geometry in the real world environment, enriches students' experiences, promotes experiential learning that facilitates understanding of some complex ideas in mathematics generally, and introduces excitement into geometry learning. Because all the students experimented, experienced and carried out activities during the out- of- class- activity, they built up lasting body of knowledge and develop powers of reasoning and acquiring attitude.

In out-of-class-activity, students developed their ability to respond effectively to mathematical problems and physical challenges both individually and in cooperation with others. For effectiveness in geometry learning, students must be provided with opportunities for active interaction with their real world and engaging in meaningful activities within this context that stimulate their senses of excitement. More often than not, geometry teachers neither have the vocabulary nor the breadth and depth of experience to offer their students entry into the community of geometrical thinking outside of the school classroom (Gfeller, 2005; Refaat2001). Nevertheless, the bottom line for efficiency in geometry learning is that activities in the in-and-out-of-class activity strategy should go hand-in-hand. As information is passed along or transmitted in class, strategies for helping students to make sense out of new information should concurrently be designed in-and- out of class, providing students the opportunity to use information in in-class knowledge and out- of class investigation can improve achievement, attitude and understanding of students (Olagunju, 2006).

2.4.2 Summary of the related principles of the social and cognitive strategy in the teaching and learning of geometry in the present study

In summary, as cited by Simon (2004) and Refaat (2005) in Abdelfatah (2010), the following points summarize the related principles of both social and cognitive constructivism in the present study context.

- Knowledge should be actively constructed by students,
- Learning is both an individual and social process.
- Learning is a process in which sense-making of the real world takes a part.
- Language plays an important part in learning and sharing thoughts.
- Learning should occur and be enhanced with situated meaningful activities.
- Students' interpretations should address the process of constructing knowledge and

beliefs.

- ❖ Students should be motivated and purposely participate in order to achieve new knowledge.
- ❖ Learning situations should recognize the cognitive structure to assimilate the new knowledge with the previous knowledge (Simon, S Refaat,2005) as cited by Abdelfatah (2010).

2.5 Out –of- Class- Activity Strategy and Academic Achievement

Olatundun (2008) investigated the impact of outdoor educational activities on primary school pupils' environmental knowledge and attitude, interaction effects of location of pupils' residence and gender on pupils' knowledge of and attitude to selected environmental issues and problems. A 2x2x2 pretest, posttest, control group quasi-experimental factorial design was employed for the study. The participants were four hundred and eighty (480) primary five pupils drawn from twelve (12) schools selected through simple random sampling technique from three Local Government Areas of Ibadan in Oyo State. The results of the study indicated that there was a significant main effect of treatment on pupils' environmental knowledge and attitude to environmental issues and problems. These findings lend credence to the findings of Brookes (2004), Smith (2002), Stine (1997) and Knapp (1996) on significance of outdoor educational Activities above the conventional teaching method.

Duffy (2001) conducted an evaluative study on a summer school programme that used a balance, accelerated and responsive approach to literacy in situation. Ten under-achieving, second-grade students participated in word study, guided reading, book talks, and aloud with the teacher, and wrote and read their stories. Analysis of the results revealed that students improved their word identification abilities, became more fluent in oral reading and writing, increased their instructional reading levels, and became more strategic in reading comprehension. The study reported that students also developed more positive attitudes towards reading and had more positive perceptions of themselves as readers.

Harlow and Baenen (2001) conducted an evaluation of the Wake Country, North Carolina, and Out- of- School Time (OST) strategy. The study had an academic summer school component followed by school year programming with academic counselling, mentoring, and Saturday school and community service. The seventh graders involved in the study demonstrated performance gains (d=.16) and reduced drop out when compared to a group of similar students who had not attended summer school. Another similar study, the Pride Programme in Newport News, Virginia, was studied by Grimim (1997). The Pride study has a residential summer school and school year component. During the school the participating middle school students attended academic classes and the field trips and were mentored by public school staff as well as Newport News shipbuilding, a partnership business. However, the standardized test results for the participants showed no gain in mathematics performance.

Malaty (1994) established Mathematics clubs for primary school pupils and designed activities that could help them learn geometric concepts. He found that geometric activities in Mathematical clubs tended to offer pupils an opportunity to think and develop their geometric thinking. Furthermore; they guided these children to discover new concepts, new terms and new symbols. They learnt to solve problems and to reflect on their solutions. In other words, they learnt to analyze and reason. Through these clubs, the pupils thus participated in the activities and had a lot of time to explore various dimensions to many problems. This can be seen that for meaningful learning of geometric concepts, teachers must use activity centered methods, which involve a lot of 2-D and 3-D instructional materials.

Duatepe (2004) investigated the effects of Drama Based instruction on seventh grade students' achievement on geometry, retention of achievements, Van Hiele geometric thinking level, attitude toward mathematics and attitudes toward geometry compared to the traditional teaching. The study was conducted on three seventh grade classes from a public school in the 2002-2003 academic year, lasting 30 lesson hours (seven and a half weeks).

The data were collected using geometry achievement test (angles, polygons, circle, cylinder), the Van Hiele geometric thinking level test, mathematics and geometry attitude scale and interviews. The quantitative analyses were used with two multivariate covariance analyses. The results showed that drama based instruction had a significant effect on students' geometry achievement, retention of these achievements, Van Hiele geometry thinking level, mathematics attitude and geometry compared to the traditional teaching.

Hanna (1986) conducted a study on gender-related differences in mathematics achievement of the middle school students. Eight-grade students in Ontario, Canada, in one of her articles were used. The results of the study revealed that the mean percent of correct responses in geometry and measurement was slightly higher for boys than for girls, though the difference was minimal. Hanna explained that boys had some previous informal training through out-of-class activities that are not normally pursued by girls. Examples of such activities are: following instructions for building models, reading charts and graphs. Hence, the differences in informal training could explain the differences in geometry achievement, especially in measurement. Similarly, McLean, Raphael and Wahlston (1983) who studied all geometry topics taught at, throughout the school years, support the idea that out-of-class activities contributed to the differences in achievement between the sexes.

2.6 The Concept of Group Counseling (CBT)

Group counselling is intended to help people (for example, the low-achieving students) who would like to improve their abilities to cope with difficulties and problems (example, problem like mathematics) in their lives. In group counselling, the meeting is with a whole group and one or two counsellors can attend to the group. Group therapy focuses on interpersonal interactions, so relationship problems are addressed well in groups. The aim of a group counselling is to help with solving the emotional difficulties and to encourage the personal development of the clients (low-achieving students) in the group (Oladele, 2007) Group counselling is suitable for a large variety of problems and difficulties; beginning with clients who would like to develop their interpersonal skills and ending with clients with emotional problems like anxiety, depression. Group counselling expands the services of a counsellor since systematic counselling can be offered to more students. More insights, ideas, confirming messages and information may be shared in the group setting (Oladele, 2007). The group setting offers an opportunity for supportive environment. Anxiety, poor academic performance and hatred for mathematics can be reduced when students realize they are not alone with their concerns. Feelings of failure, anxiety, loss of confidence, and helplessness may be replaced by a sense of enhanced performance, positive attitude, self efficacy and sense of belonging. Achievement and hope can be a definite benefit of groups.

Counselling attempts to make students realize that their maladaptive behaviour and emotional disturbances are possibly related to or determined by what they say to themselves. For example, "I can never pass mathematics". Ellis (2003) notes that human beings are both rational and irrational individuals. Emotional problems, Ellis emphasized, lie in illogical thinking. The thinking faculty of an individual plays significant role in the cognitive theory. For instance, a student's thinking influences what he or she observes or watches, which in turn influences his/her behaviour. According to Hall and Hughes (1989), Cognitive Behavioural Therapy (CBT) interventions in middle school were concerned with helping students realize three things: how their thought patterns affect behaviours; how they can take control of these thought patterns and how they apply interventions to effect behaviour change. In view of this, the role of a counsellor is to find out why the students are not performing well academically or not being effective in their live activities /goals and render a therapy which would assist the students concerned to be more effective in coping with life challenges.

2.6.1 Counselling (CBT) and Academic Achievement

Empirical studies have reported correlations between Cognitive Behavioural Therapy (CBT) intervention and increased academic achievement (Miranda, Webb, Brigman & Peluso, 2007). They reported that achievement and behaviour are positively impacted by group counselling interventions that focused not only on these desired outcomes but also address the social and emotional dimensions of the participants. The Students Success Skill (SSS) is a cognitive Behavioural Therapy (CBT) based intervention that has been effective in closing the achievement gap in the mid to low-achieving students (Brigman & Campbell, 2003; Brigman, Webb, & Campbell, 2007; Campbell & Brigman, 2005; Webb& Brigman, 2006; Webb, Brigman& Campbell, 2005). The SSS intervention is the one that has used CBT strategy to train small groups of low-achieving students in mathematics that meet once a week for 45 minutes over an eight week period. The literature review was limited by the number of students using CBT intervention solely with middle school students but in the present study, 2nd grader low-achieving students were employed. Guidance programmes foster positive attitude towards school learning and work and hence, improve academic achievement.

Venkatesh and Lissamma (2011) investigated the impact of Cognitive Behaviour Therapy on academic achievement in adolescent students. The sample for the study consisted of two hundred (200) adolescent, consisting of 100 males and 100 females. The participants were equally assigned to treatment (50 males & 50 females) and control (50males & 50 females) groups. The result indicated that there was a significant difference in the academic achievement between the experimental and the control groups. No significant gender difference was found.

Fajonyomi (2001) investigated the effectiveness of the study skill counselling (SSC), Rational Emotive therapy (RET), and a combined treatment of SSC & RET in improving the performance of students in English language. The participants for the study who were randomly selected and assigned to the three experimental and control groups, were forty senior secondary school (SSII) students. The research design was pretest and posttest control group quasi-experimental design. The experimental groups were subjected to ten weeks training. The result of the finding revealed that there was a significant main effect of treatment. The study further revealed that the three treatment modes have equivalent effect on student performance.

Ch (2006) conducted an experimental study to examine the effect of guidance services on students' study attitudes, study habits and academic achievement. The sample of the study was drawn from the 9th grader of Government High School Karim Block, Allama Igbal Town, Lahore. Ten null hypotheses were tested in five subjects at 0.05 level of significance. The results of the study indicated that the guidance services have significant effect on the students' study attitude, study habits and academic achievement. Another study was conducted by Hudesman et al., (1986) as cited by Ch (2006) to compare the impact of structured and non-directive counseling studies on academic performance of Low-achieving students. Results indicated that students in structured counselling condition had higher GPAs (grade Point Averages) than those in non-directive counselling condition at the end of semester.

Turner and Berry (2000) conducted a large-scale study of the impact of psychological counselling on academic progress and retention. They compared retention and graduation rates for counselling center clients with rates for general student population both annually and across a 6-year period (academic years 1991-1992 through 1995-1996). The researchers examined five cohorts of students during this 6-year period, with the first cohort being followed over the course of the entire study. Using both objective and self-report measures, Turner and Berry provided strong support for the value of psychological counselling in helping students in their decision to remain in school. Turner and Berry (2000) also reported that over the course of the entire study an average of 70% of the students reported that their personal problems were affecting their academic performance, and about 20% were considering withdrawing from school because of their personal problems. More than 60% of the students, who received, counselling, on average, reported that counselling was helpful in maintaining or improving their academic performance. It was found in addition that nearly half of the students reported that counselling helped them in deciding to continue being enrolled.

2.7 Cognitive Behaviour Therapy (CBT) and Self-Efficacy

Earlier studies show that self-efficacy beliefs have varied influence on the overall functioning of the individuals, particularly their performance in the academic level. According to Ormrod (2008), self-efficacy beliefs affect academic achievement through psychosocial influences. Students' achievement in arithmetic and in reading comprehension is predicted by one's perception of self efficacy (Ghosh, 2007). The findings of the study revealed that CBT was highly effective in enhancing the self esteem and Academic achievement in adolescent students.

Hyun, Chun and Lee (2005) examined the effects of cognitive behaviour group therapy (CBT) on the self esteem, depression, and self-efficacy of runaway adolescents residing in a shelter in Seoul, South Korea. The results indicated that after the treatment, depression decreased and self-efficacy increased significantly. Another study was carried out by Burleson and Kaminer (2005) on Youth substance abuse relapse prevention as a function of patients' situational self-efficacy (SE), youth developed confidence to abstain from substance use in high risk situations.

In the study conducted by Solomando, Kendall and Whittington (2008) on CBT, it was observed that CBT has a potentially important role in improving the mental health of children and adolescents. McManus, Waite and Shafran (2009) in their study titled "CBT for Low Self-Esteem", described the assessment, formulation and treatment of a patient with low self-esteem, depression and anxiety symptoms. The results of the treatment revealed large effect sizes on measures of depression, anxiety and self-esteem.

Further studies were carried out on CBT by Suveg, Sood, Comer and Kendall (2009). They examined the changes in emotion regulation following CBT for anxious youth. The findings of their study showed that the treated youth exhibited a reduction in anxiety, increased self-efficacy and emotional awareness at post-treatment. Taylor and Montgomery (2007) evaluated the efficacy of CBT in improving self-esteem among depressed adolescents aged 13-18 years. In their result they suggested that CBT might be an effective treatment for increasing global and academic self –esteem.

2.7.1 Mathematics Self-Efficacy and Mathematics Achievement

Research has been extensive on the relationship between self–efficacy and student achievement in academic settings (Marrat, 2005). Researchers have demonstrated that self-efficacy beliefs are positively related to and influence mathematics achievement (Hodges, 2003; Kabiri, 2003; Chanzadeth, 2001) and these beliefs mediate the effect of skills, previous experience, mental ability, or other self-beliefs on subsequent achievement (Pajares & Schunk 2001). Furthermore, Bong and Skaalvik (2003) have indicated that higher self-efficacy is predictive of higher performance. That is, the role of self efficacy beliefs is more prominent than that of other factors in achievement.

Collins (1982) as cited by Yinyinola (2008) identified children of high, middle and low mathematics ability who had, within each ability level, either high or low mathematics self-efficacy. After the instruction, the children were given new problem to solve and an opportunity to rework those they missed. The result of the study indicated that within each level of ability, children who had the strongest belief in their efficacy were quicker to discard faulty strategies, solved more problems, chose to rework more of those they failed, held more positive attitudes towards the subjects and did so more accurately than children of equal ability who doubted their abilities.

Pajares and Graham (1999) conducted a study to determine whether students' Mathematics self-efficacy beliefs make an independent contribution to the predictions of mathematics performance when other motivation variables shown to predict math-related outcomes are controlled. The participants for the study, who were two hundred and seventy three (273) 6^{th} graders, were assessed both at the beginning and end of the school year across the following variables: Mathematics self-efficacy, mathematics anxiety, and Mathematics self-concept. The results of the study indicated that self–efficacy made a modest but independent contribution to the prediction of Mathematics performance. Mathematics self–efficacy was the only motivation variable to predict Mathematics performance both at the beginning and end of the school year. The researcher concluded that there is strong evidence for a relationship between self-efficacy and Mathematics achievement.

In a study conducted by Kiamanesh, Hejazi and Esfahani (2004) to investigate the predictive and mediational role of self-efficacy beliefs and to identify the direct and indirect effects of mathematics self-efficacy, Mathematics self-concepts, perceived usefulness of mathematics, mathematics anxiety and gender on mathematics performance, the results of the path analysis revealed that mathematics self-efficacy was more predictive to mathematics performance than was mathematics self-concepts, perceived usefulness of mathematics or gender. Motivational beliefs, self-regulation strategies use and mathematics achievement. Similarly, Mousoulides and Philippou (2005), in their study to examine the relationship between motivational beliefs, self-regulatory strategies use and Mathematics achievement discovered that self-efficacy is a strong predictor of mathematics achievement.

Kabiri and Kiamanesh (2004) studied the role of self-efficacy, anxiety and previous Mathematics achievement in students' math performance. The participants were three hundred and sixty six 8^{th} grade students (169 boys &197 girls). They were randomly assigned to treatment and control groups, using multi-stage stratified technique. The obtained results revealed that prior math achievement had a stronger effect on mathematics performance than did any of the variables in the study. The results contradict the findings of Pajares (1996), Pajares and Kranzler (1995), since in these studies Mathematics self-concept had a stronger effect on Mathematics performance than did any other variables including prior math achievement.

2.7.2 Mathematics Self-Efficacy and Attitude towards Mathematics

Self-efficacy beliefs play an essential role in achievement motivation, interact with self-regulated learning processes, and mediate academic achievement (Pintrich, 1999).

Nicolaidou and Philippou (2003) conducted a study on relationships between students' attitudes towards mathematics, self-efficacy beliefs in problem-solving and achievement. The sample consisted of 238 fifth-grade students (99 boys and 139 girls) from eleven classes, from six primary schools in Cyprus, rural and urban. Three questionnaires were administered, measuring ATM, SE and achievement in problem solving. The analysis of the data indicated that attitudes and self-efficacy were correlated and both predicted achievement in problem-solving. A stronger relationship was further indicated between efficacy and achievement. However, efficacy was a more powerful predictor than attitudes. No gender difference was found in any of the examined variables.

Bandura (1997) believes that when an individual works in a field, he develops a high self-efficacy towards it, becomes interested in it, and is willing to pursue his work in that particular field. Hence, he creates an internal motivation towards the task. It has also been reported that positive attitudes towards mathematics is mostly determined and predicted by their self-efficacy beliefs. Liu, Hsieh, Cho and Schallert (2006) conducted a study that implemented a computer-enhanced problem-based learning environment to investigate the relationships among students' self-efficacy attitude towards science and achievement. They found self-efficacy to be a statistically significant predictor of achievement as cited by Arizpe, Dwyers and Stevens (2006).

Randhana, Bearner and Landberg (1993) as cited by Tella (2009) reported that self-efficacy is a mediator variable between mathematics attitude and mathematics achievement. Randhawa et al, (1993) adapted the Mathematics Self-efficacy scale for use with high school students and used NCES procedure to find that the composite self-efficacy score mediated the effect of a generalized mathematics attitude score on mathematics problem-solving. The criteria task used by the researchers- the solving of mathematics problems was conceptually related only to the problem subscale of the MSES. Many of the problems on the self-efficacy assessment also differed markedly from those on the achievement. Consequently, although generalized mathematics attitude had a strong direct effect on those of self-efficacy (beta =.64), they also had strong and direct effect on achievement (beta =.44) as did self-efficacy (beta = .32).

Pajares and Miller (1994), using path analysis, showed that efficacy in problem solving was more predictive of the achievement in mathematical problem solving than other variables- mathematics anxiety, gender, mathematical background, mathematics perception and perceived usefulness of mathematics.

2.8 The Concept of Gender

Gender inequality in education has become a global phenomenon (Bordo,2001). The term gender has many overlapping meanings, and its meaning, still appears evolving. First, Achor, Imoko and Ajai (2010) described it as a socially ascribed attribute which differentiates feminine from masculine. It is referred to as the social differentiation between maleness and femaleness or masculinity and femininity. This differentiation is socially constructed in social relations rather than on the basis of the biological characteristics of male and females. The term gender is also sometimes used to refer to as an attribute of all human beings, that is, one is of the male or female gender. In this second sense, gender is used interchangeably with sex as described thus. Sex refers to the physical or biological characteristics of males and females and as such, it is used as an attribute of all humans-one may be of the male or the female sex.

However, a number of studies have been conducted by various researchers (Adeyegbe, 2000; Awofala, 2002; Osinubi, 2004; Bordo, 2001; United Nations Educational Scientific and Cultural Organization (UNESCO, 2003) on the influence of gender on mathematics achievement of students. This had led to series of divergent views on the influence of gender on the mathematics achievement of students. Many studies in Nigeria have shown that boys perform better than the girls in mathematics generally (geometry included) irrespective of the fact that they are taught under the same classroom condition (Etukudo, 2002; Ezeugo & Agwagay, 2000). Contrary to this, Agwagah (1993) had reported that female students perform significantly better than male counterparts. The findings of Agwagah (1993) were supported by Etukudo (2002). There are some researchers who reject the idea of sexual differentiation in ability. This group of researchers observed that there is no disparity in the performance of boys and girls (Gbodi & Laleye, 2006; Olagunju, 2001).

Several explanations have been put forward for gender differences in mathematics. For example, The New Analysis of International Research (Science Daily,2001) opined that girls are not worse than boys in mathematics though boys are more confident in their mathematical abilities than girls. It further stated that girls are more likely to perform better than boys if they come from countries where gender equity is more prevalent. According to Lee and Lockheed (1989),the gender difference borders on the maturation of female and marriage which leads to removal of girls from schooling, particularly in traditional cultures of Northerners that question the effect of education on subsequent role of female in family settings (Anderson and Bowman 1982) as cited by Yinyinola (2008).

Benbow (1990, 1998) explains that biological differences are contributing factors to gender differences in mathematics. Republic (2001) believed that all students can perform equally in a given task, irrespective of sex. Akinsola and Tijani (1999) assert that mathematics is not a male dominated subject as people assumed it to be, but for both sexes provided that both sexes are subjected to the same learning conditions. It is not likely, therefore that if mathematics instructions are made relevant and interesting through appropriate access provoking strategies, females would perform as well as their male counterparts.

The absence of role models for the females, particularly in mathematics is a major reason for their inhibiting nature towards mathematics achievement, especially in geometry. The presence of role models, helps males feel that success in mathematics and science is both possible and legitimate. Girls are not given information about career possibilities requiring competence in advance mathematics, neither are they introduced to women role models with successful math careers. In general, role models can be an important factor in elevating a young person's aspirations. At home, parents may unconsciously fail to provide support for their daughter's interest in mathematics, either by directing them elsewhere or by giving all their supports for the education of their sons. Amelink (2009) suggests encouraging discussion of women mathematicians and scientists as this will provide girls with the opportunities to have female mathematicians as role models and lessen the male domain stereotype of mathematics.

Carr and Jessup (1997) aver that gender difference in the development of mathematics skills and knowledge are believed to emerge as a function of different experiences of both sexes in group setting, boys by their nature tend to dominate as a function of their interactions with classmates and teachers. It was explained that male demands more attention, complain more that they are not receiving enough and their teachers and female peers expect them to get it. Men dominate discussions even more as they get older, in some classes speaking as much as 12 times longer than women (Krupnick, 1985). Even when females do participate in classroom talks, their approach may suggest to teachers they have less command over the subject matter than males (Wendy & Katherine, 1992). The dominance makes their approaches to mathematics become the preferred strategies in the classroom. The dominance as well as the preference for competition, (Carr & Jessup, 1997) remark, may push boys to acquire more complex strategies and meta-cognition. Girls are believed to be more concerned with pleasing and depending on teachers. The dependence leads to rote approach to mathematics. In addition, females believe that mathematics does not have any utility in their lives (Fennema & Sherman, 1978). They see mathematics as unconnected to a relationship model of thinking. Even if they persist in taking mathematics courses, girls are apt to find that they do not like them, and liking a subject is a key to succeeding in it (Fennema, 2000). Another factor that has contributed to gender difference in achievement is linked to the role of teachers in learning. In a classroom, teachers set the standard for discourse, their reliance on teaching methods that adhere to traditional norms and belief about gender differences that benefit only male students can create unfriendly environment for girls Amelink (2009). Teachers believing that participation is an indicator of learning are likely to ignore females because they participate less than males. Moreover, teachers are often unaware that they are concentrating more on teaching males because the process of classroom interaction is unconscious, and they respond automatically to student demands for attention. Amelink asserts that teachers should employ collaborative educational experiences that could utilize group work to impact math performance of females favourably; stating that teachers should be shaping the classroom experiences for both males and females so that both groups could respond to mathematics favourably.

Yinyinola (2008) suggests that attributing Mathematics success to high ability is associated with expectations for future success and a willingness to approach new mathematics achievement situation. On the other hand, attributing failure to low ability is predicted to be associated with low expectation for future success and a desire to avoid future Mathematics achievement situation. Therefore, the implication of these for gender difference is that they affect future expectation and behaviour. .

2.8.1 Gender and Geometry Achievement

The issue of gender differences in achievement has been the concern of many researchers across different domains (e.g., Halpern, 2000). Most of the studies have reported the superior performance of boys over girls'. Bessoondyal (2005) studied the gender difference in mathematics in Mauritius. The researcher administered a test consisting of multiple choice items and word problems from strands, number, algebra, geometry and probability to secondary level students. The findings indicated that boys performed significantly better than girls in overall test, also in separate strands of the test boys, outperformed girls in geometry.

Battista (1990) conducted a study concerned with the spatial and geometrical thinking of students. The sample for the study consisted of 145 high school geometry students. The participants were tested in four areas; spatial visualization, logical reasoning, geometrical knowledge, and geometrical problem solving. Battista (1990) found that males scored significantly higher than females on geometrical knowledge and geometrical problem solving. Similarly, El-Hassan (2001) in Lebanon found that, at the 13 grade in operation and geometry topics, males performed better than females.

Ma (1995) conducted a study on a sample of 960 students from both senior and junior classes in four countries namely: British Columbia, Ontario, Hong Kong,and Japan. The aim of the study was to investigate gender differences across different education system in domain of algebra and geometry. The study utilised data from the second International Mathematics and Science Study (SIMSS). The findings indicated a significant gender difference among senior students. It was further revealed that males outperformed females in the geometry subtest.

However, some studies have found that girls are performing well in geometry than boys. For example, Ma,moon (2005) found that females had significantly higher scores than males for subtest of Mathematical Proof in his test of mathematical thinking. TIMSS (2007) study which was undertaken in 59 countries for grade 4 and 8 students in target content areas in mathematics for grade 4 were number, geometric shapes and measures ,data displayed and for grade 8 number, algebra ,geometry data and chance . It is reported for both grades that girls had higher achievement on average in geometry. Girls had higher achievement in 15 countries and boys in 6 countries.

Healy and Hoyles (2000) conducted a study on Proof conceptions in Algebra by surveying high-attaining 14 and 15-year-old students and concluded that gender of the students was significantly associated with achievement where girls obtained higher scores than boys in construction of proofs. In TIMSS (2003) Jordanian females had a significantly higher average score than males consistent with seven other countries in geometry.

Senk and Usiskin (1983) conducted a study, using a large sample of 2699 in 99 different classes to investigate any gender difference s in the understanding on geometrical proof for senior high students ranging from 7 grades to 12 grades. Three forms of a proof test were devised so that performance on a greater number of proofs could be analysed. The students were tested on their knowledge of geometry at the beginning of the year and their understanding of three types of standard geometry proofs at the end of the year. The researchers found that though boys had a slight higher score but no consistent pattern of statistically significant differences favoring either sex on any form of proof tests was found.

Huntley (1990), studied the effect of diagram formats on performance on geometry. The researcher administered a 32 experimental, multiple-choice geometry items in two pretest versions: one version did and one version did not provide a relevant diagram. Log linear analysis of the data shows that there were no significant differences between males and females students performance on these items.

Adegoke (2002) investigated the Teacher influence as determinant dependent-prone students' learning outcomes in Senior Secondary School geometry in Ibadan South East local government area of Oyo state. The research design employed for the study was A 2x2x3x3 factorial design. The participants for the study were 864 secondary school students. They were randomly selected and assigned to treatments and control groups. The data generated for the study were subjected to analysis of covariance. The result indicated that there was no significant difference between male and female participants in their achievement in geometry.

There is no single direction regarding gender difference in the performance of students in geometry. Some studies support the superior performance of the male over female in geometry and mathematical proofs (Bessoondyal, 2005; Battista, 1990; El-Hassan, 2001; Ma,' 1995) while some other report better performance in geometry by female students or no difference e.g. (Ma'moon,2005; TIMSS,2007; TIMSS,2003; Senk and Usiskin, 1983; Huntely, 1990).

2.8.2 Gender and attitude towards Mathematics.

Research findings seem to pay limited attention to gender differences, with respect to attitude towards mathematics (ATM) and gender (Ma & Kishor, 1997). In addition, boys and girls report equal confidence in their math ability during elementary school, but by high school, boys are more confident than girls (Pajares and Graham, 1999).

Nicolaidou and Philippou (2003) conducted a study on relationships between gender, students ATM and their performance in problem-solving. The participants were 238 fifth-grade students (99 boys and 139 girls) drawn from eleven classes, from six primary schools in Cyprus, rural and urban. Three questionnaires were used, measuring gender, ATM, SE and achievement in problem-solving. The analysis of data indicated that no gender difference was found in any of the examined variables. That is, gender was not significantly correlated with any of the other variables-attitude or performance. The result of Shaw and Doan (1990) indicated no gender difference in achievement and attitudes of participants towards science.

In a related study, Fadia and Menucha (2005) examined the structural model of Mathematics achievement of two culturally different groups of Jewish and Arab 8^{th} graders in terms of 5 learners-related variables, namely, gender, epistemological beliefs, self-efficacy, attitudes, and Mathematics anxiety. Multi-group structural modeling analysis indicated that the goodness of fit of the hypothezised structural model and the total effects of Mathematics self-efficacy and epistemological beliefs were comparable in both groups. The two groups differed in the effects that gender, attitudes toward Mathematics, and Mathematics anxiety exerted on Mathematics achievement. They also diverge in terms of the amount of variance in Mathematics achievement that the 5 learners-related variables accounted for.

Odunusi (1994) as cited by Yara (2009), in assessing the attitude of some science students towards modern orientation in science found that students' attitude to science is negative while gender and class level of the students did not significantly influence students' attitude towards science. Burstein (1992) as cited by Yara (2009), in a comparative study of factors influencing mathematics achievement found out that there is a direct link between students' attitudes towards mathematics and student outcomes. He also found that 25% in England and 26% in Norway accounted for the variation in students' attitude towards mathematics that were due to student gender.

Sungur and Telkaga (2004) investigated the effects of gender on attitude and achievement on reasoning ability and on the human circulatory system concept in biology. 47^{th} grade students participated in the study. Questionnaires were administered to the students. The results revealed that there was no statistically significant mean difference between boys and girls with respect to attitude and achievement in biology.

Ojo (2003) investigated the relative effects of cooperative learning, self-regulatory, combined self-regulatory and cooperative strategies; and the conventional teaching on senior secondary school students' achievement and attitude towards Mathematics. A 4x3x2x2 pretest, posttest randomized control group quasi-experimental factorial design was employed for the study. The participants were five hundred and eighty six (586) senior secondary school one (SS1) students drawn from 12 schools selected through simple stratified random sampling technique from twenty-two public schools located within Ibadan north local government area of Oyo state. The findings of the study indicated that there were no effects of gender and self-regulatory ability on students' achievement in Mathematics.

Mohamed and Waheed (2011) conducted a study to find out the students attitude and gender difference towards mathematics in a selected school of Maldives. 200 students were chosen from grade 9 and 10. Two questionnaire instruments were administered to the students regarding their personal confidence to mathematics and perceived usefulness of mathematics. The data were analyzed using statistical package for social Science (SPSS) and t-test to find significant difference between attitude and gender. The results show that the students' positive attitude towards mathematics is medium and there is no gender difference in their attitudes.

Similarly, Nicolaidou and Philippou (2003) conducted a study on relationship between students' attitude and gender towards mathematics in problem-solving. 238 fifth (99 boys, 139 girls) from eleven classes, from six primary schools; in Cyprus, rural and urban. The three questionnaires were administered to the subject measuring Attitude toward mathematics, self-efficacy and achievement in problem-solving. The analysis of data indicated there was no gender difference in the attitudes of students. Other studies that found no significant difference between attitude towards mathematics among male and female students are Mohd, Mahmood and Ismail (2011); Kogce, Yildiz, Aydin and Altindag(2009).

2.9 The Concept of Attitude

According to Yelland (2000), attitude towards a subject affects achievement. Attitude is a learned pattern of manners that is developed through one's environment (Thompson, 1993) as cited by Duatepe (2004). Attitude is a central part of human identity. Everyday people tend to love, hate, like and dislike, agree and disagree etc. All these are evaluative responses to an object which bring the definition of attitude as a summary evaluation of an object of thought (Bohner & Wanke, 2002). It represents one's feelings toward given circumstances and affect one's reaction to a particular situation. Aiken (2002) defined attitude as a learned predisposition or tendency on the part of an individual to respond positively or negatively to some objects, conditions, or concepts. Also, Akinsola and Olowojaiye (2008) believe that the students' attitudes toward a subject determine their success in that subject.

Odubunmi (1998) sees attitude as a favourable or unfavourable reaction towards some experiences, situations or activities as a result of the way such an individual perceives and conceptualizes them. Attitude is synonymous to the opinion one holds about a thing. Attitudes related to mathematics include liking, enjoying, and interest in mathematics, or the opposite, and at worst math phobia (Ernest, 2004). Ma and Kishor (1997) offered the definition of attitudes toward mathematics as an aggregated measure of liking or disliking of mathematics, a tendency to engage in or avoid mathematical activities, a belief that one is good or bad at mathematics, and a belief that mathematics is useful or useless. Attitude is often considered in educational research since the development of a positive attitude is desirable because of its association with achievement (Yelland, 2000). Ma and Kishor (1997) indicated there is a general belief that children learn more effectively when they are interested in what they learn and that they will achieve better in mathematics if they like mathematics.

Attitudes are influenced by three components according to the Multicomponent model of attitude (Eagly & Chaiken, 1993). Several factors play a vital role in influencing the attitudes of students toward mathematics. These factors are categorized into three. The first factor is associated with the students themselves: these include students' mathematical activities, students' achievement scores, self-efficacy, self-concept and motivation (Kogce, Yildiz, Aydin, & Altundag, 2009). The second factors include teacher and school factor which include teachers' content knowledge, teaching topics in relation to real life examples, personality of the teacher and classroom management. The third one is the factor relating to home background of the students which is associated with educational background of the parents, occupation and parental aspirations (Kogce et al, 2009).

A number of researchers have demonstrated that there is a significant correlation between attitude towards mathematics and academic achievement of the students (Davis, 2002; Ma & Kishor, 1997; Duatepe, 2004). However, it cannot be concluded that positive attitude always causes high achievement in mathematics. For example, Kiely (1990) showed that on average a small number of pupils who were not good enough in mathematics obtained high scores in the attitude test. Another study suggested that extremely positive or negative attitudes tend to predict mathematics achievement better than more neutral attitudes cited by Bergeson, Fitton, and Bylsma (2000) in Duatepe (2004).

Ma and Kishor (1997) conducted a meta-analysis on 113 studies on relation between attitude and achievement of mathematics. They found that the overall mean effect size was statistically significant, relatively weak at the primary school and stronger at the secondary school level. Ma and Kishor (1997) propose a wider definition; they conceive Attitude towards mathematics as an aggregated measure of a liking or disliking of mathematics, a tendency to engage in or avoid mathematical activities, as belief that one is good or bad at mathematics, and a belief that mathematics is useful or useless". Ma and Kishor (1997) also found that many children begin schooling with positive attitudes toward mathematics; these attitudes, however, tend to become less positive as children grow up, and frequently become negative at the high school.

Bergeson, Fitton, and Bylsma (2000) opined that students develop positive attitudes toward mathematics when they see mathematics as useful and interesting. Similarly, students develop negative attitudes toward mathematics when they do not do well or view mathematics as uninteresting. Capraro (2000) found that attitude towards mathematics has a positive strong relation with the geometry content knowledge.

The development of positive mathematical attitudes is linked to the direct involvement of students in activities that involve both quality mathematics and communication with significant others within a clearly defined community such as a classroom. The middle grades are the most critical time period in the development of student attitudes toward mathematics. Students' attitudes toward mathematics are quite stable, especially in Grades 7–12 (Bergeson, Fitton, & Bylsma, 2000). Ezike (2007) gave age 10-12 years as the most significant for attitude formation. Marlon (1974) as cited by Ezike (2007) gave some recipe, which if adopted by the teacher could help to develop positive attitude among pupils towards themselves, other things or people. These include:

(a) Interesting learning activities

(b) Individual differences should be adequately considered and

(c) Providing meaningful learning activities.

In conclusion, the previous studies have not provided consistent findings concerning the relationship between attitudes toward mathematics generally and mathematics achievement.

2.10 Appraisal of Literature

Low-achieving students present special difficulties when considering any type of teaching approach. Apparently, the act of grouping students by ability level can have and by itself have an influence on attitudes, self efficacy and eventual achievement of students (Adeyoju, 1997). A child who is labeled as a low achiever may experience detrimental consequences that last throughout their entire school career. In support of this effect, research has indicated that low- achieving students tend to score lower and have lower self-efficacy in comparison to others on standardized tests (Reis & McCoach, 2000). Given the current level of their performance, it is unlikely that remedial work will be sufficient to close the gap between these students and their higher achieving peers, especially when that remediation is focused on mathematics learning (Civil, 2006). Recent studies have suggested that out- of- school-Time activity (OST) strategy can improve the mathematics competence of low-achieving students (McREL, 2003). Educators see potential using OST strategies to keep their student at or above performance standards. In essence, OST is being used to provide low-achieving students with an opportunity to catch up to their peers and for improved performance. Silver and Lane (1995) were able to demonstrate that middle school students from low-income disadvantaged backgrounds were able to outperform their peers in a demographically similar school when they participated in the Quasar project, a programme that emphasized reasoning problem - solving, and understanding.

Research by (Bonotto & Basso, 2001; D'Ambrosio, 2006) also showed that instruction that emphasized out-of-class-activity (OCA) strategy builds on students' understanding while increasing their desire to learn mathematics and provides more meaningful learning opportunity for students struggling with mathematics. Impact of out –of-class-activity has been shown to foster mathematics achievement and positive attitude towards mathematics for all students in the 3rd and 6th grade student (Lauer et al, 2004).

Most research efforts on instructional strategy have focused on experimental studies that engage students only on academic activities inside the classroom. Learning and personal development occur as a result of students engaging in both academic and non-academic activities, inside and outside the classroom (Astin, 1993; Lohr, 2004; Pascarella & Terenzini 2005). Previous works done by researchers suggest some of the innovative methods of teaching Science and Mathematics. These include Cooperative Learning (Omosehin, 2004), problem solving (Iroegbu, 1998); Concept Mapping (Okebukola, 1990) which could improve the students' academic performance and enhance their mathematics concepts. However, these methods, as laudable as they might be, have not considered the needs of students who are performing below the academic standard (low-achieving students). Further more, most of these studies do not create situations in which students examine the connections between their studies and life outside the classroom and to apply what they are learning. In many cases, the needs of these students are identified by the teachers who believe that the deficiencies of the students cannot be addressed using the traditional method of instruction.

One option being considered is the use of Out-of-Class-Activity (OCA) strategy. Educators see potential in using OCA strategy to help the low- achieving students improve mathematics performance. There is every possibility that out- of- class- activity strategy has not been used in Nigerian Mathematics classrooms at the time of this research work. For these, this study can fill the existing gap.

CHAPTER THREE

METHODOLOGY

This chapter presents information on research design, population, sampling procedure and sample, instrumentation, procedure for carrying out the experiment, data collection and data analysis procedures.

3.1 Research Design

A 3x2x2 quasi-experimental pre-test, posttest control group design was adopted for the study. The pretest, posttest control group design was adopted because the design has been recognized for its ability to establish cause and effect relationship. It is also known for its potential for controlling all threats to validity, so that a cause-and-effect relationship may be established (Ogunsanwo, 2003; Yinyinola, 2008). The treatment conditions are: A1 (Out-of-Class-Activity + instruction), A2 (Group Counselling Strategy + instruction), and A3 (the Control group, which received instruction only). The moderating variables are: Mathematics Self-efficacy (MSE) and gender. MSE varies at two levels: low mathematics self-efficacy and high Mathematics self-efficacy. Gender also varies at two levels: that is male and female.

3.2 Outline of Design

A brief summary of the outline of the design is symbolically shown in figure 3.1

Figure 3.1: Pre-test, Post-test, Control group, Experimental design.

A_1: O_1 X_1 O_2

A_2: O_1 X_2 O_2

A_3: O_1 X_3 O_2

Where:

$A_{1,2}$ = represent experimental groups.

A_3 = represents control group.

O_1 = represents pre-test scores

O_2 = represents post-test scores

X_1 = represents OCA with instruction

X_2 = represents GCS with instruction

X_3= represents Control Group with instruction only.

Table 3.1: 3x2x 2 Factorial Designs

	Mathematic self-efficacy(B)				**Total**
	Low MSE (B_1)		**High MSE (B_2)**		
	Gender (C)				
	Male (C_1)	Female (C_2)	Male (C_1)	Female (C_2)	
A_1	A_1 B_1 C_1 N= 11	A_1 B_1 C_2 N = 6	A_1 B_2 C_1 N = 13	A_1 B_2 C_2 n=10	40
A_2	A_2 B_1 C_1 N = 5	A_2 B_1 C_2 N = 7	A_2 B_2 C_1 N = 10	A_2 B_2 C_2 n = 8	30
A_3	A_3 B_1 C_1 N = 10	A_3 B_1 C_2 n =12	A_3 B_2 C_1 N = 8	A_3 B_2 C_2 n = 10	40
	26	25	31	28	110

3.3 Variables in the study

The following variables were involved in the study.

3.3.1 Independent variable: Instruction strategy operating at three levels:

3.3.1.1 Out-of-Class-Activity Group (out- of- class -activity +instruction)

3.3.1.2 Counselling Group (group counselling strategy +instruction)

3.3.1.3 Control Group (which received instruction only)

3.3.2 Dependent variables

The two dependent variables are:

3.3.2.1 Achievement in Geometry

3.3.2.2 Attitude towards Geometry

3.3.3 Moderator Variables:

3.3.3.1 Mathematics Self-efficacy varying at two levels:

(i) Low

(ii) High

3.3.3.2 Gender: Varying at two levels

(i) Male

(ii) Female

3.4 Population

All low-achieving Junior Secondary school students in Ibadan formed the population for this study.

3.4.1 Participants

The participants for this study consisted of one hundred and ten (110) low-achieving Junior Secondary Two (JS2) students (57males and 53females). The ages of the participants ranged between 12 and 18 years. The mean and standard deviation of their ages were 14.34 and 1.60 years, respectively. The demographic information about the participants is presented in Table 3.2

Table 3.2: Information About the 110 Participants Involved in the study.

Variable	Distribution	Number	Percentage (%)
Age	12-14	63	57
	15-17	45	41
	18-20	2	2
Gender	Male	57	52
	Female	53	48
Self-efficacy	Low	51	46
	High	59	54

The choice of JS2 students was based on the following reasons.

The second year of the Junior Secondary School is a crucial year in the life of Junior Secondary School students. This is because at this stage, the students have studied some Mathematics content enough to be able to respond to questions given to them by the researcher. The set of students are not preparing for immediate external examinations (BECE), unlike the JS3 students, they could participate effectively in the research. Any positive effects that the treatment has, could be fed-back into the system since they still have sufficient time in the school to use whatever they gain to their own advantage. And if any group is negatively affected by the treatments, they still have about two years in secondary school for necessary remediation.

The preclusion of JS3 students who were supposed to be beneficiaries to the programme was based on the fact that they were conscious of the prescribed Basic Education Certificate Examination (BECE). Teachers on their own side are equally anxious to complete the prescribed syllabus, even at the expense of depth and comprehension.

Again, most secondary school authorities do not allow their final year students to take part in research studies.

3.5 Sample and sampling procedure

One hundred and ten (110) low-achieving secondary school students (LASSS) participated in the study. They were selected out of 247 students contained in the intact classes, 113 were identified as low-achieving students based on their performance in the selection test. However, 110 students were finally selected to participate in the study having met the inclusion criteria of:

(i) volunteerism

(ii) Parental consent.

Multi-stage random sampling procedure was adopted in the study. Three Local Government Areas (LGAs) were randomly selected out of the existing five LGAs in Ibadan metropolis. From the three LGAs thus selected, two schools were randomly selected from each LGA, thereby making a total of six (6) schools that were finally selected for the study. The researcher assigned the first LGA as experimental group I, the second LGA selected was labeled as experimental group II while the third LGA selected was tagged as control group III. This was done to avoid filtration of information thereby controlling for hawthorne effect.

The distribution of the schools and the number of students selected for the experiment are presented in Table 3.3 below:

Table 3.3: Distribution of schools and students used for the study

Ibadan	Total No. of Junior secondary schools	No. of selected Junior Secondary schools	No of Selected junior secondary Two Low-achieving students
Ibadan North	51	2	30
Ibadan North West	37	2	40
Ibadan South East	36	2	40
Total	124	6	110

3.6 Instrumentation

For the purpose of collecting relevant data for this study, the following instruments were employed:

i. Students' Selection Test (SST)
ii. Achievement Test in Geometry (ATG)
iii. Mathematics Self Efficacy Scale (MSES)
iv. Geometry Attitude Scale (GAS)

Each scale used was preceded by a section (section A) that required the participants to enter their demographic information.

3.6.1 Students' Selection Test (SST)

The Students' Selection Test was a multiple-choice cognitive Mathematics achievement test developed by the researcher to identify low-achieving students. The items included the topics in Geometry which the participants had done on perimeter of plane shapes, properties and areas of planes. The initial number of test items was thirty-five. The test was given to mathematics teacher in the junior class to go through and make suggestion and modification. This was done to ensure the content validity of the instrument. The suggestion and modification as well as the result of the item analysed carried out on the instrument reduces the total items on the test to twenty (20). The test was given to Mathematics experts to go through and make corrections to make it possess content validity. Item analysis was further carried out which reduced the number of the test items to twenty. SST has two sections. Section A contained personal data while section B contained test options which ranged from A to D. The reliability of the instrument was carried out by administering the scale on a sample of 30 students who did not take part in the study. The test-retest reliability coefficient obtained after two weeks interval was .70.

3.6.2 Achievement Test in Geometry (ATG)

Achievement Test in Geometry (ATG) was constructed and validated by the researcher. It consists of thirty Multiple Choice Questions (MCQ) which were aimed at making decision on evaluation of treatment procedure. Initially, the researcher constructed sixty items. The test was given to five Mathematics experts who determined the degree to which the test served as an adequate sample of the area of measure. The test was further subjected to item analysis to ascertain the suitability or otherwise of each item of the test. The necessary suggestions from the experts as well as the results of the item analyses helped in the deletion of some items on the scale thereby reducing the items on the test to the present 30 items. The mean difficulty and discrimination indices obtained for the final test were 0.58 and 0.51 respectively. The test items could be judged to be suitable for the class it was designed for.

The test was thereafter administered by the researcher on a sample of sixty (60) Junior Secondary two (JSII) low achieving students that did not take part in the study. The test retest reliability coefficient after two weeks was 0.81. The items were generated across the three cognitive domains (knowledge, comprehension and application) using the scheme of work for JS2 Mathematics (from the section of geometry). The three levels of cognitive domains were employed because of the academic level of the participants. The result of how the items of the test were generated is displayed in Table 3.4.

Table 3.4: Table of Specification for Geometry

Content	Knowledge 30%	Comprehension 40%	Application 30%	Total No. of questions
Identification of 3-Dimentional objects	1, 25	4, 8	26	5
Surface area of cubes & Cuboids	13	9, 12	19, 21	5
Surface area of cylinder & cone	20, 28	6, 7	16	5
Basic properties of pyramid & sphere	24, 30	2, 5	29	5
Volume of cube and cuboids	3	14, 15	10, 11	5
Volume of cylinder & cone	27	17, 18	22, 23	5
Total	**9**	**12**	**9**	**30**

3.6.3 Mathematics Self-efficacy Scale (MSES)

Mathematics self-efficacy scale (MSES) was administered to the participants prior to the treatment. This was done to assess their level of Mathematics self-efficacy. The MSES developed and validated by Marat (2005) was adapted by the researcher. It comprised two parts:

Part one dealt with demographic information of the participants.

Part two included nine sections, each assessing self-efficacy in Mathematics on a range of specific dimensions. The participants responded on a five-point Likert scale responses options of not well at all, not too well, satisfactory, pretty well and very well.

The maximum score obtainable was 345, while the minimum score obtainable was 69. The higher the score, the more Mathematics efficacious the respondent is. The MSES was recently revalidated by Yinyinola (2008) on a sample of 50 Nigerian students. The test-re-test reliability coefficient obtained after two-week interval was 0.85.

3.6.4 Geometry Attitude Scale (GAS)

Geometry Attitude Scale (GAS) developed and validated by Alvaro (1973) was adapted to obtain information about the attitude of students towards **Geometry**. GAS had sixty items, drawn on a five-point Likert scale response options of strongly agree (SA), Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SD). Positive statements were scored as 5,4,3,2, and 1 and negative statements were scored as 1, 2, 3, 4 and 5. The items rated 3 retained their positions. Alvaro reported KR20 reliability coefficient of the scale as 0.96. The Alvaro's attitudinal scale was modified as follows: the scale was confined to geometry by replacing mathematics with geometry in all the statements of Alvaro. The double-barrel statements such as "I prefer sets of mathematics problems that are all alike rather than sets having different kinds mixed". Now written as; I prefer sets of Geometry problems that are all alike rather than sets having different kinds mixed. The items were made short because long statements can be boring and do not appeal to the respondents. Another point was that the wordings of the statements of the scale were made explicit, hence, there were no reason for misinterpretation. For example, "I often forget how to do one kind of geometry problem after I have worked on other kinds". The total score for all the items constituted the index of attitude.

For the purpose of revalidating the instrument, the test-re-test reliability was carried out on a sample of 50 J.S.II low achieving students that were not taking part in the study. The reliability coefficient obtained after two weeks interval was 0.73.

3.6.5 Researcher's Instructional Guide in Geometry (RIGG)

Researcher's Instructional Guide in Geometry (RIGG) was a note of lesson prepared by the researcher and which was used by the mathematics teachers in the selected schools to teach participants geometry in both the experimental and control groups. The RIGG was vetted by an experienced WAEC mathematics examiner before being used.

3.7 Procedure for the experiment

The following steps were taken while carrying out this study. The concerned authorities of the selected schools were met and permission was sought by the researcher and it was granted. A two-day training programme was organised by the researcher for the teachers in different groups according to the treatment conditions. They were selected based on the following conditions:

(i) They must be graduates of mathematics.

(ii) (ii) They must have taught for 3 years

(iii) (iii) They must be professional counsellors with a B.ed in Counselling and Mathematics.

(iv) They must have had the experience of counselling for 3years.

Table 3.5: Shows Training Time-Table for the Teachers

Day	session	Activity
1	1	The researcher met with the teachers of experimental groups (1&2) for general discussion. This discussion centered on the problems of teaching and learning geometry in secondary schools as highlighted by WAEC Chief Examiners' Reports as well as research findings. Hence the need for an intervention. The prepared manual was introduced.
2	2	The teaching commenced with the researcher doing the demonstration teaching to the teachers. The teaching involved a topic each from the experimental groups 1 & 2 manuals. The experimental group 1 teachers were given the opportunity to carry out micro teaching as well, after which they were corrected. The counsellors in experimental group 2 were also given the hypothetical case to handle because counsellors do not teach but help students to solve problems.
2	3	Discussions followed after the micro teaching. Teachers were allowed to comment about the problems they encountered and the researcher gave some suggestions about how to overcome their problems during the subsequent lessons. Questions were asked from the teachers and more clarifications were made by the researcher on the topics treated.

The trained teachers were eight research assistants, consisting of 2 male teachers,4 female ones and 2 female counselors. The professional counsellors with the knowledge of Mathematics/ Guidance & Counselling were employed by the researcher due to the nature of the counselling training (Mathematics/ Counselling) that were involved in what they would deliver to the participants. Secondly, the professional counsellor therefore had the necessary skills and qualification required for the training which the school counsellor might not have. Most of the times, the school counsellors were classroom teachers picked up at random by the school principals simply because the teacher had the little knowledge of counselling or because he/she studied counselling in Nigeria College of Education. Based on the above reasons the researcher employed the services of the professional counsellors for the training of the experimental group two (II) participants in the study. However, all the research assistants were trained on how to use the prepared treatment packages given to them.

During the first week of the training programme, the following instruments were used to collect baseline data on all the participants in the three groups with the help of the research assistants. Students' Selection Test (SST), Achievement Test in Geometry (ATG) Mathematics Self Efficacy Scale (MSES) and Geometry Attitude Scale (GAS)

Students' Selection Test (SST) was administered to all the students in the selected JS2 arms in the selected schools. Scores obtained on the selection test were used in grouping the participants into low and high achieving students based on the first quartile. Scores collected from MSES were only used to group the participants on the basis of their level of Mathematics self efficacy (low and high) based on the first quartile. Any participant who scored below the first quartile was regarded as having low mathematics self-efficacy and any one who scored above the first quartile was regarded as having high mathematics self-efficacy.

One hundred and ten participants out of two hundred and forty-seven were used for the study. Experimental Group II consisted of 30 participants instead of 40 like in the case of Experimental Group1 and Control Group. This was done following the suggestion of researchers like Borg and Gall (1983) as cited by Oladele (2001) who claimed that in group counselling, it is desirable to have a maximum of 15 cases. 15 participants were selected from each of the two schools selected for counselling group and making a total of 30 participants for counselling group.

Instruction commenced in all the groups in the second week of the training. During the next six weeks, the geometry content of Junior Secondary two (JSII) curriculum from which the concepts of geometry were chosen, was covered using a lesson per week period, each period lasting forty (40) minutes. The two treatment groups met once a week- Tuesday and Thursday respectively. The training took place during break period after which the participants went back to their classroom and received their normal lesson by the teacher (the research assistant) on the topic prepared by the researcher on the Teachers' manual for that particular week .The take-home assignment stated in the Teachers' manual were often done after the training period at home since the 40 minutes were not enough for the activities and learning. The take-home assignment was corrected by the teacher based on the answers provided by the researcher. This was not part of the assessment used for data collection for this study.

All the geometry concept materials for the activities for the experimental groups were supplied to the teachers on weekly basis to ensure that no prior practicing took place before the time for which they were necessary. While the training was going on, the researcher moved round the sampled schools for supervision, to ensure that the teachers followed the Teachers' manual judiciously. In the Control Group, the participants were taught geometry instruction only, using Conventional method. The training was conducted on a period per week for each of the three groups, spanning over a period of eight weeks.

The eighth week of the training was used for collection of the posttest data using ATG and GAS. Both pre and post tests were administered in all the groups by the teachers, assisting to collect the question papers and administer. The treatment packages for the three groups are presented below apart from the general procedures discussed above.

3.7.1 Experimental Group 1 (OCA+ instruction)

Out of class activity Strategy (OCA)

The group underwent an activity that infused out- of- class- activity with instruction.

Week I: Selection of weak students, General orientation about the training and administration of pretest measures.

Week II: Explanation of the goal of the training and identification of 3-Dimensional (3-D) objects.

Week I II: Exploration of the surface area of cube and cuboid.

Week IV: Exploration and discussion on the surface area of cylinder and cone using the real life experiences of the participants.

Week V: Discussion on the properties of the pyramid and sphere with concrete experiences of the participants.

Week VI: Discovering of the volume of cube cuboid of 3-D objects

In out-of-class-activity strategy, the teacher used the relevant experiences of the participants to teach them simple geometry. How? The participants were asked to gather geometrical objects from their community. The participants were also taken out of the class to collect geometrical objects within the school community by the guidance of the teacher. Such geometrical objects as plastic funnel, milo tins, blocks, etc were used to improvise mathematics laboratory. Participants were led to measure the length, breadth and height of the geometrical objects. For example,

Volume**:** The volume of a cuboid which is often taught by mere definition and memorization of equation was illustrated and taught linking the concept to the experience of the participants. The participants were led to measure the length, breadth and height of the block they collected out of the class. Thus: Length – 6cm, breadth-3cm and height-1½cm. By using the dimensions of the blocks, the concept of the volume of cuboids was studied and taught. The dimensions were used to teach the concept of volume of cuboids in the in-class, connecting the fact in the out- of- class- activity with corresponding idea in the in-class geometry content. This brings about geometry curriculum that incorporates ideas from the out-of-class-activity to in-class knowledge. Doing so might provide rich real life and relevant experiences for finding solutions to mathematics problems generally.

Week VII: Exploration and discussion of volume of cylinder and cone using real life experiences of the participants.

Week VIII: Administration of post test measures using Achievement Test in Geometry (ATG) and Geometry Attitude Scale (GAS). For more detail, see Appendix V

Experimental Group I

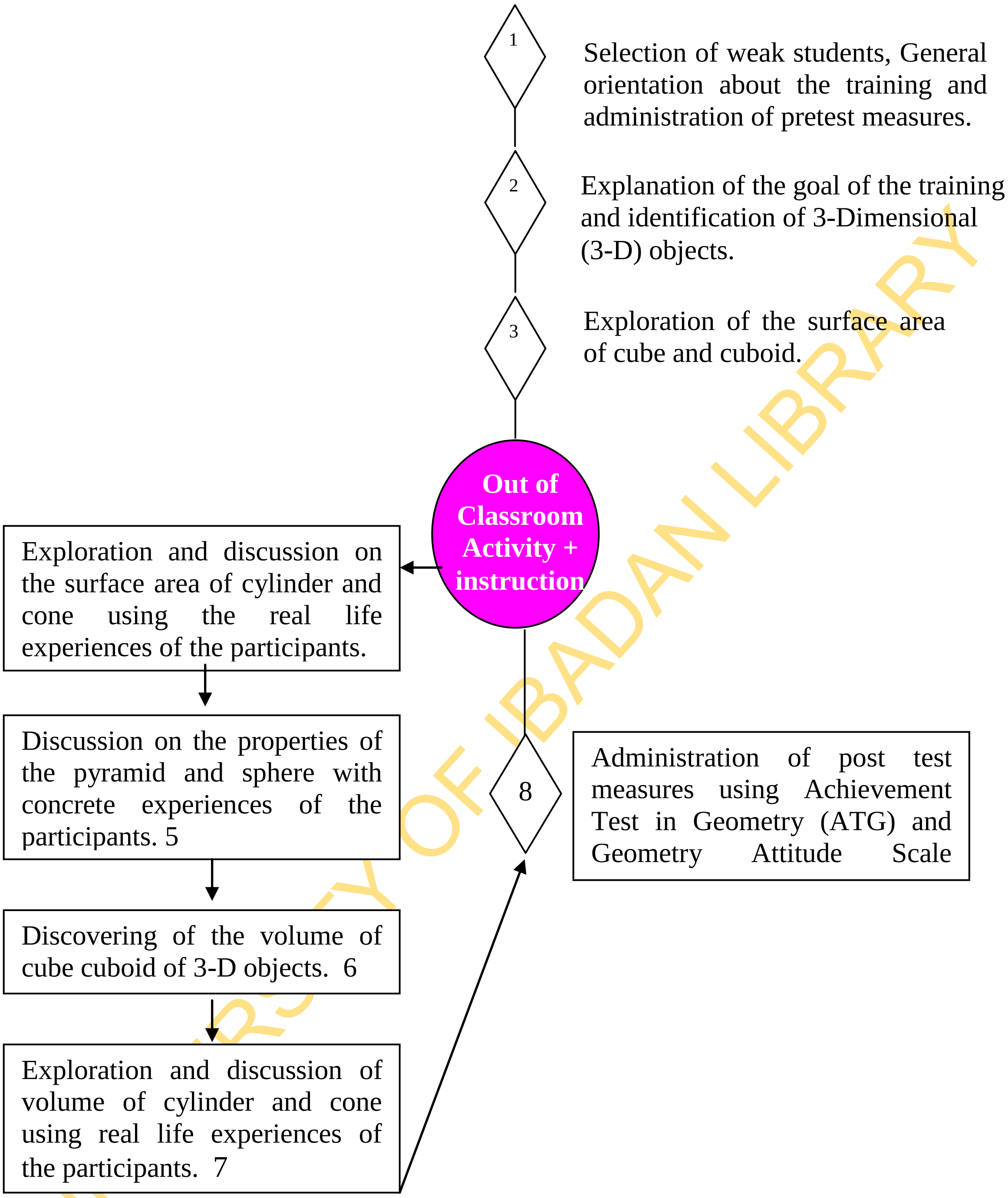

Figure 2

Schematic Representation of Experimental Procedure: Out-of-Class-Activity (OCA) Strategy + Instruction. Adapted from Falaye, 1995.

3.7.2 Experimental Group II (GCS + Instruction)

This group was exposed to counselling training by the professional counsellor using the counselling guide prepared by the researcher which was based on Cognitive Behaviour Therapy (CBT).

Week I Selection of low-achieving students, General orientation about the training and administration of pretest measures

Week II: Explanation of the goal of going to school to the participants.

Week III: Explanation of the concept of Cognitive Behavioural Therapy (CBT) and Identification of cognitive distortions.

Week IV: Discussion and explanation of the concept of CBT using the technique of Cognitive rehearsal and Validity testing.

Week V: Further explanation on the concept of CBT using the technique of writing in a Journal and Guided discovery as an aid to memory.

Week VI: Discussion on Modelling and Homework as CBT techniques to increase the probability of the emission of the desired behaviour.

Week VII: Further explanation on CBT technique of Systematic positive reinforcement using the case study of Felicia.

Week VIII: Administration of post test measures using Achievement Test in Geometry (ATG) and Geometry Attitude Scale (GAS). For more detail see (appendix VI)

Experimental group II

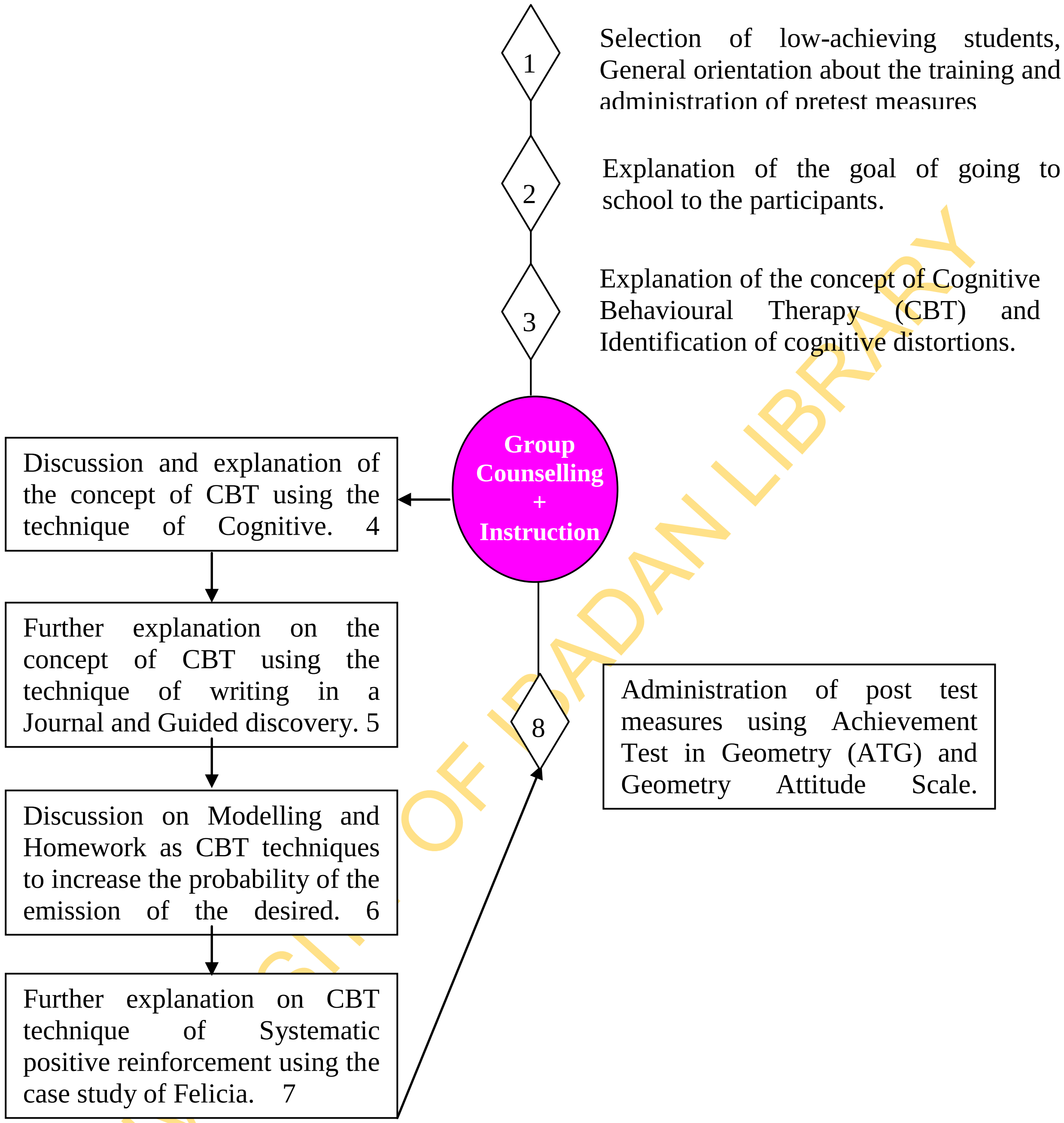

Figure 3

Schematic Representation of Experimental Procedure. Group Counseling Strategy (GCS) + instruction. Adapted from Falaye, 1995.

3.7.3 **Control group:** Conventional Method

Participants in this group received instruction on geometry using only the conventional method, with the instructional guide prepared by the researcher. The conventional teaching strategy is described as expository in nature, involving teacher-student interaction through chalk and talk. To accomplish this conventional model, the teacher needs to evolve a certain mode of behaviour. A conventional teacher strives to be in control of her class; he/she assumes the role of an authoritative figure. The participants are usually expected to get permission from the teacher to speak. All participants are expected to be silent when the teacher is talking, and try to understand her explanation. The teacher uses the first fifteen minutes to introduce a new concept. He/she provides all the necessary facts on geometry concepts in question to the participants. He/she teaches, gives facts and opinions, and overviews of materials about the subject matter being discussed. The concept is then illustrated on the chalkboard by the teacher working out some related examples for ten minutes or more.

At this stage, the participants proceeded with 'Seat work'. This is the part of the lesson when participants usually work at their desks, independently trying to solve problems similar to the ones worked out on the board by the teacher. During seat work, the teacher supervises the participants' works by making sure that the participants are working quietly so they do not disturb others. Finally, the discussion of the assignment usually means that the teacher is willing to work out solutions on the chalk-board. He/she involves the participants in working these problems by asking those questions so that the problem is really being solved as collaboration between participants and the teacher. During this time, the teacher expects the whole class to pay attention to what is being done. At the expiration of the eight weeks duration, the Achievement Test in geometry (ATG) and the Geometry Attitude Scale (GAS) were given to the participants as post-test measures.

3.8 Control of Extraneous Variable

In an experimental study of this nature that involves the manipulation of independent variables by researcher to determine the effect of independent variable on the participants, it becomes imperative for the researcher to determine whether the observed differences or effect noticed in the study as represented by measured outcomes is actually not due to other extraneous variables within and without, participants, researcher, environment and methodology. The fact is that in an experimental study of this kind, a lot of contamination, which can distort the result of an experiment if the researcher does not adequately control the extraneous variables, is possible. The researcher, having all these in mind therefore, controlled the extraneous variable through the use of experimental design. A 3x2x2 factorial design, which guided against the possible variations that could occur in participants. This was forestalled through randomization.

The assignment of treatment and control groups to schools employed, creates the necessary distance between the participating schools such that there was no filtration of information of treatment from one school to another, thereby controlling Hawthorne (novelty) effect. To ensure that the research assistants followed the treatment manuals religiously, thorough supervision was carried out by the researcher. In addition, little or no explanation was given by the teachers during the pre and posttests. Since the language of the items were simple and straight forward and coupled with the fact that the researcher has provided all the necessary instructions at the beginning of the test, there was little or no quest for explanation.

The use of ANCOVA reduces the effect of selection bias and other possible sources of threat to validity. Best (1981) as cited by Yinyinola (2008) describes ANCOVA as an important method of analyzing experiments carried out under a condition which otherwise could be unacceptable. Differences in the initial status of the groups being compared are removed statistically so that they can be compared as though their initial status had been equated. In this case, the pretest scores were used as covariates in the analyses.

3.9 Data analysis

The data collected for the study were subjected to Analysis of Covariance (ANCOVA) with the pretest scores as covariate to test for the main effect. ANCOVA was employed because it has the high tendency to adjust the initial mean differences that might exist between the experimental groups on pretest measure, and correlates the pretest and posttest measures as covariates (Kerlinger, 1973). It was also used to determine the effects of the independent variables (treatment, Mathematics self-efficacy, gender) on the dependent variables (participants' achievement in geometry and attitude towards geometry). To ascertain the relative effectiveness of the independent variables, Scheffe pair wise test was employed.

Table 3.6: The Hypotheses and the Method of Analysis

S/N	HYPOTHESES	Method of Analysis
(1) (2) (3)	There is no significant main effect of treatment self-efficacy and gender on (a)achievement in geometry (b) attitude towards geometry	ANCOVA
(4) (5) (6)	There is no significant 2-way interaction effect of treatment by self efficacy treatment by gender self-efficacy by gender on (a) achievement in geometry (b) attitude towards geometry	ANCOVA
(7)	There is no significant 3-way interaction effect of treatment, self-efficacy and gender on (a) achievement in geometry (b) attitude towards geometry	ANCOVA

CHAPTER FOUR

4.0 Results and Discussion

This chapter presents the results and discussion of the findings based on the hypotheses stated in chapter one of this study. The hypotheses were tested and the results were interpreted at the 0.05 level of significance.

The results are hereby presented in the order in which the hypotheses were stated.

4.1 Hypothesis 1a

There is no significant main effect of treatment on participants' achievement in geometry. Table 4.1 shows the adjusted mean as well as the standard deviation of participants' score in geometry achievement test after the treatment.

Table 4.1: Mean and Standard Deviation of Participants' Score in Geometry Achievement Test.

Treatment	N	Mean	S.D	Lower Bound	Upper Bound
OCA	40	18.763	3.99	17.886	19.639
GCS	30	17.694	3.56	16.666	18.722
Control	40	13.650	3.75	12.773	14.526

From Table 4.1 the mean difference between OCA and control group is 5.11; between GCS and Control 4.04; between OCA and GCS (1.069). The results of ANCOVA in Table 4.2 shows that the mean differences in scores among the group is statistically significant $F_{(2, 97)}$ = 35.77, $p< 0.05$. Partial Eta Square =0.424. The null hypothesis 1a was therefore rejected. The fact that the three groups were homogeneous before the training and were found to be significantly different after the training is an indication that the treatment was effective. The result presented in Table 4.2 also indicated that the partial Eta square estimate was 0.424. This implies that the treatment accounted for 42.4% of the total variance observed in the achievement posttest scores in Geometry.

Table 4.2: ANCOVA of between subject effects

Source of variation	Sum of square	Df	Mean square	F	Sig of F	Eta squared	
Covariates							
Corrected Model	1915.693	12	159.641	22.217	.000	.733	
Intercept	468.509	1	468.509	65.202	.000	.402	
Pre-Ach. Score	729.220	1	729.220	101.484	.000	.511	
Treatment	514.081	2	257.041	35.772	.000	.424	*
Gender	12.261	1	12.261	1.706	.195	.017	Ns
Self efficacy	29.233	1	29.233	4. 068	.046	.040	*
TRS X Gender	2.499	2	1.249	.174	.841	.004	Ns
TRS X Self efficacy	17.242	2	8. 621	1.200	.306	.024	Ns
Gender X Self – efficacy	9.230	1	9. 230	1.284	.260	.013	Ns
TRS X Gender X Self-Efficacy	5.754	2	2.877	. 400	.671	.008	Ns
Error	696.998	97	7.186				
Total	33324. 000	110					
Corrected Total	2612.691	109					

R^2 = .733 (Adjusted R^2 = .700)

*=sig. at p<.05 Ns=Not Significant

In order to determine the actual source of the observed significant differences, Scheffe Post hoc analysis was carried out on the posttest mean scores of the three (OCA, GCS and Control) groups. The summary of the Scheffe test is as presented in Tables 4.3

Table 4.3: Scheffe Post Hoc Means for Groups in Homogeneous Subsets by Treatment.

MEAN	**Groups**	**OCA**	**GCS**	CONTROL
18.763	OCA			*
17.694	GCS			*
13.650	CONTROL	*	*	

* Pairs of categories significantly different at 0.05 level

From the Scheffe Post hoc analysis presented in Table 4.3, the following observations were made:

(i) There was a significant difference in the achievement test scores in geometry between the participants in OCA (18.763) and Control groups (13.650).

(ii) GCS (17.694) group differs significantly from the control (13.650) group on measures of achievement in Geometry.

(iii) However, there exists no significant difference between the posttest mean scores of the participants in OCA (18.763) and GCS (17.694) groups.

4.1.1 Hypothesis 1b: There is no significant main effect of treatment on participants' attitude towards geometry.

Table 4.4: Shows the mean and standard deviation of treatment on participants' attitude towards geometry

Attitude	Number	Mean	Std. Deviation	95% confidence interval	
				LowerBound	UpperBound
OCA	40	220.200	28.58	212.450	224.624
GCS	30	205.867	21.86	198.934	212.856
Control	40	157.925	27.40	152.702	164.509

From Table 4.4the mean difference between OCA and Control (62.275), between GCS and Control (47.942), between OCA and GCS (14.333). The mean difference among the group is statistically significant ($F_{(2, 97)} = 108.214$, $p<0.05$).

Table 4.5: ANCOVA of participants' Attitude Scores by Treatment, Self-efficacy and Gender

Source	Sum of squares	Df	Mean square	F	Sig of F	Eta squared
Corrected model	125091.280	12	10424.273	30.078	.000	.788
Intercept	32797.324	1	32797.324	94.632	.000	.494
PREATS	36218.850	1	36218.850	104.505	.000	.519
TRS	75008.901	2	37504.450	108.214	.000	.691
Gender	103.300	1	108.300	.312	.577	.003
SEL EFF	275.404	1	275.404	.795	.375	.008
TRS x Gender	137.413	2	68.706	.198	.821	.004
TRS x Self Efficacy	57.617	2	28.809	.083	.920	.002
Gender x Self-Efficacy	114.960	1	114.960	.332	.566	.003
TRS x Gender x Self-Efficacy	344.453	2	172. 227	.497	.610	.010
Error	33617.893	97	346.576			
Total	4283551.000	110				
Corrected Total	158709.173	109				

R squared =.788 Adjusted R =.762)

*=Significant at p<.05 ns=Not Significant

Table 4.5 revealed that the main effect of treatment on participants' attitude towards geometry was significant ($F_{(2, 97)}$ =108.214, p<.05). The hypothesis which stated that there is no significant main effect of treatment on participants' attitude towards Geometry was rejected. The result presented in Table 4.5 also indicated that the partial square estimate was 0.691. This implies that the treatment accounted for 69.1% of the total variance observed in the attitude post test score in Geometry. In order to determine the significant group difference, Scheffe Post-hoc analysis was done. The results are presented in Tables 4.6a and 4.6b.

Table 4.6(a): Scheffe Post Hoc Multiple Comparison of Participants' Attitude by Treatment

(I)Treatment	(J)Treatment	Mean (I-J) Difference	Sig
OCA	GCS Control	14.333* 62.275*	.008 .000
GCS	OCA Control	-14.333* 47.942*	.008 .000
Control	OCA GCS	-62.275* -47.942*	.000 .000

*=Mean difference is significant at p<.05

Table 4.6(b): Scheffe Post Hoc Means for Groups in Homogeneous Subsets on Attitude by Treatment

Mean	Treatment	OCA	GCS	Control
220.200	OCA		*	*
205.867	GCS	*		*
157.925	Control	*	*	

*=Pairs of categories are significantly different at p<.05

From the results presented in Tables 4.6a and 4.6b, the following are observed:

(i) There was significant difference in attitude towards Geometry between participants in OCA and GCS groups (14.333).

(ii) There was significant difference in attitude towards Geometry between participants in OCA and Control groups (62.275)

(iii) There was significant difference in attitude towards Geometry between participants in GCS and Control groups (47.942).

4.2 Hypothesis 2a: There is no significant main effect of self-efficacy on participants' achievement in geometry.

Table 4.7: Shows the mean and standard deviation of self-efficacy on participants' achievement in geometry.

Self-efficacy	Number	Mean	Std. Deviation	LowerBound	UpperBound
OCA: Low/SE, H/SE Total	17 23	18.824, 19.304 19.100	3.83 4.18 3.99	212.450	224.629
GCS: Low/SE, H/SE Total	12 18	17.833 19.833 19.033	3.22 3.65 3.57	198.934	212.856
Control: Low/SE, H/SE Total:	22 18	12.955 12.111 12.575	3.91 3.60 3.75	152.702	164.509

The result presented in Table 4.7 shows that the mean difference between high math self-efficacy (HMSE) and low math self-efficacy (LMSE) in achievement test scores in geometry were: OCA and control (6.525), between GCS and control (6.458), between OCA and GCS (0.067). The observed MSE difference was however statistically significant ($F_{(1, 97)} = 4.068$, $p < .05$).

The result presented in Table 4.2 shows that there is significant main effect of self-efficacy on participants' achievement in geometry ($F_{(1, 97)} = 4.068$, $p < .05$). The hypothesis was therefore rejected. The result also indicated that the partial Eta squared estimation was .040, this means that self-efficacy accounted for 4% of the variance in the observed post-test achievement scores in geometry. For the purpose of establishing where the significant difference lies, Tables 4.8a and 4.8b are presented below.

Table 4.8 (a): **Scheffe Post Hoc Multiple Comparison of Participants' Achievement in Geometry**

(I)Self-Efficacy	(J)Self-Efficacy	Mean Difference (I-J)	Sig.
Low	High	-1.220*	.046
High	Low	1.220*	.046

*The mean difference is significant at P<.05

Table 4.8(b): Homogenous subsets by Self-Efficacy

Mean	Self-Efficacy	Low	High
16.050	Low		*
17.270	High	*	

*=Pairs of categories significantly different at .05 level.

It is revealed from Tables 4.8(a) and 4.8(b) that the difference between the means of low self-efficacy (x=16.050) and high self- efficacy (x=17.270) participants is significant. Therefore, level of self-efficacy contributed significantly to the participants' achievement in geometry.

4.2.1 Hypothesis 2b: There is no significant main effect of self-efficacy on participants' attitude towards Geometry. Results on Table 4.5 revealed that self-efficacy did not have a significant main effect on participants' attitude towards Geometry ($F_{(1, 97)}$ =.795; p>.05).

Table 4.9: Shows the mean and standard deviation of self-efficacy on participants' attitude towards geometry.

Self-efficacy	**Number**	**Mean**	**Std.Deviation**	**LowerBound**	**UpperBound**
OCA: Low/SE, H/SE Total	17 23 40	212.118 226.174 220.200	23.78 30.81 28.58	212.450	224.629
GCS: Low/SE, H/SE Total	12 18 30	203.833 207.222 205.867	23.35 21.38 21.86	198.934	212.856
Control: Low/SE, H/SE Total	22 18 40	154.546 162.056 157.927	25.65 29.61 27.40	152.702	164.509

From Table 4.9, the mean difference between high and low mathematics self-efficacy on OCA (14.056); between high and low mathematics self-efficacy on GCS (3.389), between high and low mathematics self-efficacy on Control (7.510). The mean difference among the group is not statistically significant ($F_{(1.97)}$ =.795, p>0.05).

Based on this finding, hypothesis 2b was not rejected. Though high self-efficacy participants' attitude mean score (196.01) was higher than that of low self-efficacy participants, with mean attitude score of (192.69), it was not statistically significant.

4.3 Hypothesis 3a: There is no significant main effect of gender on participants' achievement in geometry.

Table 4.10: Shows the mean and standard deviation of gender on participants achievement in geometry

Gender		Number	Mean	Std. Deviation	95% confidence interval	
					LowerBound	UpperBound
OCA:	male	24	18.999	3.84	17.898	20.099
	female	16	18.527	4.15	17.145	19.908
GCS:	male	15	17.940	3.13	16.453	19.427
	female	15	17.448	3.94	16.062	18.834
Control Group:	male	18	14.213	3.63	12.925	15.501
	female	22	13.086	3.89	11.934	14.238
Total	male	57	17.614	4.74		
Total	female	53	15.736	4.92		

The result in table 4.10 shows that the gender differences in achievement test scores in geometry were OCA (0.472), GCS (0.492) and control (1.127). The overall gender difference was 1.878. The observed gender difference was however not statistically significant ($F_{(1, 97}=1.706, p>0.05$).

The result presented in Table 4.2 shows that there was no significant main effect of gender on participants' achievement in geometry ($F_{(1, 97)} = 1.706$; $p>.05$). The hypothesis was therefore accepted. The partial Eta square estimate was .017. This implies that gender accounted for 1.7% of the variance observed in the post-test scores of the participants in geometry.

4.3.1 Hypothesis 3b: There is no significant main effect of gender on participants' attitude towards Geometry.

Table 4.11: Shows the mean and standard deviation of gender on participants' attitude towards geometry

Gender (Attitude)		Number	Mean	Std. Deviation	95% confidence interval	
					LowerBound	UpperBound
OCA:	Boy Girl	24 16	217.833 223.750	31.39 24.31	17.898 17.145	20.099 19.908
GCS:	Boys Girls	15 15	209.867 201.867	20.89 22.78	16.453 16.062	19.427 18.834
Control Group:	Boys Girls	18 22	154.889 160.409	25.27 29.37	12.925 11.934	15.501 14.238

The result presented in Table 4.11 shows that the gender difference in attitude test scores in geometry were OCA (5.917), GCS (8.000) and Control (5.520). The observed gender difference was however, not statistically significant ($F_{(1, 97)}$ =.312, p>0.05).

The ANCOVA summary in Table 4.5 has shown that gender did not have a significant main effect on participants' attitude towards Geometry ($F_{(1, 97)}$ =.312, p>.05). Consequently, hypothesis 3b was accepted. The estimated Eta square reveals that gender contributed 31 percent of the variance observed on the participants' attitude towards Geometry. Male participants had higher mean post-attitude score (195.38) while the female had a lower post attitude score of 193.32. However, the difference in the posttest attitude scores between the two groups being compared was not statistically significant.

4.4 Hypothesis 4a: There is no significant interaction effect of treatment by self-efficacy on participants' achievement in geometry. The data on Table 4.2 show that there was no significant interaction effect of treatment by self-efficacy on participants' achievement in geometry ($F_{(2,97)}$ = 1.2000; P>.05). The conclusion was that the hypothesis 4a was not rejected. This implies that the self efficacy of participants had no effect on treatment (out-of-class-activity and group counselling) strategies to produce joint effects on dependent variables. Each of the strategies could be effectively used by practicing Mathematics teachers, whether participants are of low or high self-efficacy group.

4.4.1 Hypothesis 4b: There is no significant interaction effect of treatment and self-efficacy on students' attitude towards Geometry. The ANCOVA summary in Table 4.5 showed that there was no significant interaction effect of treatment by self- efficacy on participants' attitude towards Geometry ($F_{(2,97)}$= .083, p >.05). As a result of this finding, hypothesis 4b was accepted.

4.5 Hypothesis 5a: There is no significant interaction effect of treatment by gender on participants' achievement in geometry. Table 4.2 revealed that there was no significant interaction effect of treatment by gender on participants' achievement in Geometry ($F_{(2, 97)}$ = .174, p >.05). As a result of this finding, hypothesis 5a was therefore accepted. It, thus, implies that the effect of treatment on the achievement of participants in geometry is not sensitive to gender. The treatment strategies used during the whole of this study could be used to improve participants' performance in geometry whether they are male or female.

4.5.1 Hypothesis 5b: There is no significant interaction effect of treatment by gender on participants' attitude towards Geometry. The results presented on Table 4.5 showed that there was no significant interaction effect of treatment and gender on participants' attitude towards Geometry ($F_{(2, 97)}$ =.198, p >.05). Therefore, hypothesis 5b was not rejected.

4.6 Hypothesis 6a: There is no significant interaction effect of self efficacy by gender on participants' achievement in geometry. The two-way interaction on Table 4.2 showed that there was no significant interaction effect of self-efficacy by gender on participants' achievement in geometry ($F_{(1,97)}$=1.284), p >.05). Based on this result, hypothesis 6a was accepted. It means that participants' performance in geometry was not significantly affected by the interaction of self efficacy by gender.

4.6.1 Hypothesis 6b: There is no significant interaction effect of self- efficacy by gender on participants' attitude towards Geometry. Table 4.5 showed that there was no significant interaction effect of self-efficacy by gender on participants' attitude towards Geometry ($F_{(1,97)}$=.332, P>.05). The hypothesis 6b was therefore accepted.

4.7 Hypothesis 7a: states that there is no significant 3-way interaction effect of treatment, self-efficacy and gender on participants' achievement in geometry. ANCOVA result presented on Table 4.2 showed that there was no significant interaction effect of treatment, self-efficacy and gender on participants' achievement in geometry ($F_{(2,97)}$ = .400, P>.05). It then follows that the hypothesis 7a was not rejected.

4.7.1 Hypothesis 7b: There is no significant 3-way interaction effect of treatment, self-efficacy and gender on participants' attitude towards Geometry ($F_{(2, 97)}$ =.497, P>.05).

The three-way interaction ANCOVA result for this hypothesis as shown on Table 4.5 revealed that there was no significant interaction effect of treatment, self-efficacy and gender on participants' attitude towards Geometry. ($F_{(2, 97)}$ =.497, P>.05). Therefore, hypothesis 7b was not rejected. That is, participants' attitude towards Geometry was not significantly influenced by the interaction effects of treatment, gender and self-efficacy. It then suggests that practicing Mathematics teachers could use any of the teaching strategies (out-of-class activity or counselling) to support the instruction of Mathematics (geometry included), irrespective of the gender and self-efficacy of participants.

4.8 Discussion

4.9 Hypothesis 1: The hypothesis stated that there is no significant main effect of treatment on participants':

(a) achievement in geometry; and

(b) attitude towards **geometry.**

The results of the finding revealed that there was a significant main effect of treatment on the participants' achievement in geometry. The hypothesis could not be upheld with the result of the findings; the hypothesis was therefore rejected. It is therefore concluded that there is a significant main effect of treatment on the participants' achievement in geometry.

The findings show that the two therapeutic techniques proved to be effective in enhancing the participants' achievement in geometry. The participants in the experimental groups (OCA&GCS) showed a significantly greater enhancement in the posttest scores on Achievement Test in Geometry (ATG) than the participants in the control group. The fact that the participants in the experimental groups performed better in the posttest scores in ATG than the control group proved that the treatments employed were effective on one hand and that the utilization of the treatment gain by the participants on the other hand.

The low scores of the participants in the control group as observed in the posttest scores on the ATG is not a surprise, since they did not have the opportunity of taking part in the treatment programmes. It is obvious that they maintained their previous performance. It was possible that while the participants in the experimental groups were participating actively in the various training programmes, the participants in the control group were engaged in various other activities that are not capable of enhancing their achievement in geometry. The findings tend to confirm that students exposed to OCA & GCS excelled more than those who had the same ability but lacked the skills in the training programmes.

The results further indicated that there was no significant difference in the post test score on ATG between the participants in OCA & GCS. The techniques inherent in these two techniques produced equal amount of effectiveness in enhancing achievement in geometry among the participants.

One way of explaining this result is that the training prgorammes created the much needed self-awareness, independent will and the need of the participants to have their achievement in geometry improved. The results have therefore confirmed that achievement in geometry could be enhanced through OCA and GCS. This result also confirmed the observation of Olatundun (2008) that Outdoor Educational Activities were effective in enhancing academic achievement in his study. The results of the findings also corroborate those of Brigman,Webb and Campbell (2007), Ventakesh and Lissaman (2004), Fajonyomi (2001).

Another possible explanation for the significant improvement in the ATG scores of the participants in the experimental group may be found in the degree of motivation to acquire some basic skills in learning which they hitherto lacked. The participants in the experimental groups might have been experiencing some degree of moderate dosage of anxiety because of the importance of geometry to their daily lives. Some researchers such as (Burton, 1999, Adegoke, 2002, Duatepe, 2004) lent credence to the importance of geometry. The result of this finding deviates from the view of Eysenk (1952; 1965) as cited by Yinyinola (2008) who held the opinion that researches on psychological, educational and behavioural treatment showed no convincing effect. However, the result is in line with the opinion of some researchers (Robbinson, Berman & Neinmeyer, 1990; Smith & Glass, 1977) as cited by Yinyinola (2008) who reported that in psychotherapies, differences are found, and when they are, they can often be attributed to the allegiance of the investigators involved.

The outcome of the result from hypothesis one also agrees with the findings of the previous researchers (Harlow & Baenen, 2001, Grimm, 1997, Brookes, 2004; Smiths, 2002) who found that OCA was effective in enhancing academic achievement of participants in their various studies.

The outcome of the result also supports the findings of the previous researchers (Brigman & Campbell, 2003; Webb & Brigman, 2006; Campbell & Brigman, 2005) Venkatesh & Lissaman, 2011) who found that cognitive behavioural Therapy was effective in enhancing academic performance. The findings also support the view of Fakunle, 2007 and Johnson 1984 who acknowledge the influence of counseling strategies on student academic performance.

4.9.1 Hypothesis1b: The hypothesis stated that there is no significant main effect of treatment on participants’ attitude towards geometry. The result of the findings revealed that there was significant main effect of treatment on participants’ attitude towards geometry. The hypothesis was not supported with the result of this findings, the hypothesis was therefore rejected. It is therefore concluded that there is a significant main effect of treatment on participants’ attitudes towards geometry.

The findings showed that the two training programmes proved to be effective in enhancing participants’ attitude towards geometry. The participants in the experimental group showed a significantly greater enhancement in the posttest score on Geometry Attitude Scale (GAS) than the participants in the control group. The fact that the participants in the treatment group performed better in the posttest scores on GAS than the control group proved that the training programmes employed were effective in enhancing attitude towards geometry on one hand and that the utilization of the treatment gain by the participants on the other hand.

The low scores of the participants in the control group as observed in the post test is not surprising since they did not have the opportunity of taking part in the treatment programmes. It is obvious that they maintained their previous position. It was possible that while the participants in the experimental groups were participating actively in the various training programmes, the control group participants were engaged in various other activities that are not capable of enhancing their attitude towards geometry. The findings tend to confirm that the participants with positive attitude excelled those who have the same abilities but had low attitude towards geometry.

The results of the finding indicate that the participants in the Out-of-class activity (OCA) group performed better than their counterparts in the GCS group. This can be explained in terms of the effectiveness of each of the training programmes. This is seen in the light of various techniques such as cognitive rehearsal and validity testing; writing in a journal and guided discovery; modelling of appropriate behaviour and homework; systematic positive reinforcement used in the delivery of the training programme, which are unique in the individual training; and which distinguished one training programme from the other. The techniques inherent in these training programmes are expected to produce varying degrees of effectiveness in enhancing attitude towards geometry among the participants. One way of explaining this result is that the training progammes created the much needed self-awareness, independent will and the need of participants to have their attitude towards geometry improved. The result has therefore confirmed that attitude towards geometry could be enhanced through out-of-class-activity and group counselling strategies. This result also confirmed the study of Duffy (2001) who observed that students' attitude can be enhanced through out-of-school-time and group counselling strategies.

The exposure of the GCS group to counselling skills which reduced mathematics anxiety, which the participants suffer during mathematics lesson might be accounted for the development of positive attitude towards geometry. This has been in line with findings of researchers (Duatepe, 2004; Duffy, 2001; Grimm,1997; Hanna, 1986; Malaty, 1994) who have observed that when participants are taught mathematics (geometry included) using activity based instructions, they have reduced anxieties, develop positive attitude towards mathematics (geometry included) and even have better performance than equally competent participants who are taught without using activity-based instructions.

Another possible explanation for the significant improvement in the attitude towards geometry of the participants in the experimental groups may be found in the degree of motivation to acquire some basic skills in learning which they hitherto lacked.

The participants in the experimental groups might have been experiencing some degree of moderate dosage of anxiety because of the importance of geometry to their daily life. Some researchers such as Burton (1999); Adegoke (2002); Duatepe (2004) lend credence to the importance of geometry,

The results of this finding deviate from the view of Eysenk (1952, 1965) as cited by Yinyinola (2008) who held, the opinion that researches on psychological, educational and behavioural treatment showed no convincing effect. However, the results is in line with the opinion of some researchers (Robbinson, Berman & Neimeyer, 1990; Smith & Glass, 1977) as cited by Yinyinola (2008) who reported that in psychotherapies, differences are found and when they are, they can often be attributed to the allegiance of the investigators involved.

The outcome of the results from hypotheses one also agrees with the findings of previous researchers (Bergeson, Fitton & Bylsm 2000, Duatepe, 2004, Knap, 1997, Olosunde, 2009) who observed that the development of positive attitudes of participants in their various studies can be linked to the direct involvement of students in activities.

The outcome of the result also corroborates the findings of previous researchers (Webb & Brigman, 2006; Brigman, Webb & Campbell, 2007; Tylor & Montgomery, 2007) who found in their studies that counselling could be an effective treatment for increasing global and academic self-esteem. The findings also support the views of Ch (2006) who reported that counselling services were found to be effective on the students' study attitude.

4.10 Hypothesis 2: There is no significant main effect of Self-efficacy on participants':

(a) achievement in geometry and

(b) attitude towards, Geometry

There was a significant main effect of Mathematics Self-Efficacy (MSE) on participants' achievement in geometry. The hypothesis 2a was rejected based on this finding. The results of ANCOVA analysis on Table 4.2 indicated a significant main effect of self-efficacy on participants' achievement in geometry. This showed that participants with high mathematics self-efficacy can be associated with high achievement in geometry. In other wards, MSE was a positive predictor of achievement in geometry. This finding further revealed that participants who were confident of their performance in geometry tended to have better achievement in geometry.

One of the possible reasons of a significant main effect of MSE on participants' achievement in geometry can be attributed to the instructional strategies employed in the study. Research has indicated that self-efficacy could be increased through the use of appropriate instructional strategies (Siegle & McCoach,2007),which include, helping students to set a learning goal Bandura (1997), encouraging students to study harder and also the use of models (Siegle & McCoach,2007).

Another reason for a significant main effect of mathematics self-efficacy could stem from the observation made by Bandura (1997) that high self-efficacy and skills are the determinants of academic success. Skill without self-efficacy might not necessarily result in high personal accomplishment. Hence, the high MSE participants that performed better than the low MSE participants in geometry achievement could be interpreted to mean that the participants with high level of self-efficacy were confident that they could master the skills being taught in geometry lessons, they tend to approach challenges with the feeling of optimism which invariably afforded them good performance. The findings of this study corroborate the findings of Hodge (2005); Nicolaidou and Philippou (2003) ; Yinyinola (2008) whose findings revealed a significant relationship between mathematics self-efficacy and mathematics achievement. The results of the study contradict the findings of Kabiri and Kiamanesh (2004) who observed that prior mathematics achievement predicts mathematics achievement better than mathematics self-efficacy.

4.10.1 Hypothesis2b: However there was no significant main effect of MSE on participants' attitude towards geometry. Based on this finding, hypothesis 2b was accepted. This could be explained by the fact that the type of instructional strategies employed by the researcher in the teaching of geometry gave both the high and the low MSE participants a non-threatening environment (that is, a democratic environment), which might have motivated the low MSE participants to develop positive attitude towards geometry. The finding has therefore implied that the classification of participants into high or low levels of MSE does not affect their attitude towards geometry. The finding supports the observation of (Liu, Hsieh, Cho & Schallert, 2006) who found no significant effect of MSE on participants' attitude to science

4.11 Hypothesis 3: There is no significant main effect of gender on participants':

(a) achievement in geometry and

(b) attitude towards geometry

The results of the finding revealed that there was no significant main effect of gender on participants' achievement in geometry. Hypothesis3a was accepted. The existence of no difference in posttest scores on achievement in geometry between male and female participants can be said that both male and female participants benefited equally, in the same manner from the training programme they were exposed to. One way of giving possible explanation for no significant main effect of gender on participants' achievement in geometry could be attributed to the existence of role models for girls. The fact that women are seen holding different key positions in various fields of endeavour like their male counterparts was an inspiration for the girls. This is a factor that provides situations of success for both sexes. Consequently, this could improve females' sense of efficacy and their attitudes towards learning.

Gender difference that had been observed before in students' learning outcomes could also be said to be diminishing due to the effort of science educators towards the formulation and design of policy statements and intervention strategies that can promote gender equality for educational advancement. The finding is in line with that of Akinsola and Tijani (1999) who assert that mathematics is not a male dominated subject as people assumed it to be, but for both sexes provided that both sexes are subjected to the same learning conditions. The results of this study lent credence to the findings of previous researchers such as Adegoke (2002); Akay (2011) and Seleshi (2001) in Adegoke (2002) who did not find main significant gender differences in their various studies. The result did not support the finding of Olatundun (2008) whose study reported a main significant difference in the environmental knowledge scores of male and female pupils.

Table 4.5 presents a summary of the results of the Analysis of covariance (ANCOVA) for the dependent variable: attitude as measured by the Geometry Attitude Scale (GAS), which tested the second part of this hypothesis. The results in Table 4.5 revealed that there was no significant main effect of gender on participants' attitude towards geometry. The reason could be that both male and female participants have the same opportunities in the classroom environment. That implies that female participants can express themselves in the classroom situation and also take part actively in the lessons as much as their male counterparts. The findings corroborate the observations of Adegoke (2002) who found no significant main effect of gender on dependent-prone students' posttest mean scores in Geometry Achievement Test and Mathematical Attitudinal Scale. The results of the study also lent credence to the findings of Akay (2011) who did not find any significant gender difference in transformational geometry and attitude towards mathematics. The results of the study contradict the observations of Olatundun (2008) whose study reported a main significant difference in the environmental knowledge and attitude scores of male and female pupils.

4.12 Hypothesis 4: There is no significant 2-way interaction effect of Treatment by Self-efficacy on participants' Achievement in and Attitude towards Geometry

There is no significant interaction effect of treatment by self-efficacy on participants' achievement in and attitude towards geometry. The two treatments can be generalized across the levels of self-efficacy (low and high). This implies that any of the treatments could be applied either of low self-efficacy or high self-efficacy. This indicates that the combination of treatment (OCA, GCS) does not have a great influence on the participants' achievement. High and low self-efficacy of participants in the treatment groups had post-test mean scores that were statistically insignificant. This observation supports the results of Bridgeman and Wendler (1991), who observed that the pattern of achievement of high and low Mathematics self-efficacy levels of participants in the study group were not significantly different from one another.

4.13 Hypothesis 5: There is no significant 2-way interaction effect of Treatment by Gender on participants' Achievement in and Attitude towards Geometry

From the ANCOVA summary as shown in Tables 4.2 and 4.5, there was no significant 2-way interaction effect of treatment by gender on participants' achievement in and attitude towards, geometry. This implies that treatment (OCA, GCS) is not gender sensitive to participants' achievement in and attitude towards geometry. In other words, the treatments can be generalized across the two levels of gender (male & gender). The findings of this study also corroborate the results of other studies (Adegoke, 2002; Ajiboye,1996; Ishola, 1999) as cited by Adegoke (2002) who observed no statistical significant interaction effect of instructional strategies and students' gender on geometry, population concepts and physics achievement test in and attitude towards problem-solving. The result is in conflict with such study as that of Olatundun (2008) who found interaction effect of treatment by gender in his study.

4.14 Hypothesis 6: There is no significant 2-way interaction effect of Self-efficacy by Gender on participants' Achievement in and Attitude towards Geometry

There is no significant 2-way interaction effect of self-efficacy by gender on achievement in and attitude towards, geometry. The results of this study indicate that the two-way interaction effect of self-efficacy by gender was not significant on participants' achievement in and attitude towards geometry. This indicates that the effect of self-efficacy on achievement and attitude towards geometry can be generalized across the two levels of gender (male & female) The findings of this study agreed with the reports of Venkatesh and Lissammi (2011); Stage & Kloosterman (1995) and contradict the results of Skaalvik and Rankin (1994) who affirm that Mathematics self-efficacy of males was statistically superior to that of females.

One way of explaining the result of the present study is the fact that both the male and female participants were exposed to the same treatment conditions which gave the two sexes equal opportunities to learn. The female participants now believe in their abilities that they can learn. This is different in the time past, when the culture of the participants exerted influence on male participants who were given free interaction while the females were expected to be engaged in domestic works. But with the present provision of equal learning opportunities, females could perform as well as their male counterparts.

4.15 Hypothesis 7: There is no significant 3-way interaction effect of Treatment, Self-efficacy and Gender on participants' Achievement in and Attitude towards Geometry

The three-way interaction effect of treatment, self-efficacy and gender was not significant on participants' achievement in and attitude towards geometry. This implies that the combination of treatment, self-efficacy and gender does not associate with participants' learning outcomes (achievement and attitude). That is, the interaction effect involving the three variables is not mutually influenced by achievement and attitude to produce a joint effect. The effect of the treatment can be generalized across the two levels of self-efficacy (low & high) and two levels of gender (male & female).

CHAPTER FIVE

SUMMARY AND CONCLUSIONS

5.1 Introduction

The major findings of this study as well as their educational implications and recommendations are summarized. Also, the limitations of this study as well as suggestions for further research are presented.

5.2. Summary of findings

The findings of this study are summarized below:

1. There was significant main effect of out-of-class- activity, counselling and conventional teaching strategies on participants' achievement in and attitudes towards Geometry.
2. Out-of-class and counselling strategies produced better participants' performance in geometry than conventional strategies.
3. Attitude of participants was better under out-of-class-activity and counselling than the conventional strategy.
4. There was significant main effect of self-efficacy of participants on achievement in Geometry.
5. There was no significant main effect of self-efficacy on participants' attitudes toward Geometry
6. There was no significant main effect of gender on participants' achievement in Geometry.
7. There was no significant main effect of gender on participants' attitudes towards Geometry.
8. There was no significant two-way interaction effect of treatment by self-efficacy on participants' achievement in and attitude towards Geometry.
9. There was no significant two-way interaction effect of treatment by gender on participants' achievement in and attitude towards Geometry.
10. There was no significant two-way interaction effect of self-efficacy by gender on

participants' achievement and attitude towards Geometry.

11. There was no significant three-way interaction effect of treatment, self- efficacy and gender on participants' achievement in and attitude towards Geometry.

5.3 Implications of the findings

The findings of the study have many implications for Mathematics education. The instructional strategies of Out-of-Class-Activity (OCA) and Group Counselling Strategy (GCS) employed in this study showed superiority over the Conventional Teaching Strategy (CTS) throughout the study. That the treatment had significant main effect on achievement and attitude implies that the two strategies are viable alternatives to the Conventional Teaching Strategy and, as such, should be encouraged for use in our schools alongside the Conventional Teaching Strategy. Moreover, the strategies have been found to be effective in the teaching of geometry, especially to low-achieving students. This is a pointer to the fact that there is a need to shift from the traditional way of Mathematics instruction to some other instructional strategies that are more provocative, facilitative and have empowering effects on the students. Hence, the results of the study have exposed the effectiveness of Out-of-Class-Activity and Group Counselling Strategy in the teaching of geometry and therefore suggest that Mathematics teachers should adopt the Out-of-Class-Activity and Group Counselling Strategies in the teaching of Mathematics generally at the Junior Secondary School level. The present study has proved that OCA and GCS are effective strategies in enhancing learning outcomes among low-achieving secondary school students, especially in the area of geometry.

The study has also exposed the participants to the importance of rational thinking through counselling strategy, which affected their performance in Mathematics positively. The two therapeutic strategies applied were effective in improving achievement in and attitude towards Mathematics. A significant relationship has been found to exist between attitude and achievement. As participants' mathematics achievement improves, they tend to develop positive attitude towards Mathematics. Low-achieving students are bound to achieve better in Mathematics when taught with appropriate teaching strategies. It is envisaged that the introduction and implementation of these strategies in our schools could further enhance the much needed positive attitude not only to Mathematics, but also to other related disciplines. Another implication is that Mathematics students should not be taken as a homogenous group without due cognizance to individual inherent innate learning characteristics which are embodiments of learning styles in the classroom situation. In other words, Mathematics educators should put into consideration individual differences among students. If this is not done, Mathematics educators will be teaching a fraction of the class with a resultant effect of poor academic performance and negative attitude to Mathematics from students whose learning styles and needs may not be met in the normal regular classroom. A large number of studies discussed in this study stress that it is desirable to improve the instructional strategy of students. Therefore, it is very necessary to include out-of-class-activity and group counselling strategies as part of the instructional strategies in the mathematics curriculum. This might help the classroom teachers in working with students who are low-achieving in Mathematics. The results of this study also show that concerted efforts are needed to help students to maximize their potential and improve their area of academic weaknesses. The findings of this study have educational implications for Mathematics classroom teachers, counsellors, policy makers and curriculum planners.

5.4 Recommendations

The following recommendations are made based on the findings of the study:

Secondary school mathematics teachers should be encouraged to explore the application of Out-of Class-Activity Strategy in their classroom instruction

Teachers can sequence their instructional content to include OCA strategy for learning new topics. This is because changing the instructional method from traditional to modern has a positive effect on the academic performance of the low-achieving students.

Students should be given a chance to be involved in the teaching and learning process to learn meaningfully. School counsellors should implement a comprehensive school counselling programme that would focus on increasing students' academic achievement using rich empirically based intervention strategies, such as group counselling strategy.

Government should organize workshops, seminars, symposia, and conferences for teachers whereby they will be exposed to various enhancement strategies that will assist them in taking care of individual differences among students in the classroom environment. This will help students develop positive attitude towards Mathematics, have confidence in themselves, and be more positively disposed towards obtaining good scores in Mathematics and even in other related subjects.

The Mathematics educators should utilize the findings of this study to encourage the school counsellors to be organizing school intervention strategies that will assist not only the low-achieving students but also all the students generally on the need for the learning of Mathematics, for their future careers. Utilizing the findings of this study would help the students control cognitive thought processes and positively impact on academic achievements.

5.5 Limitations of the study

There are limitations to this study that should be considered before the results are applied. The sample selected was restricted to only six junior secondary schools in three local government areas out of the existing eleven local government areas in Ibadan. This reduces the degree of generazability of the results. Only students in Junior Secondary Two (JS2) were included in the study as samples. Further research with inclusion of all categories of secondary school students is needed to understand more the effect of the interventions on the dependent variables.

Another possible limitation to the study is the sample size; the number of participants in the study (110) seems small compared to the large number of secondary school students.

Despite the experimental method that has been adopted to control the present study, differences of such factors as personality, socio-economic background and gender cannot be controlled. Randomization does not take care of these differences. Therefore, statistical control was used to equate factors like mental ability and other forms of individual differences.

Another area of possible limitation is the fact that it is not possible to conduct the experiment in an entirely stimulus controlled experimental environment. There is a possibility that routine school procedures would have been a source of distraction to experimental groups. Should such distractions have effect, only the treated groups would be affected.

The use of intact class could not permit randomization of the participants used for the study. Although any error in sampling should have been taken care of, through the use of ANCOVA.

5.6 Suggestions for further study

Replication of the study is needed with longer period of treatment; say 12 weeks, as well as with students from varied abilities (high, moderate and low) to see if the same results would be obtained.

Furthermore, it is necessary to vary the experimental conditions to see their effects on the participants. For example, a different design, like 4x3x2 which will combine the two experimental groups (OCA and GCS) as well as three levels of Mathematics self-efficacy (high, moderate and low) could be employed.

The study could be carried out in such a way that one would avoid the use of intact class which would permit randomization of participants to treatment and control groups
Other aspects of Mathematics could be looked into to see what effect OCA would have on

them.

5.7 Contribution to knowledge

The main contribution of this study is the attempt to improve Geometry achievement by using Out-of-Class-Activity (OCA) strategy. This approach will hopefully make Geometrical concept more real than abstract since the activities are those they engage in on a day to day basis outside their classroom.

The findings of the study have shown the effectiveness of Out-of-Class -Activity and Group Counselling Strategies (OCA and GCS) as means of enhancing achievement in Geometry and attitude of low-achieving students towards Geometry.

The strategies employed have exposed the fact that the teaching learning process should not be restricted to the four walls of the classroom alone.

The study proves to the educators that when low-achieving students are equipped with appropriate teaching strategies, their academic achievement could be improved. It also assures stakeholders in education that when classroom instruction is supported with OCA, performance could be enhanced. In sum, the result of the study provides a basis for curriculum innovation in the preparation of Mathematics teachers.

The study has demonstrated that the combination of classroom and out-of classroom activities have positive effect on achievement as well as attitude.

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APPENDIX I

ICEE DEPARTMENT)

UNIVERSITY OF IBADAN, IBADAN

STUDENTS' SELECTION TEST (SST)

Instruction: This test contains questions in Mathematics. Each question is followed by the four options: A-D, shade the letter that corresponds to the correct option on the answer sheet provided for you.

Name:____

Class:____

Name of the school:___________________________________

Age:__________ **Sex:**___________**Male ( ) Female( )**

(1) Which of the following is not an example of quadrilaterals? (a) Triangle (b) Trapezium (c) Square (d) Rhombus.

(2) One of the base angles of an isosceles triangle is 70, find in degrees the other angles of the triangle. (a) $50^0$and 45^0(b) 80^0and10^0 (c) 70^0 and 40^0 (d) 60^0and30^0

(3) Calculate the circumference of a circle with radius of 7cm (a) 21cm (b) 22cm (c) 28cm (d) 44cm

(4) A triangle in which all the sides are equal is ---------- (a) isosceles triangle (b) right angled-triangle (c) scalene triangle (d) equilateral triangle.

(5) The perimeter of a circle is the same as (a) circumference (b) diameter (c) chord (d) radius.

(6) A polygon with six sides is called -------- (a) nonagon (b) octagon (c) hexagon (d) pentagon

(7) Plane figures that are formed from straight lines are called (a) symmetry (b) polygons (c) isosceles triangle (d) kite

(8) A plane shape with four equal sides is called -------- (a) cuboid (b) parallelogram (c) square (d) rectangle.

(9) A triangle in which only two of its sides are equal is called (a) equilateral (b) isosceles (c) scalene (d) right angled-triangle.

(10) The perimeter of rectangle is 12cm,its length is 3cm, find the breadth (a) 6cm (b)1cm (c) 2cm (d) 3cm

(11) A square has -------- line of symmetry (a) 2 (b) 4 (c) 1 (d) 3.

(12) The longest side of a right angled-triangle is (a) line segment (b) adjacent side (c) hypotenuse (d) opposite side.

(13) A quadrilateral with one pair of parallel sides is called --------- (a) rhombus (b) parallelogram (c) kite (d) Trapezium

(14) The area of a rectangle with length 6cm and breadth 31/2 (a) $21cm^2$ (b) 21cm (c) $21cm^3$ (d)21

(15) A decagon has --------- sides (a) 20 (b) 10 (c) 15 (d) 12

(16) The base of a parallelogram is 6cm long and its height is 4cm. Calculate the area of the parallelogram (a) $24cm^2$ (b) 24cm (c) $27cm^2$ (d) $26cm^2$

(17) One side of the square is 6cm, calculate the area of the square (a) 26cm (b) $30cm^2$ (c) $36cm^2$ (d) 36cm.

(18) If the length of one side of the square is given as x, then the perimeter of the square is (a) x (b) 4 (c) 4x (d) $4x^2$

(19) Calculate the perimeter of a circle of radius70m (a) 40m (b) 400m (c) 410m (d) 440m

(20) The special name for a polygon with all the angles equal is -------- (a) equilateral (b) equiangular (c) polygon (d) parallelogram.

APPENDIX II

ICEE DEPARTMENT
UNIVERSITY OF IBADAN, IBADAN.
ACHIEVEMENT TEST IN GEOMETRY (ATG) PRE-TEST AND POST-TEST

Name: ____

Class: ____

Name of school:_______________________________________

Age: _______ **Sex:**_________ Male ( ) Female ( )

Religion: Christianity ( ) Islam ( ) Others ( )

Time: 40 minutes

Instruction: This is a multiple choice test with only one correct answer

Each question is followed by four options (A-D). Find the correct option and shade the letter that corresponds to the correct option on the answer sheet provided for you.

Questions

1. One example of 3-dimensional object is (a) square (b) kite (c) parallelogram (d) cylinder.
2. A sphere has ______faces (a) 2 (b)1 (c)0 (d) 3
3. The volume of a cuboid of length ɭ, breadth b and height h, = (a) ɭhv (b) ɭbv (c) ɭbh (d) bhv
4. One property common to all solids is: (a) inside (b) outside (c) Inside and outside (d) solid and inside.
5. The net of a square pyramid has ___ triangular shapes (a) 8 (b) 4 (c) 2 (d) 12.
6. The surface area of a cone is given by д r1 (b) д r (c) д1 (d) дr^2
7. The surface area of a cylinder is obtained by circumference of a circle times (a) length (b) height (c) slanting line (d) radius.
8. A point where two or more edges meet is called (a) face (b) vertex (c) edge (d) height.
9. If the side of a cube is ɭ centimeter, what is the total surface area?(a) 6 ɭ cm^2 (b) 6 $ɭ^2$ cm^2 (c) 6 $ɭ^3$ cm^2 (d) 6$ɭ^4$ cm^2
10. Calculate the volume of a cube of length 4cm(a) $16cm^3$ (b) 64cm (c) $64cm^3$ (d)$24cm^3$
11. calculate the volume of a cuboid of length = 9cm, breadth = 7.5cm and Height= 2cm (a) $129cm^3$ (b) $130cm^3$ (c) $128.5cm^3$ (d) $135cm^3$
12. A cuboid has_____ rectangular faces (a) 8 (b) 10 (c) 12 (d) 6
13. Which of the following is the total surface area of a cuboid? (a) 2(bh+ ɭ) (b) 2(ɭb + ɭh) (c) 2(ɭb) (d) 2(ɭb +bh + ɭh)

14. The cube of dimensions, ɭ centimeter, will have the volume v= (a) ɭ^3 cm^3 (b) ɭ cm^3 (c) ɭ^2 cm^3 (d) ɭ^4 cm^3

15. Given the area of the base to be 40cm and the volume of a cuboid is 240cm$^{3.}$ Find the height of the cuboid (a) 2 cm (b) 4 cm (c) 6 cm (d) 10 cm

16. A cylinder has a base radius of 7cm and a height of 10cm.Find the curved surface area of the cylinder (a) 470cm^2 (b) 440cm^2 (c)400cm^2 (d) 450cm^2

17. The volume of a cone is ____ of a cylinder(a) 1/3 дr^2 (b) 1/3 дr^{2}h (c) 1/3дrh (d) 1/3дr^{3}h

18. The volume of a cylinder of equal height and radius with a cone can be filled with ___ cones of sand (a) 4 (b) 5 (c) 3 (d) 7

19. Find the total surface area of a cube of length 15cm (a) 1325cm^2 (b)1350cm^2 (c) 1332cm^2 (d) 1225cm^2

20. The formula for the surface area of a cone is (a) д r1 (b) д r (c) д1 (d) дr^2

21. Calculate the total surface area of a cuboid of length 8cm,breadth 6cm and height 4cm (a)208cm^2 (b)218cm^2 (c) 308cm^2 (d) 318cm^2

22. Calculate the volume of a cylinder of height 4cm and base radius 7cm (a) 620cm^3 (b) 619cm^3 (c) 617cm^3 (d) 616cm^3

23. Calculate the volume of a cone of base radius of 3cm and height 7cm(a) 9cm^3 (b) 21cm^3 (c) 81cm^3 (d) 66cm^3

24. A square pyramid has ______ edges (a) 6 (b) 8 (c) 4 (d) 5

25. Which among the following has the greatest number of vertices (a)sphere (b) cylinder (c) cube (d) cone.

26. _____ is a 3-D object because it has length, breadth and height (a) square (b) kite (c) cube (d) rectangle.

27. The volume of a cylinder of height h, base D and radius r is given by (a) 1/3 дr^2 (b) 1/3 дr^{2}h (c) 1/3дrh (d) 1/3дr^{3}h.

28. The total surface area of a cylinder is (a) 2д r (h+l) (b) 2д r(h+ b) (c)2дr (h+r) (d) 2д r(h+r^2)

29. Half of a sphere is called ___(a) radius (b) circumference (c) perimeter (d) hemisphere.

30. How many vertices has a sphere? (a) 1 (b) 0 (c) 2 (d) 3

APPENDIX III

UNIVERSITY OF IBADAN
INSTITUTE OF EDUCATION
INTERNATIONAL CENTRE FOR EDUCATIONAL EVALUATION
MATHEMATICS SELF-EFFICACY SCALE (MSES)

Dear Respondents,

This measuring scale is aimed at assessing the level of Mathematics self-efficacy of students. Any information you supply will be used for research purpose only and will be treated with utmost confidentiality. Please, respond to each question in the relevant box. Fill in your response as truthfully as possible.

SECTION A:

Name: ____

Name of School____________________________________

My next birthday: __________________________________

Age:_______ Sex: Male ( ) female ( ) Language: English ( ) Others ( )

Religion: Christianity ( ) Islam ( ) others ( )

SECTION B:

Instruction: Kindly read the following items and rate yourself accordingly. You are expected to tick.

5. - Very well
4 - Pretty well
3 - Satisfactory
2 - Not too well
1 - Not well at all

Section 1

The focus here is on the belief in your capability to solve Numerical Problems and Problems in Measurement.

		5	4	3	2	1
1	How well do you believe you can calculate accurately numerical problems mentally?					
2	How well do you believe you can calculate accurately numerical problems on paper?					
3	How well do you believe you can estimate and make approximations?					
4	How well do you believe you can interpret the accuracy of results and measurements?					
5	How well do you believe you can calculate the effects of change in variables using mathematics models?					
6	How well do you believe you can predict the rate of change of variables using mathematics models?					

Section 2
The focus is on your belief in your capability to attempt successfully problems in Geometry.

		5	4	3	2	1
1	How well do you believe you can recognize the geometrical properties of objects in daily life?					
2	How well do you believe you can use geometrical models to solve practical problems in daily life?					

Section 3
The focus is on your belief in your capability to attempt successfully problems in Algebra.

		5	4	3	2	1
1	How well do you believe you can recognize patterns and relationships in Mathematics and generalize from these?					
2	How well do you believe you can think abstractly and use symbols to communicate mathematics concepts, relationships and generalizations?					

3	How well do you believe you can think and use graphs and diagram to communicate mathematics concepts, relationships and generalizations?					
4	How well do you believe you can use algebraic expressions to solve practical problems?					

Section 4

The focus here is on your belief in solving problems in Statistics

		5	4	3	2	1
1	How well do you believe you can summarize statistical data as reports and summaries?					
2	How well do you believe you can interpret data presented in chart, tables and graphs?					
3	How well do you believe you can estimate probabilities?					

Section 5

The focus here is about your beliefs in using mathematics processes.

		5	4	3	2	1
1	How well do you believe you can use logical and systematic thinking in mathematics contexts?					
2	In a mathematical problem solving situation, how well do you believe you can critically reflect on the method you have chosen?					
3	How well do you believe you can use information technology in mathematics contexts?					
4	How well do you believe you can be part of a problem-solving team, expressing your idea, listening and responding to others?					
5	How well do you believe you can use the knowledge and skills in mathematics to interpret presentations of mathematics					
6	How well do you have developed skills in using your own ethnic language to express mathematical ideas?					

Section 6

Self-Belief in Motivation Strategies

		5	4	3	2	1
1	How well do you believe you can study in appropriate ways that you will be able to learn mathematics					
2	How well do you believe that if you try hard enough you will be able to understand the different concepts in mathematics					
3	How well do you believe that you understand the most complex concepts in mathematics?					

4	How well do you believe that you can master the skills taught in mathematics					
5	How well do you believe that you can do an excellent job on the assignment and tests in mathematics					

Section 7

Self-Belief in Cognitive Strategies

		5	4	3	2	1
1	When studying Mathematics how well do you believe you can set goals for yourself to direct your activities?					
2	When you study Mathematics, how well do you believe you can outline the material to help organize your thoughts?					
3	When you study Mathematics, how well do you believe you can formulate questions to focus your thoughts?					
4	When studying Mathematics, how well do you believe you can go through your notes and readings to find out the most important concepts?					
5	When studying a new Mathematics concept, how well do you believe that you can skim it to see how it is organized?					
6	When studying Mathematics how well do you believe you can think through the topic to decide what it is you are supposed to learn rather than just reading it over?					
7	When studying Mathematics, how well do you believe that you can use information from different sources such as class, notes, text books and discussions?					
8	When studying Mathematics, how well do you believe that you can ask yourself questions to make sure that you have understood the material?					
9	When studying Mathematics, how well do you believe that you can change the way of study to fit the requirement of the topic?					
10	When studying Mathematics, how well do you believe you can memorize key words to help recall important concepts?					

11	When studying Mathematics, how well do you believe you can summarize concepts of the topic of study?					
12	When studying Mathematics, how well do you believe you can determine the concepts you have not understood well?					
13	When studying Mathematics, how well do you believe you can relate ideas from Mathematics to other subjects?					
14	When studying Mathematics, how well do you believe you can try to relate material to what you already know?					
15	When studying Mathematics, how well do you believe you can sort out confusion which arises over missing note taking in class?					

Section 8

Self-Belief in resource Management Strategies

		5	4	3	2	1
1	How well can you believe you can explain a topic in Mathematics to your classmate/friend?					
2	How well do you believe you can work on your own, even if you have trouble learning the material in Mathematics class?					
3	How well do you believe you can use your study time for Mathematics?					
4	How well do you believe you can work with your classmates to complete the course assignments?					
5	How well do you believe you can work in class even if you don't like what is being done?					
6	How well do you believe you can stick to your study schedule?					
7	How well do you believe you can seek clarifications from your Mathematics teacher when you do not understand a concept?					
8	How well do you believe you can persist on the topic					

	in Mathematics when you find the material difficult?					
9	How well do you believe you can ask a peer/another student in class for help in Mathematics when you cannot understand the material being taught?					
10	How well do you believe you can keep up with topics and assignment in Mathematics?					
11	How well do you believe you can manage to keep working in Mathematics even when you find the material uninteresting?					
12	How well do you believe you can review your Mathematics notes/readings before an exam?					

Section 9

Self-Belief for Self-Regulated Learning

		5	4	3	2	1
1	How well do you believe you can finish your Mathematics homework/assignments by deadlines?					
2	How well do you believe you can learn Mathematics when there are other interesting things to do?					
3	How well do you believe you can concentrate on school subjects?					
4	How well do you believe you can concentrate in Mathematics in the classroom?					
5	How well do you believe you can take notes of class instruction?					
6	How well do you believe you can take notes of Mathematics during class instruction?					
7	How well do you believe you can use the internet facilities to get information for class assignment?					
8	How well do you believe you can plan your school work?					
9	How well do you believe you can remember					

	information presented in class and text book?					
10	How well do you believe you can arrange a place to study without distractions?					
11	How well do you believe you can motivate yourself to do school work?					
12	How well do you believe you can motivate yourself to do school work in Mathematics?					
13	How well do you believe you can participate in class discussions?					
14	How well do you believe you can classify doubts in Mathematics in class?					

APPENDIX IV

UNIVERSITY OF IBADAN
INSTITUTE OF EDUCATION
INTERNATIONAL CENTRE FOR EDUCATIONAL EVALUATION
GEOMETRY ATTITUDE SCALE (GAS)

Instruction: Please respond to each question in the relevant box. Fill in your response as truthfully as possible. Note that the information you provide is for research purposes only and will be treated with utmost confidentiality. Thank you.

Section A: About yourself and the school

Name:____

Name of school: ____

Age:_______ Sex: Male (   ) Female   (   ) Language: English (   ) others (   )

KEY: SA for strongly agree, **A** for agree, **U** for undecided, **D** for disagree **SD** for strongly disagree.

Section B: Instruction

Tick (√) good in the space which best indicates how appropriately you agree or disagree with feeling expressed in each statement below.

S/N	**Item**	**SA**	**A**	**U**	**D**	**SD**
1	Students forget geometry easily.					
2	Students are happy on the day they do not have geometry.					
3	Geometry textbook is too hard.					
4	Student remembers most of the things he/she learned in geometry					
5	Geometry is not practiced during the long vacation.					
6	Geometry is not being discussed with my friends.					
7	Geometry tests are easy for me.					
8	Geometry has always been liked by me.					
9	Geometry book is interesting.					
10	Students do not like being asked questions in geometry.					
11	Not getting good marks in geometry does not border me.					

12	Students worry about their marks in geometry.					
13	Other books about geometry should be read besides the one used in class.					
14	Geometry book is liked better than most school books.					
15	Students wish geometry classes were shorter.					
16	Geometry classes are preferred to be missed.					
17	Geometry is the best of all my school subjects.					
18	Students dislike taking tests in geometry.					
19	Geometry classes are enjoyable.					
20	Students do not enjoy studying from geometry book.					
21	Geometry problems are often been forgotten after working on other kinds.					
22	Geometry homework is not easy for me to do					
23	Student often thinks "he can't do geometry" when a work problem seems hard.					
24	Geometry homework can be done in the class.					
25	Geometry is easy for me.					
26	Much geometry is not remembered over the summer vacation.					
27	Students like geometry.					
28	Geometry is preferred than other subjects.					
29	Students like to answer questions in geometry classes.					
30	Geometry is interesting to students.					
31	Failing to get solution to geometry problems does not discourage students					
32	A student is sure of himself/herself in geometry.					
33	Fewer geometry problems are often wished to be done.					
34	Geometry problems that are alike are preferred rather than the mixed problems.					
35	Students wish that geometry tests were easier.					
36	Geometry is hard for students.					
37	Students are glad when it is time for geometry class.					
38	Students enjoy working harder problems in geometry.					

39	Geometry problems take too much time.					
40	Most of my friends think geometry is dull.					
41	Geometry is one of my favorite subjects.					
42	Students would rather do geometry than read books.					
43	Students enjoy talking to their teacher about geometry.					
44	Students like to do word problem in geometry.					
45	Students would take geometry next year even if they do not have to.					
46	Students like the easy problem in geometry.					
47	Students like to do extra work in geometry when they have time.					
48	Student likes to work geometry problems with his/her friends.					
49	Students would rather be authors than scientists.					
50	Students prefer a job involving geometry.					
51	Students like taking tests in geometry.					
52	Students prefer a job which never used any geometry.					
53	A job which used a great deal of geometry is accepted by students.					
54	It is not enjoyable talking to parents about geometry.					
55	Geometry homework often takes more time than any other school subjects.					
56	Students hate geometry.					
57	Geometry is not student's best subject.					
58	Writing a story is better than working geometry problems					
59	Students do not like doing geometry homework.					
60	Students do not have to spend much time on geometry to pass it.					

APPENDIX V

EXPERIMENTAL GROUP 1: OUT-OF-CLASS- ACTIVITY STRATEGY

WEEK 1

Topic: Orientation and administration of instrument to obtain baseline data.

Objectives:

- To do self introduction.
- To acquaint the participants with the benefits of the training programme and the roles they would play.
- To inform the participants the rules of the training.
- To obtain the baseline data.

Step I: The teacher welcomed the participants and introduced herself to familiarize with and sensitize the participants. The participants were also instructed to introduce themselves individually by mentioning their names only. The teacher urged the participants to feel free to make their contributions to the programme by expressing their own views and opinions in a polite way by respecting the views of others.

Step II: **Acquitting the participants with the benefits of the programme.**

The teacher acquitted participants with the nature and benefits of the training programme. The teacher highlighted the benefits the participants might derive from the training, if they participate meaningfully. Such benefits might include the development of positive attitude towards mathematics, particularly in the area of Geometry; high level of self-efficacy and improvement in their academic performance.

The teacher emphasized the need for participants to cooperatively participate effectively in all the eight training sessions, as this would enable them to follow the programme sequentially and logically, since the outcome of the programme depended on their complete participation in the training programme, and the training programme was cumulative in nature. This implied that any break in session would create a gap in knowledge, which might deprive the participants of the full benefits of the programme and therefore prevent the programme from producing the desired result.

Step III: Administration of the pre-test measures.

The teacher informed the participants that they would complete some tests Participants were advised to complete all items in the test and give correct information. She informed the participants that the scores on the tests had nothing to do with their school grades. The teacher did this to reduce anxiety from the participants.

The teacher highlighted her role in the programme, which included assisting, guiding, discussing and advising participants as well as coordinating the training programme in such a way that the psychological, as well as the academic performance of the participants might be enhanced.

The teacher administered the instruments for the pre-test measures. SST, ATG MSES and GAS were distributed to all the participants. She explained to them what they supposed to do and how they were expected to respond to the instruments. After the explanation, she inquired from the participants if the procedure was clear, giving them the opportunity to signify where they did not. The teacher reiterated the need for participants to objectively respond to the items in each of the tests as scores on the instruments were for research purpose and not related to their school grade. The teacher collected the instruments after the participants had responded to each of the instruments one after the other. Scores obtained from the tests during this session formed the pre-test scores.

Step IV: Agreement on time and venue

The teacher discussed the issue of time and venue of meeting with each of the groups. The teacher picked the school hall as the venue and Tuesday, 11.20 AM-12.00 Noon as the time of meeting. This period fell into the break period of the school. Since this period is meant for the students to take refreshment and the teacher has already taken care of this, hence, the participants were not disadvantaged. The teacher picked this time in order not to disrupt the school programme and overstay the participants in the school. This was because; the participants were equally engaged in the afternoon lesson being organized by the school. Having done that, the teacher then emphasized the need to be regular and punctual at the sessions, so that once the training commences, there would be no going back, so as to maximize the time of training.

Step V: Home -assignment

The teacher concluded the session by thanking the participants for volunteering to participate in the training programme. The teacher encouraged the participants to ensure that they participated fully in all the sessions and gave them the following home -assignment.
The participants were requested to (a) list from home reasons why they go to school and (b) to collect some specified 3-Dimensional and 2-Dimensional objects

WEEK 2
Topic: Identification of 3-Dmensional Objects
Objectives:

- To review the previous home-assignment.
- To guide the participants in knowing why they go to school.
- To guide the participants in knowing why the training is being organized.
- To identify 3-Dimensional objects.
- To differentiate between the 3-D and 2-D objects

Step I: The teacher took the participants out of the classroom to collect geometrical objects within the school community. Teacher reviewed the previous home-assignments with the participants on why students go to school. The teacher asked the participants reason why they come to school. The participants responded that they have come to school to learn. The teacher informed the participants that they have come to school to learn, so that after leaving the Junior School, they will transit to Senior School where they will write the Senior School Certificate Examination (SSCE) with which they will gain admission into tertiary institution (University, Polytechnic, College of education, School of nursing, and School of Surveying). The teacher informed the participants that before they can gain admission into any of these tertiary institutions, they must obtain credit pass in certain school subjects, especially English and Mathematics. Research findings have shown that most students could not transit to the tertiary institution because students' performance in mathematics was poor. The Joint Examiners' reports as well as Adeleke (2007) and Adegoke (2002) have shown that the major area where students have problem is in the area of Geometry (a branch of mathematics). It has also been observed that the method of teaching this aspect of mathematics was problematic and therefore should be corrected. It is in line with this that this training programme tagged Out-of-Class-Activity (OCA) is being organized. The principles involved in this programme include the popular Chinese proverb, which states that:

What I hear, I forget.

What I see, I remember.

What I do, I understand (Alemni, 2008. abstract. P .v)

Step III: Identification of 3-Dimentional (3-D) objects. The teacher let the participants know the purpose of taking them out of the class. The teacher took the participants out of class to allow them collect geometrical objects within the school community. To let the participants realize that mathematics is real and can be done outside the four walls of classroom. The teacher collected all the geometrical objects gathered by the participants from home and those ones within the school community, to improvise mathematics laboratory. The teacher distributed both the 2-Dimensional (2-D) (square, triangle kite, etc) and 3-D (matchbox, cubes of sugar, Milo tin, etc) objects to the participants to enable them identify 3-D objects and also to differentiate 3-D objects from 2-D ones. What can you say about their shapes, sizes and lengths? The teacher told the participants that they are familiar with some common 2-D and 3-D objects in their homes and outside their homes. The only problem is that they may not know the name and the significance of what they are playing with. She guided the participants in outlining the difference between the 2-D and 3-D objects. A 3-D object is one that has length, breadth and height. It occupies space. There are many types of 3-D objects. Examples are cube, cuboids, cone, pyramid, cylinder and sphere. A 2-D figure is one that has only length and breadth (width). Examples are square, rectangle, triangle and circle. The teacher got the participants directly involved in identifying the 3-D objects.

Step IV: Home-assignment: Participants were asked to give (i) three examples of 3-D and three examples of 2-D objects each. (ii) To bring from home some specified 3-D objects.

WEEK 3

Topic: Surface area of cube and cuboid**.**

Objectives:

- To discuss the previous assignment.
- To take the participants out of class.
- To lead the participants discover the formula for the surface area of cube and cuboid.

Step I: Take the participants out of the class. Using the 3-D objects collected from home and school community by the participants, the teacher guided them to measure the sides of cubes of different sizes. What can you say about the sides of a cube?

Step II: The teacher led the participants to discover properties of a cube. The teacher also helped them discover that surface area (outside of an object) of cube is $6L^{2.}$ All the sides of a cube are equal. To find the area of one face of a cube, it is length
= (ɭ) x Breadth (B). But a cube has six equal faces which you have seen. This implies that the surface area of a cube = ɭ x B + ɭ x B + B x H + B x H + ɭ x H + ɭ x H (But ɭ =B = H)
Therefore the surface area of a cube =6 (ɭ x ɭ)
= 6 $ɭ^2$

Step III: Surface area of a cuboid. Participants were guided to measure the dimensions of different given cuboids. They were led to discover both the properties of a cuboid and the formula for the surface area of a cuboid as thus:
Surface area of a cuboid = L x B + L x B + B x H +B x H + L x H + L x H
= 2LB+2BH+2LH. A cuboid has six rectangular faces of two equal faces. This implies that the surface area of a cuboid
= 2(L B+BH+LH).

Step IV: Home-assignment: Group assignments were given to the participants. Participants are to measure the dimensions of their mathematics text book and use the measurements to find the surface area of the cuboid. (b) Measure the dimensions of a cube of sugar and use it to find the surface area of a cube. (c) They were asked to collect from their home environment some specified 3-D objects like funnel, Bornvita tin etc.

WEEK 4
Topic: Surface Area of cylinder and Cone
Objectives:

- To take the participants out.
- To discuss the previous assignment.

To use the 3-D objects around the participants' immediate environment to lead them to discover the surface area of cylinder and cone

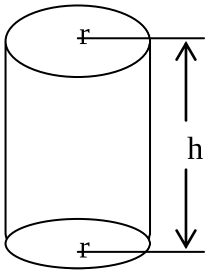


Fig. a

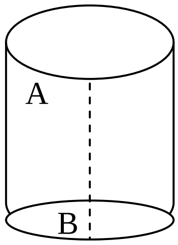


Fig. b

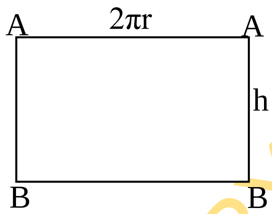


Fig. c

Participants in this group were taken out of the class to school community to gather some 3-D objects. The 3-D objects gathered from home and school were used by the participants to deduce the surface area of cylinder and cone under the guidance of the teacher.

Step II: Deduction of formula. The core of a toilet roll in figure (b) above was cut open using scissors and was spread out to form a rectangle in figure (c). Measure the length and breadth of the rectangle and calculate the area of the rectangle. You are familiar with area of rectangle, which is Lx B.

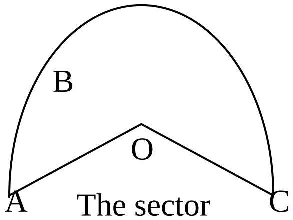
Step III: What is the relationship between the area of the rectangle and the curved surface area of the cylinder in figure (a)? The breadth B of the rectangle is the height h of the cylinder, while the length L of the rectangle is the circumference of the circular base of the cylinder which is $2\pi r$.

Area of the rectangle is L x B = curved surface area of a cylinder = $2\pi r$ x h = $2\pi r$ h. Therefore, area of the curved surface of a cylinder, height h, base radius r is given by $2\pi r$ h.

While the total surface area of a cylinder is the area of curved surface + area of the top + area of the base. Therefore, for a cylinder of radius r and height h, the total surface area is

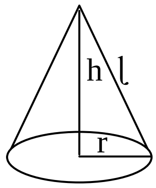
$$2\pi r h + \pi r^2 + \pi r^2$$
$$= 2\pi r h + 2\pi r^2$$
$$= 2\pi r (h + r)$$

Step IV: A model of cone with a given radius, from cardboard and a piece of paper which is cut in the shape of a circle in figure2 is made from figure1. The participants and teacher constructed the model of the cone. The cone was used to deduce the curved surface area of a cone.



The sector

fig.1



A Cone

fig.2

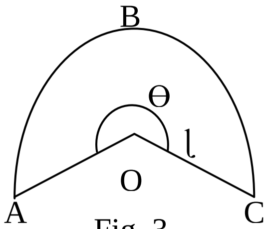


Fig. 3

The formula for the curved surface area of a cone is πrl where r=radius of a cone, l= slant height of a cone. The area of the base of the cone is πr^2

$\therefore$ the total surface area of the cone is $\pi rl + \pi r^2 = \pi r(l + r)$

Step V: Home-assignment. Participants were given cardboard to construct a cone with a given specified radius. Participants were asked to collect 3-D objects that are spherical in nature. Examples of spherical shapes as ball, onion, apple etc.

WEEK 5

Topic: Properties of Pyramid and Sphere.

Objectives:

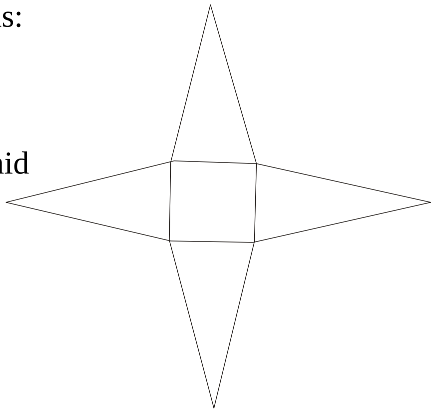
- To review the previous lesson.
- To take the participants out of class.
- To construct the net of square -based pyramid using cardboard
- To discover the properties of a pyramid and a sphere.
- To draw a sphere

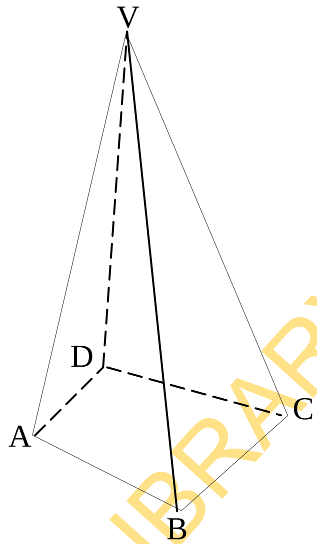
Step I: The teacher welcomed the participants and reviewed the previous lessons with them. Participants were taken out of the class to collect 3-D objects within the school community. The 3-D objects collected from school and the ones from home environment were used to form mathematics laboratory.

Step II: The teacher distributed the spherical object and wooden pyramid to the participants to feel and to observe. The participants were led in identifying the properties of a square-based pyramid modeled by the researcher. With card-board, a net of a square based pyramid was constructed.

Step III: A chart of a square-based pyramid was given to the participants to use to answer the following questions:

The net of a pyramid





Questions

a. What is the shape of face VDA?

b. What is the true shape of face ABCD?

c. How many edges meet at the vertex V?

d. How many faces has the pyramid?

e. How many faces are triangular and how many are square in shape?

Step IV: The participants examined different spherical objects which led to the identification of the properties of a sphere. Use the knife to cut onion into two equal parts. What can you say about each half of the onion? What is the name given to it? What can you say about the edge of the ball, face and vertices? They were led to discover the properties themselves. Home-assignment: Participants were given card-board to construct a net of a pyramid and also collect empty cylindrical objects and conical objects.

WEEK 6

Topic: volume of cube and cuboids

Objectives:

- To take the participants out of class
- To improvise the mathematics laboratory using the collected local materials
- To review the previous assignment
- To guide the participants discover the volume of cube and cuboids

Step I: Taking participants out of class. Improvisation of mathematics laboratory

The teacher used the 3-D objects collected by the participants from their local environment to improvise mathematics laboratory

Step III: Discussion on the previous session

The teacher reviewed the previous session with the participants.

Step IV: Calculation of the volume of cube and cuboids.

Step VI: The participants were given different sizes of cube and cuboid to measure their dimensions and record in their note book. With those dimensions, the participants were led to the volume of a cube and cuboids. Thus, length of the block (L) = 12cm, Breadth of the blocks (B) = 6cm and Height of the block (H) = 4cm.

Volume of the block (V) = L x B x H x cm x cm x cm

Volume = 12x6x4xcm^3

= 288cm^3

Volume of the cube of sugar measured by the participants implied length (L) x Breadth (B) x height (H) x cm x cm x cm

$\Rightarrow$1½cm x 1½cm x 1½cm $\Rightarrow$3/2 x 3/2 x 3/2 cm^3 = 27/8

Step VII: Home-assignment

Participants were asked to measure the dimensions of a cube of magi and box of match and calculate their volumes.

WEEK 7

Topic: Volume of Cylinder and Cone

Objectives:

- To discuss the previous home-assignment
- To take the participants out of class
- To improvise mathematics laboratory
- To construct cylinder and cone

Step I: The teacher welcomed the participants and expressed appreciation for their cooperation and regular attendance.

Step II: Out of class activity

The teacher took the participants out of the class to collect the 3-D objects that relate to participants' real life situation

Step III: Discussion on the previous session

Previous session was reviewed and home-assignment was discussed.

Step IV: Construction of cylinder and cone

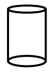
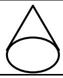
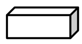
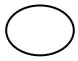
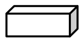
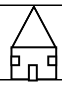
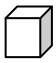
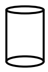
The teacher distributed the 3-D objects (cylinder and cone) to the participants. The teacher guided the participants in constructing a cylinder and a cone with the same radius and the same height. The teacher used the constructed cylinder and cone to let the participants establish the relationship between the volume of a cylinder and cone. The participants were asked to fill a cone with sand and pour the sand into the cylinder until the cylinder is filled up. How many cones of sand fill the cylinder? To deduce the formulae of the volumes of cylinder and cone, you have seen that the volume of cone = $^1/_3\ \pi r^2 h$.

Step V: summarize the whole session

The completion of the table of identification.

The participants identified and related the given 3-D objects to real world Common solids

Table 1: This was done to see the extent they could identify and relate geometrical objects to their real world.

S/N	Name of objects	Freehand drawing	Name of basic shape
1	Tin of margarine		
2	A plastic funnel		
3	Block		
4	Onions		
5	Exercise book	- 	
6	A mound of groundnut		
7	A cube of magi		
8	Milk tin		
9	Sharp-end of a pencil		
10	Half of the orange		
11	Moon		

Sorting and classification table

Step VI: Home -assignment

Participants were asked to construct a cylinder and a cone having the same radius and the same height in groups of five consisting of 8 members each. Card-boards and cellotapes were given to them by the teacher. The teacher instructed the participants to use the cylinder they have constructed to find the number of faces, edges and vertices a cylinder has. Also the participants were asked to collect five local 3-D geometrical objects and relate them to their real world like the table above.

WEEK 8

Topic: Administration of post-test measures and official termination of the training.
Objectives:

- To obtain post-test measures
- To summarize the whole session
- To formally terminate the training

- To appreciate the participants

Step I: General summary of all the sessions

Step II: Administration of post-test measures

Step III: The teacher administered achievement test in Geometry and Geometry attitude scale to the participants and collected them back at completion.

Step IV: Formal Termination of the training. The teacher appreciated the participants and commended the participants for their active role they played all through the training. The participants were encouraged to see that mathematics is real and not abstract. Secondly, mathematics is culture of people Participants were enjoined to develop positive attitude towards geometry as geometry is useful in their lives.

APPENDIX VI

TRANINING PROGRAMME (GCS)

WEEK 1

General Orientation and Administration of Pre-test measures

Topic: Orientation and administration of instrument to obtain baseline data.

Objectives:

- To introduce one another.
- To acquaint the participants with the benefits of the training programme and the roles they would play.
- To inform the participants about the rules of the training.
- To obtain the baseline data.

Step1: Self-introduction between the researcher and the participants.

The counsellor welcomed the participants and introduced herself to familiarize with and sensitize the participants. The participants were also instructed to introduce themselves individually by mentioning their names only. The counsellor urged the participants to feel free to make their contributions to the programme by expressing their own views and opinions in a polite way by respecting the views of others.

Step II: **Acquitting the participants with the benefits of the programme.**

The counsellor acquitted participants with the nature and objectives of the training programme. The counsellor highlighted the benefits the participants might derive from the training, if they participated meaningfully. Such benefits might include the development of positive attitudes towards Mathematics (geometry included), high level of self-efficacy and improvement in their academic performance.

The counsellor emphasized the need for participants to cooperatively participate effectively in all the eight training sessions, as this would enable them to follow the programme sequentially and logically, since the outcome of the programme depended on their complete participation in the training programme, and the training programme was cumulative in nature. This implied that any break in session would create a gap in knowledge, which might deprive the participants of the full benefits of the programme and therefore prevent the programme from producing the desired result.

Step III: Administration of the pre-test measures.

The counsellor informed the participants that they would complete some tests. Participants were advised to complete all items in the test and give correct information. She informed the participants that the scores on the tests had nothing to do with their school grades. The counsellor did this to reduce anxiety from the participants.

The counsellor highlighted her role in the programme, which included assisting, guiding, discussing, teaching and advising participants as well as coordinating the training programme in such a way that the psychological, as well as the academic performance of the participants might be enhanced.

The counsellor administered the instruments for the pre-test measures. SST, ATG MSES and GAS were distributed to all the participants. She explained to them what they were supposed to do and how they were expected to respond to the instruments. After the explanation, she inquired from the participants if the procedure was clear, giving them the opportunity to signify where they did not. The counsellor reiterated the need for participants to objectively respond to the items in each of the tests as scores on the instruments were for research purpose and not related to their school grade. The counsellor collected the instruments after the participants had responded to each of the instruments one after the other. Scores obtained from the tests during this session formed the pre-test scores.

Step IV: Agreement on time and venue of meeting.

The venue and time of meeting was same as in group 1(OCA) except that the day of meeting was Thursday.

Step V: Home-assignments

The counsellor also emphasized the need for the participants to do the home-assignments that would be given to them. The counsellor informed the participants that assignment would provide greater opportunity for them to practice and familiarize themselves with the skills that were being taught. The counsellor concluded the session by thanking the participants for volunteering to participate in the programme. The counsellor encouraged the participants to ensure that they participated fully in all the sessions and gave them the following home-assignment.

The participants were requested to list from home reasons why they attend schools. The aim is to enable participants to see the need of setting a goal in their study. This is also meant to assist them in self-appraisal before the next session.

WEEK 2

Topic: **The goal of coming to school**

Objectives:

- To appreciate the participants for coming.
- To discuss the previous home-assignment.
- To inform the participants about the goal of coming to school

Step I: The counsellor welcomed the participants and appreciated them for their punctuality.

Step II: Review of the previous homework

Step III: The counsellor asked the participants the reason why they come to school. The participants responded that they have come to school to learn. The counsellor informed the participants that they have come to school to learn, so that after leaving the Junior School, they will transit to Senior School where they will write the Senior School Certificate Examination (SSCE) with which they will gain admission into tertiary institution (University, Polytechnic, College of education, School of nursing, and School of Surveying). The counsellor informed the participants that before they can gain admission into any of these tertiary institutions, they must obtain credit pass in certain school subjects, especially English and Mathematics. Research findings have shown that most students could not transit to the tertiary institution because students' performance in mathematics was poor. The Joint Examiners' reports as well as Adeleke (2007) and Adegoke (2002) have shown that the major area where students have problem is in the area of geometry (a branch of mathematics).

Step IV: Home-assignment.

What are the reasons for not performing well in mathematics (geometry included)? What are the conditions for gaining admission into institutions of higher learning?

WEEK 3

Topic: The concept of Cognitive Behaviour Therapy and Cognitive Distortions

Objectives:

- To discuss the previous home-assignment
- To explain the concept of CBT.
- To identify some cognitive distortions.

Step I: **review of the previous home-assignment**

The counsellor reviewed the discussion of the previous session home-assignments with the participants. She asked the participants to read out the information they recorded on their note books on the condition for gaining admission to institution of higher learning..

Step II: the concept of CBT

It has been observed that among the reasons listed by the participants why students are not performing well in mathematics is that the subject is difficult and also, that it is too abstract. This is a misconception (wrongly-held notion about mathematics). Psychologists say that most of our emotions and behaviours are the results of what we think or believe about ourselves, other people, and the world. These cognitions shape how we interpret and evaluate what happens to us, influence how we feel about it, and provide a guide to how we should respond. Unfortunately, sometimes our interpretations, evaluations, and underlying beliefs thoughts contain distortions, errors, or biases that are not very useful or helpful. This results in unnecessary suffering and often causes us to react in ways that are not in our best interest. It is on this line that this training programme tagged Cognitive Behaviour Therapy (CBT) is being organized. This programme, CBT is intended to assist you in modifying your negative thought patterns about the subject, mathematics. The principles involved in this programme include a systematic and goal-oriented procedure through the use of cognitive behaviour therapy techniques. These techniques were discussed below in the subsequent sessions.

Step III: identification of some cognitive distortions.

The term "cognitive distortion" refers to errors in thinking or patterns of thought that are biased in some ways. They may include (A) interpretations that are not very accurate and selectively filter the available evidence, (B) evaluations that are harsh and unfair, and/or (C) expectations for one and for others that are rigid and unreasonable. The more a person's thinking is characterized by these distortions, the more they are likely to experience disturbing emotions and to engage in maladaptive behaviour. For example, if a student thinks or believes that the subject is difficult, that feeling or that thinking may affect his performance in that subject. A number of cognitive distortions have been identified. These include:

(1) Mind reading: This implies reading more into the mind of others more than is really there or can be described as when you jump to conclusions or make assumptions (usually negative about what others may be thinking about you or what you talk about yourself).

(2) Mental filter: Focusing on a single negative detail and dwelling on it exclusively until one's vision of reality becomes darkened.

(3) Name-calling or Labeling criticism: Attaching a negative name (label) to oneself or others instead of discussing the actual behaviour or action. Or continually putting oneself down (often more than you would others).

(4) Magnification or minimization: magnifying the negative and minimizing the positive.

Step IV: Homework. The counsellor asked the participants to write down two examples of cognitive distortions and their meanings.

WEEK 4

Topic: CBT Techniques (case study)

Objectives:

- To welcome the participants.
- To review the previous home-assignment
- To modify maladaptive thought patterns using CBT techniques (a) Cognitive Rehearsal and (b) Validity Testing)

Step I: The counsellor welcomed the participants to another session and requested for the home-assignment that was given to them. This was discussed and more light was shed on the participants' given responses.

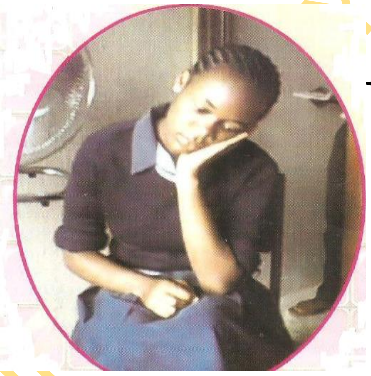
Step III: CBT Techniques

The counsellor introduced the topic for discussion cognitive rehearsal and validity testing.

Discussion:

The counsellor informed the participants that the essence of this (cognitive rehearsal) was to allow the participants to imagine a difficult situation they have faced in the past. The participants were then informed to list the problems they have encountered in the past in the process of learning mathematics**.** The participants listed the problematic situations they have encountered. The counsellor in a step-by-step manner probed the genuiness of those problems (validity testing). The counsellor guided the participants on the possible solution to those problems. The counsellor advised the participants to be practicing all what they have discussed during the session.

A case study of a student with self-defeating thought patterns about mathematics .



Step III: **Effects of self-defeating thought patterns about mathematics (geometry included).**

It promotes negative attitude towards the learning of mathematics.

It could result to poor academic performance.

It can reduce motivation towards the acquisition of mathematical skills.

It could debar one from achieving one's life goals.

Step IV: Home-assignment: The counsellor informed the participants to imagine any difficult situation they may face in the course of learning and suggest possible solution(s).

WEEK 5

Topic: Writing in a Journal and guided discovery.

Objectives:

- To appreciate the participants.
- To discuss the participants' home-assignment.
- To explain the CBT techniques.

Step I: appreciation

The counsellor thanked the participants for their punctuality and regularity. She equally appreciated them for the cooperation and contribution during each session.

Step II: The counsellor reviewed the previous session.

Step III: The counsellor requested for the homework given to the participants last session. The various problems imagined and possible solutions suggested were discussed.

Step IV: The counsellor introduced the new topic for the session __Writing in a Journal and Guided discovery.

Discussion

The counsellor asked the participants to mention aids to memory. Among the aids listed was record keeping. The counsellor informed the participants that they need to maintain a diary to keep an account of situations that arise in their day-to-day activities. They were advised to write the thoughts that were associated with those situations and behaviours they exhibited toward the situation. The counsellor gave an example of a student who thought that the mathematics counsellor would not come to school; the situation that arose was that he did not bother to bring his math notebook to school and the counsellor came. The behaviour exhibited was absenteeism in the math class because he felt that his math teacher might discover this and punish him.

The counsellor explained what is meant by cognitive distortion and explained to the participants what to do in order to modify their behaviours.

Step V The counsellor responded to various questions being asked by the participants.

Step VI: Home Assignment: The counsellor instructed the participants to write three names of people they would wish to be like, as well as the reason why they want to be like them.

WEEK 6

Topic: Modelling and Homework

Objectives:

- To welcome the participants
- To discuss the previous home-assignment.
- To modify cognitive distortions using the techniques of modelling and homework

Step I: Welcoming participants

The counsellor commended the participants for their regularity and cooperation.

Step II: The counsellor reviewed the previous session. The given home-assignment was collected by the counsellor and discussed.

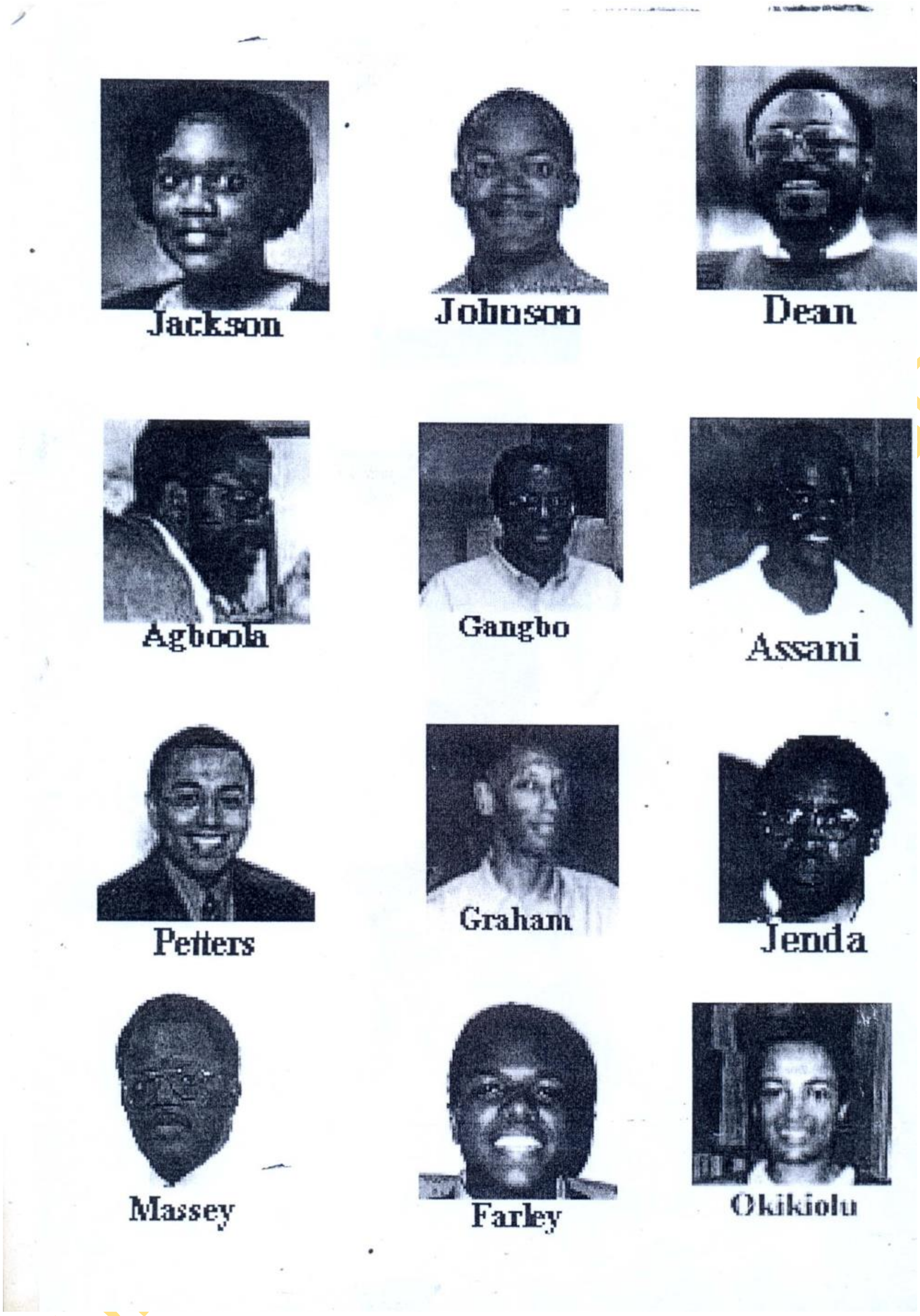
Step III: Modelling and Homework

Discussion

The counsellor introduced the topic for the session_ modelling and homework. The counsellor prompted the participants to identify the names they would wish to be like with reasons. Each response was used to treat expected behaviour.

Modelling: Modelling is a behaviour change method that provides ample experience to the observer who might imitate the observed behaviour. The counsellor instructed the participants about the models of great mathematicians to enable them formulate appropriate cognitive logical thought patterns for dealing with mathematics problems. The pictures were displayed. The counsellor asked the following questions from the participants:

The model of great mathematicians



Are these models of mathematicians' only males?

What can you say about their ages?

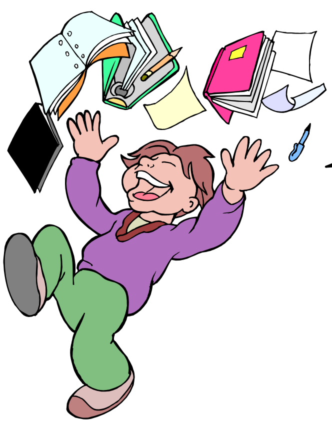
Are they old?

Do they have positive attitude towards mathematics?

The counsellor let them know that gender is not a barrier in studying mathematics. Both male and female can achieve greatness in mathematics if they have positive thought patterns and attitude towards mathematics and also work hard like these great mathematicians. For example, Ezilo & Katherine Okikiola achieved great success in mathematics. Secondly, the counsellor informed them that age is not the determinant of success in the learning of mathematics. Any person can learn mathematics irrespective of their ages, whether young or old. For you to be as successful as those models you mentioned and these mathematicians also, you must be a self-regulating (self- control) students who must be ready to do his or her own mathematics homework (homework techniques).

Doing homework helps to broaden one's knowledge and facilitates understanding. It is therefore necessary that homework should be seriously carried out without procrastination (postponement). The counsellor instructed the participants that any homework given to them by teacher must be done immediately. Any homework that is difficult should not be kept aside, because if you do, the homework might either not be done or it might be poorly done or it might not be done at all. The counsellor further informed the participants about the importance of homework using a case study of a student who does his homework conscientiously and these leads to better understanding of mathematics, which eventually leads to enhanced performance in mathematics. The counsellor instructed the participants to always do their homework.

Step IV: A case study of a student who does his homework regularly and also having positive thought patterns about mathematics.



The counsellor explained that it is the liking in mathematics with the doing of his homework that might have brought about good performance in mathematics. That is

A- Liking for mathematics

B- Regular doing of homework

C- High scores

Step V: Home-assignment

The counsellor asked the participants to write three importance of homework to them.

The counsellor asked the participants to write three things to be done by a student who wants to acquire ability to know mathematics.

WEEK 7

Topic: Cognitive Behaviour Therapy Technique - systematic positive reinforcement
Objectives:

- To appreciate the participants
- To discuss the previous session and the given home-assignment
- To acquire mathematical skills using the CBT technique, systematic positive reinforcement

Step I: Appreciation

The counsellor appreciated the participants for their cooperation and regularity from the beginning of the training.

Step II: The home-assignment was requested for, collected and discussed by both the counsellor and the participants.

Step III: The counsellor introduced the new topic for discussion- systematic positive reinforcement.

Discussion

The counsellor told the participants the story of a girl, Felicia who wanted to study Mechanical Engineering in the university but was deficient/weak in mathematics. She was good in other subjects but her major problem centered on mathematics which was the major skill needed for

Felicia to be able to fulfill her desire. The counsellor asked the participants to tell her what they (the participants) think that Felicia should do in order to improve her mathematics ability? The counsellor first of all wants to know what the participants would suggest the Felicia could do so as to possess mathematical skills. The counsellor prompted the participants to give their own suggestions to the class. The Participants were actively involved in the discussions.

Step IV: Interaction and discussion ensured between the participants and the counsellor.
Responses of the participants

i) "Felicia should read her mathematics book every day."

ii) "She should make sure that she does her mathematics assignment promptly"

iii) "If she does not have mathematics text book, she should buy one"

iv) "Felicia should move with friends who know math better than her so that they would teach her "

v) " she should employ the lesson teacher to teach her mathematics at home "

vi) "She should tell her math teacher about her problem".

Step V: However, the counsellor told them that they all answered well. She informed the participants what Felicia did in other to improve her mathematics ability. Felicia sought the help of a counsellor who gave her counselling remedy on mathematics.

Step VI: The counsellor explained that the past records of Felicia's mathematics scores were checked and it was discovered that Felicia has not been performing well in mathematics. Felicia was instructed that self-defeating thought can affect academic performance. Therefore, she should first of all believe that she can perform well in the subject in question, mathematics. The counsellor explained the importance of mathematics to Felicia and enjoined her to work harder. After the counselling, Felicia was determined to be studying mathematics everyday. The Continuous Assessment test was given, Felicia out performed the whole class. The mathematics teacher asked the class to clap for her (positive reward). Also, at the end of the term, Felicia scored the highest mark in mathematics and she was given a new mathematics text book (positive systematic reinforcement). Positive systematic reinforcement can be described as the step –by- step method of giving reward to individual in order to increase the probability of emission of desirable behaviour in that individual.

Step VII: The counsellor used the case of Felicia to inform the participants about the importance of mathematics also, letting them know that rational thinking can promote good performance in mathematics. The counsellor explained that one of the profitable things a student who wants to learn could do is to have determination to achieve and then, to study. Determination is by personal choice and all profitable life enterprises require the force of determination and hard work. The counsellor stressed that learning mathematics is a profitable exercise that requires regular attendance of classes, prompt doing of assignment and constant study. Counsellor emphasized that any student that does that would be rewarded just as the same way Felicia was rewarded for passing her mathematics examinations. The story was summarized by the counsellor as follows: Cognitive Behaviour Therapy. Table of a student who requires improvement on general mathematical ability.

Situation	**Requiring improvement of general mathematical ability.**
Automatic thoughts	I can not achieve my dream of becoming a Mechanical Engineer if I am deficient in Mathematics. I am a failure (name –Calling, magnifying negative and minimizing positive
Emotions	Sad/depressed, Discouraged
Behaviour	Not studying mathematics.
Counsellor	Evaluate and modify the behaviour. Baseline data were sought by digging into her previous mathematics records. How many times do you study mathematics a week? Don't you think that increasing the period of studying mathematics per week can improve your proficiency? Allocate more time to mathematics since it is identified as a problem subject. Regular attendance of classes, promt doing of home-assignment and determination to succeed. Success is the product of hardwork, so work hard.

Step VIII: Home-Assignment.

The counsellor asked the participants to (a) enlist ten other things a student can do to acquire mathematical ability and (b) seven CBT techniques they had learnt in the course of training. (c) Give one reason why they study the techniques.

WEEK 8

Topic: Administration of Post-test measures and Termination of the training

Objectives:

- To summarize the whole session
- To obtain post-test measures
- To formally terminate the training programme
- To appreciate the participants

Step I: General Summary of all the sessions

The counsellor, using the previous home-assignment summarized the whole session. She elicited questions and provided answers. She clarified issues that were mentioned by the participants.

Step II: Administration of post-test measures

The counsellor assisted the researcher in administering Achievement Test in Geometry and Geometry Attitude Test Scale and collected them on completion .

Step III: Formal termination of the training

The counsellor appreciated the participants for their active participation and cooperation. She enjoined the participants to maintain the gain of the training.

APPENDIX VII

RESEARCHER'S INSTRUCTIONAL GUIDE IN GEOMETRY (RIGG)

WEEK 1 SAME AS IN OCA AND GCS

WEEK 2

Subject: Geometry

Topic: Identification of 3-Dimensional objects.

Instructional Objectives: By the end of the lesson, the participants should be able to:

(i) Define 3-Dimensional objects.

(ii) List six examples of 3-Dimensional objects.

(iii) Differentiate 3-D from 2-D objects.

Instructional Materials: Chalkboard and diagrams relating to the concept of the day.

Previous Knowledge: Participants are familiar with different shapes such as square, rectangles, circle and triangles.

Presentation: The explanation of the topic

- Concept of 3-Dimensional objects
- Teacher instructed the participants to give examples of 2-Dimensional shapes they had studied in JSI (square, rectangle, circle etc.). The teacher instructed them to list other solid shapes they can see around their homes or in their school environment (Milo tin, play ball, funnel, a cube of sugar, magi cube and a matchbox). Teacher explained that these other solid shapes such as Milo tin, play ball, funnel, a cube of sugar, magi cube an hut and a matchbox are called 3-Dimensional shapes. They are different from the 2-Dimensional shapes you have studied in JSI. 3-Dimensional shapes have a common property, an inside and an outside. While 3-Dimensional shapes have length, breadth and height, the 2-D shapes have only length and breadth. 3-Dimensional objects can be written as 3-D shapes or 3-D objects. Examples of 3-Dimensional shapes were written and drawn on the chalkboard.

The following questions were asked from the participants to review the whole lesson.

(a) Explain what is meant by 3-D objects.

(b) Name six types of 3-D objects.

(c) Give an example of each of the 3-D objects mentioned in (b).

(d) What is the shape of (i) a sheet of paper? (ii) a hut (iii) the moon

(e) What is the difference between 3-D and 2-D objects?

Participants responded to the questions above.

Home-assignment: Participants were asked to write down five everyday objects that are 3-D in shape and five that are 2-D.

WEEK 3

Topic: Surface area of cube and cuboids

Duration: 40 minutes

Instructional Objective: By the end of the lesson, the participants should be able to:

1) Identify the following terms (i) ii) faces (iii) edges and vertices of cube and cuboid.

ii) Define each of (i) above

iii) Explain the properties of cube and cuboids

iv) Calculate the surface area of cube and cuboids

Previous Knowledge: Participants could explain the meaning of 3-Dimensional objects

Instructional Material: chalkboard.

Presentation: Explanation of the concept.

Teacher discussed the properties of cube and cuboid with the participants.

Definition

Surface: The outer view of a solid is called its surface

A face: A face is any of the pieces which make up a surface

An edge: An edge is a line where two or more surfaces meet. It may be curve or straight

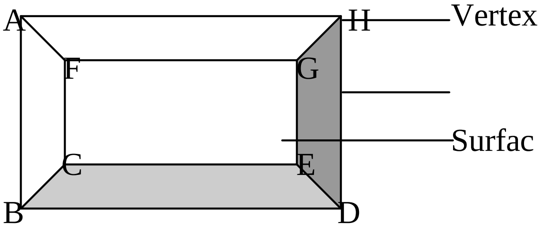
A Vertex: A vertex is a point or corner where three or more edges meet.

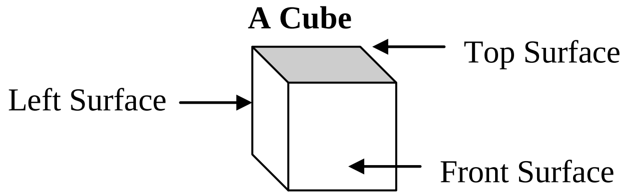
Properties of a cube and cuboid

A cube: A cube is a 3-diemnsional object with equal size. It has equal length, breadth and height. It may be described as a cuboid in which all the six faces are square.

A cube has six faces, eight vertices and twelve edges. Examples are magi cube, ludo dice.

A cuboid





Cuboids: cuboids are examples of 3-D objects. Each of the faces of cuboids has the shape of a rectangle. The face of the cuboids could either be flat (plane) or curved. Cuboids also have six faces, eight vertices and 12 edges. Examples of cuboids are chalk box, match boxes, textbooks,

Calculation of surface area of cube and cuboids. Explanation of how to calculate the surface areas of cube and cuboids was given by the teacher. Thus, cube has 6 equal faces. Each of the faces is a square. Area of one of the square faces is Length x Breadth = Lx B =Lx L (since L=B), that is, L^2

To find surface area of the 6 faces implies $6xL^2 = 6L^2$ square unit

Cuboids: cuboids have 6rectangular faces. Surface area of cuboids is, LB +LB + BH + BH + LH+ LH

= 2LB + 2BH + 2LH

= 2 (LB+ BH + LH) square unit.

Examples are done on the chalkboard. What is the surface area of a cube of 7cm long? (b) Calculate the surface area of a cuboid with dimensions 6m by 5m by 3m.

Solved examples

Cube: length =7cm, Breadth

=7cm,

i.e, L=B =7cm Surface area of a cube

$= 6\ell^2 = 6 \times \ell \times \ell$

Surface area = $6 \times 7 \times 7\ cm^2$

$= 294cm^2$

Cuboids with length 6, breadth 5 and height 3 has the

Surface area = 2 (LB+ BH + LH)

=2(6x5 + 5x3+ 6x3)

= 126cm^2

Home-assignment

Find the surface area of (i) a cube of sugar and (i) cuboid of a chalk box.

WEEK 4

Topic: Surface Area of Cylinder and Cone

Duration: 40 minutes

Instructional Objectives**:** By the end of the lesson, the participants should be able to:

(i) Explain the properties of cylinder and cone.

(ii) State the formulae for the surface area of a cylinder and a cone.

(iii) Calculate the surface area of (a) cylinder and (b) cone

Previous Knowledge: The participants could explain the properties of cube and cuboid.

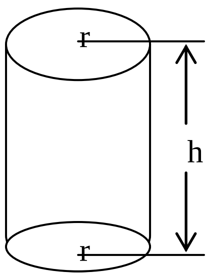
Instructional Materials: Chalkboard, meter ruler and a sheet of paper.

Presentation: The teacher reviewed the previous session and introduced the new lesson to the participants.

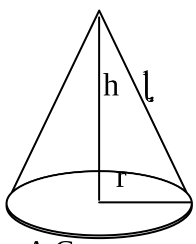
The objects like milk tin and Bornvita tin you know are called 3-D objects. They have some properties which can be used to identify them.

Cylinder: Cylinder can be described as a 3-D object with round ends and long straight side. The surface of a cylinder consists of three faces: flat top face, round face and bottom flat face. The cylinder has two plane faces and one curved one. It has two edges and no vertices. The two plane faces are both circles.

Cone is another example of 3-D object and examples are funnel, a sharp end of a pencil,or biro. The base of a cone is a plane circle. It has two faces, one vertex and one edge.



Cylinder



A Cone

Surface area of cylinder and cone.

Cylinder: Participants are familiar with the areas of the circle and rectangle. A plane sheet of paper was folded into a cylindrical shape. This is made up of three regions.

A=the circular top

B = curved surface

C= the circular base. The circumference of the circle is $2\pi r$. The circular top of the cylinder becomes the length of the rectangle $2\pi r$ and the height of the cylinder becomes the breadth of rectangle. The formula for the area of the curved surface of the

cylinder = L x B = $2\pi r$ x h

= $2\pi r$ h.

While the total surface area of a cylinder is the area of curved surface + area of the top + area of the base. Therefore, for a cylinder of radius r and height h, the total surface area is

$2\pi r h + \pi r^2 + \pi r^2$

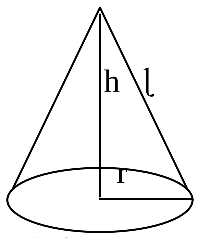
$= 2\pi r h + 2\pi r^2$

$= 2\pi r (h + r)$

Curved surface area of a cone is given by $\pi r l$ where radius of the cone =r and slight height $l = l$.

The area of the base of the cone is πr^2

$\therefore$ the total surface area of the cone is $\pi r l + \pi r^2 = \pi r (l + r)$



A Cone

Example one.

Calculate the surface area of the cylinder of r= 2cm, h = 14cm.

Solved problem

Radius of the cylinder = 14.

Height of the cylinder = 2cm

Area of the curved surface of the cylinder = $2\pi r$ h

=2 x22 x2 x14/7

= $176cm^2$

Cone. Curved surface area of a cone is given by $\pi r l$. Find the area of curved surface of cone with radius 7cm and length of slighting side 10cm.

Area is given by nrl = 22/7 x7 x 10 cm^2

=$220cm^2$

Home- assignments. Calculate the surface area of each of the following cylinders.

Radius=3cm, height =21cm (b) radius =28, height = 10 (c) what is the radius of a cone with slight side of length 10cm and curved surface area of $220cm^{2?}$

WEEK 5

Topic: Basic properties of Pyramid and Sphere

Duration: 40 minutes

Instructional Objective: By the end of the lesson, the participants should be able to:

(i) State the properties of a pyramid and sphere.

(ii) Draw pyramid and sphere.

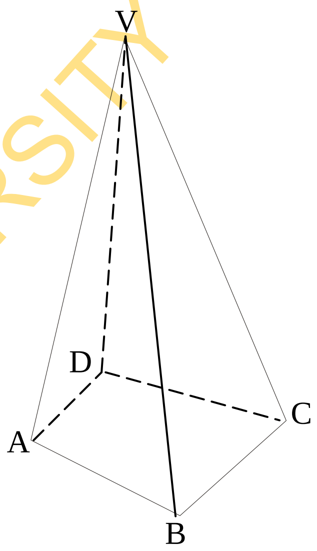
(iii) Give examples of pyramid and sphere.

Previous Knowledge: Participants are familiar with the mound of ground, rice, beans, hut, ball.

Instructional Materials: Chalkboard, diagrams.

Concept of pyramid and Sphere

The teacher reviewed the previous assignment and introduced the new lesson to the participants.



A Pyramid

The name pyramid is derived from the shape of its base-face.

A square-based pyramid has five faces, five vertices and eight edges. Four of the faces are triangular and one is square. Examples of pyramid are huts, mounds of ground, rice, beans

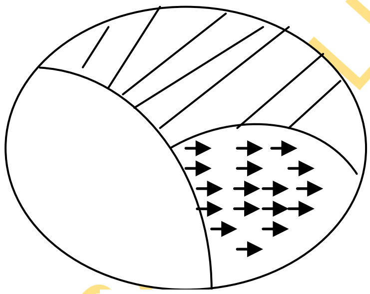
Sphere: A sphere is another type of 3-dimensional object. It is described as a solid figure that is not completely round but spherical in shape; and every point on its surface is at equal distance from the centre. Examples of a sphere are play ball, the shape of the earth, apple. Half of a sphere is called a hemisphere. A typical example of a hemisphere is half of a moon

Properties of a sphere

A sphere has no edge.

It does not have any vertex.

A sphere has only one face.



A Sphere

Summary Table

Name	No. of Vertices	No. of edges	No. of faces
Pyramid	5	8	5
Sphere	0	0	1

Home-Assignment: Give three objects each under the following 3-D shapes:

(a) Pyramid (b) sphere

(2) How many vertices has a pyramid and how many has a sphere?

Draw a net of a pyramid on the given cardboard and submit to the teacher.

WEEK 6

Topic: Calculation of Volume of a cube and a cuboid

Duration: 40 minutes

Instructional Objectives: By the end of the lesson, the participants should be able to:

(i) Define the following terms: (a) volume (b) capacity.

(ii) Identify the unit of (a) volume (b) capacity

(iii) Write down the formulae for the volume of cube and cuboid.

(iv) Calculate the volume of a cube and cuboid

Previous Knowledge: The participants are familiar with things in their local environments

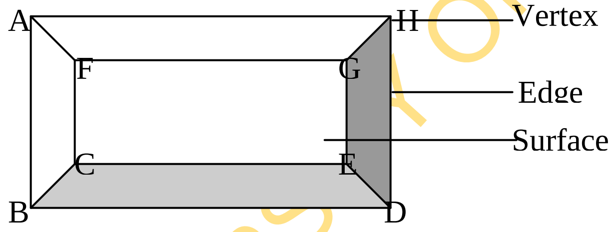
Presentation: Explanation of the volume.

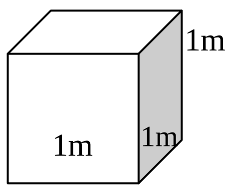
Volume: Volume refers to the amount of space an object can occupy. Or the measure of the space occupied by a solid shape is called the volume of the shape. The units of volume are cubic centimeters and cubic meters. Teacher explained that every measurement that is carried out has its units. The unit of volume can be measured in cubic centimeters (cm^3) or in cubic meters (m^3), the choice of a unit of measurement to a large extent should depend on the object(s) being measured.

Capacity: The capacity of a container is the amount of liquid it holds. The basic unit of capacity is the liters or centiliters. For example, the capacity of the liquid in Coca-Cola bottle is 35cl or 50cl and the capacity of engine oil in a gallon is 4 liters.

Volume of a cuboid

A cuboid





The volume of 3-D object is base area multiply by height. But cuboid has a rectangular shape, therefore,

Volume=Base area x height

Where base area =length x breadth

Hence,

Volume of the cuboid is

= L x B x H cubic centimetre

Example1: A match box has lenght 4cm, breadth 3cm and height 2 cm.

Volume = LxBx H

= 24cm^3

Example2

What is the volume of a cube whose length, breadth and height are 6cm, 6cm and 6cm, respectively.

Volume of a cube = L x B x H =6 x 6 x 6 x cm x cm x cm

=216cm^3

Home-Assignment: (a) Find the volume of the following

L = 6cm, B = 3cm and H = 4cm

3cm, 3cm and 3cm

5cm, 5cm and 5cm

10cm, 5cm and 3cm

WEEK 7

Topic: Volume of Cylinder and Cone.

Instructional Objective: By the end of the lesson, the participants would be able to:

- review the previous assignment
- Calculate the volume of Cylinder and Cone applying the formulae.

Volume of Cylinder

Participants should remember that

Volume =base area x height.

Again, remind the participants that cylinder has a circular base.

Therefore, the volume of cylinder is circular base x height

= nr^2 x h

= nr^2h cubic unit

Example1: Calculate the volume of cylinder of height 7cm and radius of 7/2

Volume = nr^2h

= 22/7 x7/2 x7/2 x 7

=1191/2cm^3

Volume of cone:

Volume of the cone = 1/3 of the cylinder volume

=1/3$\pi r^2 h$

Example2: calculate the volume of a cone with base 8cm and height 5cm.

Volume of the cone = $1/3\pi r^2 h$

$= 1/3 \times 22/7 \times 8 \times 8 \times 5$

$= 335cm^3$

Home-Assignment: (1) Find the radius of a cone whose volume and height are $1100cm^3$ and 7cm respectively.

(2) If the volume of the cylinder is $1408cm^3$ and the radius is 9cm find the height in cubic metre.

WEEK 8

Administration of post-test measures.

Instructional Materials: Chalkboard, all the post-test instruments: Achievement Test in Geometry and Geometry Attitude Scale.

Objectives:

- To generally review all the sessions and conduct final evaluation.
- To appreciate the participants.
- To obtain post-test measures.

Presentation: The teacher reviewed all the sessions and emphasized that all the activities were aimed at enhancing their attitude and improving performance in mathematics generally, especially in the area of Geometry. Achievement Test in Geometry (ATG) and Geometry Attitude Scale (GAS) were administered with the help of the Research Assistants. They were collected on completion.

The teacher appreciated the participants for their patience, regularity and full participation throughout the sessions. The teacher's Instructional Guide in Geometry (RIGG) was used to teach the three groups the Geometry instruction.