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**EFFECT OF COGNITIVE CONFLICT INSTRUCTIONAL STRATEGY ON GEOMETRY ACHIEVEMENT AND RETENTION AMONG SECONDARY SCHOOL**

**STUDENTS IN MINNA, NIGER STATE**

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**Abstract**

*The study determined the Effect of Cognitive Conflict Instructional Strategies on Student’s Achievement and Retention in Geometry among Secondary School Students in Minna, Niger State. The study employed quasi-experimental research design (pretest and posttest experimental and Control groups) Two (2) research questions were raised and two (2) research hypotheses were formulated and tested at 0.05 significant level. The population of the study comprised 8,251 mathematics students (2020/2021) academic session in senior secondary schools in Minna, Niger State.The researcher used an intact class of 71 students (46 male and 25 female). The students were taught using cognitive conflict instructional strategy. Geometry Achievement Test (GAT) was used as research instrument for collecting data for the study. The instrument was validated by three experts and the reliability of the instrument was determined through test and retest method, the data collected were analyzed using Pearson’s Product Moment Correlation Coefficient and reliability coefficient of 0.72 was obtained. After teaching, an achievement test (posttest) was administered on the students and retention test was given after the period of two weeks. The data collected were analyzed using descriptive statistics of mean and standard deviation and independent sampled t-test. The findings revealed no Gender influence on the achievement and retention of students taught Geometry concept using cognitive conflict instructional strategy. The study recommends that: Geometry is about identification, description of shapes and there properties, so teachers’ should teach most of the concepts through cognitive conflict instructional strategy to improve students’ achievement and retention in geometry.*

**Keywords:** Achievement, Retention, Cognitive, Conflict, Collaborative, Geometry

**Introduction**

The school mathematics resulted from the confluence of two traditions. The first rooted in Babylonia astronomy, Egyptian earth measurement and ancient commerce, is mathematics as a reckoning, as a tool required for everyday life. The second tradition is rooted in Greek geometry and medieval algebra, is mathematics as reasoning, as one of liberal art whose mastery marks an educated person. In this tradition, mathematics offers aesthetics satisfaction as well as a means of developing the mind capacity for abstract thought. Every society attempts to pass to its children the language and skills it has acquired or developed for dealing with numerical and spatial problems. When schools are organized to give children grounding in their culture or to achieve their desires, this practical sort of mathematics is what appears in the curriculum (Farhat, 2016).

Among the branches of mathematics is geometry. According to Farhat (2016) geometry is the branch of mathematics that deals with the properties of spaces. He maintained that, geometry in its most elementary form is concerned with metrical problems of determining the areas and diameters of two dimensional figures and surface areas and volumes of solids. He further added that other fields of geometry include descriptive geometry, analysis situs or topology, the geometry of spaces having four or more dimensions and non-Euclidean geometry. ***9th Hybrid International Conference of School of Science and Technology Education (SSTE)***

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According to Ahmad (2016) Mathematics is one of the science subjects taught in Nigeria's primary, secondary, and tertiary institutions. It logically consists of thinking, formulating and testing conjectures, making sense of things, forming and justifying judgment, inferences and conclusions. He further added that, geometry is one of the seven major areas in mathematics in content in curriculum and taught at all secondary schools in Nigeria, and it is an aspect of mathematics that deals with the study of different shapes and their properties. Furthermore, Geometry is often taught to students separated from their real life experiences. As a result, they often cannot apply the concepts they have been taught to solve real life problems and in some circumstances, gain no benefits from learning mathematics.

Teaching and learning mathematics is essential to students and important to teachers to impart knowledge more appropriately to students. Therefore, teachers need to use an instructional strategy that can facilitate teaching and learning mathematics more meaningful to ensure that the students pay attention to them so that they should not get lost in mathematics. It is essential to capture students' attention with appropriate methods to motivate students. Every geometry course taught calls on logical and cognitive reasoning and visualization ability. Cognitive conflict is related to the content of mathematics, such as geometry. Because of geometry's cognitive nature, the cognitive conflict has been linked with geometry achievement Mitchemore (2015).

Cognitive Conflict Instructional Strategy is one of the major independent variables to be used in this study. Cognitive Conflict occurs when students are presented with examples which cause them to question their incomplete understanding of geometry shapes (for example rectangle among others), in this strategy the teacher promote Cognitive Conflict in the classroom by having students predict which of the shapes drawn by the teacher matches their expectation. When a teacher causes discrepancy among students in the class or the teacher tried using an approach that will cause uncertainty/conflict on the students’ previous ideas on how to solve geometry problems in order to encourage conceptual change, he/she will use model process cognitive conflict to anticipate how students may experience cognitive conflict. This model process helps a teacher not to let students have conflict by guiding the student out of dissonance or confusion. Mufit *et al*. (2018) defined Cognitive Conflict as a conflict between structure Cognitive (that is, a structural Organized knowledge in the brain) with the environment (For example, an experiment, demonstration, opinions of peers, books, or other), or conflict between concepts in the cognitive structure.

This instructional strategy has recently been receiving much attention in teaching and learning, particularly in the area of mathematics education. There is evidence in the mathematics education literature that significant number of students are often confronted with contradictions between their way of describing and explaining concepts and how such concepts are explained by their peers, teachers, or textbooks. As a result, mathematics educators have a great interest in conceptual change through the use of cognitive conflict, as it is instrumental in promoting deeper learning and conceptual understanding in mathematics (Adnyani, 2020). capture students' attention with appropriate methods to motivate students. Every geometry courses taught calls on logical and cognitive reasoning and visualization ability. Cognitive conflict is related to the content of mathematics, such as geometry. Because of geometry's cognitive nature, the cognitive conflict has been linked with geometry achievement Mitchemore (2015).

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Cognitive conflict refers to a situation where a student is confronted with a discrepancy between their existing cognitive elements (attitudes, perceptions, knowledge, and behaviors) to form new information or ideas (Zazkis & Chernoff, 2016). During mathematics learning, cognitive conflict occurs when students have a preconceived idea about how a mathematical problem should be solved, which differs from how it is being solved (Maumee & Mathews, 2017) Utilizing Cognitive Conflict during Mathematics lessons can help promote the idea of Cognitively Guided Instruction (CGI) which underscores the need for teachers to pay more attention to students during mathematics learning to improve students' thinking and teacher skills in explaining concepts (Jacobs *et al*., 2017). Furthermore, teachers need to appreciate and understand students' existing ideas and understandings and present students with situations that provoke cognitive conflict to reveal the inadequacy of the students' ideas and encourage the formation of new knowledge. Mathematics teaching based on cognitive conflict can improve students' ability to solve Mathematical problems, develop critical thinking and improve their communication skills (Widada *et al*, 2018 Gal*.,* 2019).

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This above strategies can be used to improve students’ achievement and retention in geometry aspect of mathematics.

Achievement is one of the dependent variable in this study. According to Abdullahi (2015) achievement is a positive and optimal output as a result of successive solving of mathematics problem through effort, as a result of hard work. Despite the importance of geometry in specific and mathematics in general, the problem of students' poor achievement and retention capacity in the subject is undoubtedly worrisome and has been a major concern to the educationalist. Unfortunately, teachers and educators in different parts of the world are disappointed about the poor state of geometric skills in our mathematics classroom Royal Society / Joint Mathematical Council (JMC, 2020).

Another important variable in this study is gender. Food and Agriculture Organization of the United Nations (FAO), 2013define Gender in relation to man and woman, both perceptual and material. Gender is not determined biologically due to the sexual characteristics of either women or men but is constructed socially. Gender is a person's self-representation as male or female or how that person is responded to by social institutions based on the individual gender presentation. Yang and Chen (2013) state that among various human factors, spatial ability and gender differences are critical to geometric learning and gender ***9th Hybrid International Conference of School of Science and Technology Education (SSTE)***

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differences play an important role in geometric learning because boys and girls show different outcomes in different learning environments when they learn geometry. Thus, the present study will examine the effect of Cognitive Conflict Instructional Strategy on Achievement and Retention in the Geometry aspect of Mathematics among Senior Secondary School Students (SSII) in Niger State.

**Statement of the Research Problem**

Research studies have revealed that, many students in Nigeria secondary schools are not adequately prepared for geometry concepts and contents (Etsu & Ahmad, 2018). Ahmad and Idris (2017) opined that too much emphasis is often placed on formal symbolism and naming in the curriculum while relational understanding is underestimated. This therefore makes students in senior secondary schools to lack experience in reasoning about geometry. They further stressed that, students would perform well and developed good reasoning about geometry situations if they had substantial experience in geometry during their junior secondary school classes. Therefore, they report that, the above problem is one of the reasons that made most of the secondary school students and the general public at large to erroneously believe and developed the idea that, geometry is difficult to study. No doubt, there is evidence of discontentment in the achievement of students in mathematics at the senior school certificate examination despite the positive roles played by science educators specially Mathematics educators.

It has been reported that teaching and learning of Mathematics, geometry in particular, has been unsatisfactory (Odetola & Salama, 2014). This was compounded by the conventional method of instructions adopted by most mathematics teachers, which led to poor students' comprehension of relevant mathematics concepts, especially in geometry (Abakpa & Iji, 2013). Instructional methods of teaching mathematics have been identified to be one of the reasons why students perform poorly in mathematics, this should be a great reason for mathematics educators to explore more in other modern instructional strategy since, conventional methods of teaching and have relative limitations on students’ academic achievement and retention (Ahmad, 2016).

Thus, it has become necessary to search for an innovative pedagogy capable of improving the students' achievement and retention. Based on this, the study will investigate the effect of cognitive conflict instructional strategy and collaborative instructional strategy on achievement and retention in geometry aspect of Mathematics among secondary school students in Niger State.

**Aims and objectives of the study**

The aim of the study is, to investigate the effect of cognitive conflict instructional strategy on achievement and retention in geometry aspect of mathematics among secondary school students in Minna, Niger State. Specifically, the objectives of the study are:

1. Determine the influence of gender on the achievement of students taught geometry concepts using cognitive conflict instructional strategy;

2. Determine the influence of gender on the retention of students taught geometry concepts using Cognitive Conflict Instructional Strategy;

**Research Questions**

The following research questions were raised to guide the study:

1. What is the difference in the mean achievement scores of male and female students taught geometry concepts using cognitive conflict instructional strategies?

2. What is the difference in the mean retention scores of male and female students taught geometry concepts using cognitive conflict instructional strategies?

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**Research Hypotheses**

The following null hypotheses were formulated and testedat P= 0.05 level of significance:

**HO1:**There is no significant difference in the mean achievement scores of male and female students taught geometry concepts using cognitive conflict instructional strategies;

**HO2:** There is no significant difference in the mean retention scores of male and female students taught geometry concepts using cognitive conflict instructional Strategy

**Research design**

The study used quasi-experimental research design (Non-equivalent, Non-randomized and Experimental-Control group design). A quasi-experimental design is a type of design that aims to establish a cause and effect relationship between an independent and dependent variable.

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| --- | --- | --- | --- | --- |
| **Table 1: Research design layout Groups**  | **Pretest**  | **Treatment**  | **Post-test**  | **Retention**  |
| Cognitive Conflict (Exp I)  | O1  | X1  | O2  | O3  |
| Conventional (Control Group)  | O1  | X0  | O2  | O3  |