# Senior Secondary School Students' Interest on Geometry Teaching Using Geoboard

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***Abstract*** *— This study was designed to investigate the effectiveness of Geoboard manipulatives in senior secondary school students' interest in Geometry. The study sample comprised of one hundred (100) senior secondary school one (SSS1) students which were purposely selected from Degema Local Government Area. The students were made up of two groups, the experimental and the control groups. The experimental group consisted of seventy-four (74) students while the control group consisted of twenty-six (26) students from two (2) government schools in the Local government area. However, the experimental group was taught using Geoboard manipulatives whilst the control group was taught using the conventional (traditional) method. The instrument used for data collection was questionnaire. The reliability of the instrument was tested using Cronbach's Alpha with coefficient of 0.81. The study was guided by two (2) research questions and two (2) hypotheses. The research questions were answered using mean and standard deviation while the hypotheses were tested using z-test at 0.05 level of significant. Findings revealed that there was no significant difference in the interest of students taught Geometry using Geoboard and those taught using the conventional lecture method. Gender did not significantly influence students' interest in Geometry taught using Geoboard. Geoboard was also found to be effective in enhancing and promoting the students' interest in the learning of Geometry.*

**Keywords** — *Mathematics, geoboard, manipulatives, teaching.*

## I. INTRODUCTION

Mathematics is seen today as the mother of all subjects. It is an important subject that is applicable to all facets of life. Everyone in the society makes use of Mathematics on daily basis including market women. Mathematics is seen as a subject that no one should toy with. As a result of this, Ernest and Okyere (2016)[4] explained that the role played by Mathematics in almost all areas of development in live cannot be under-estimated. Mathematics serves as a backbone to all technological advancement in the world. There can be no meaningful development in this modern world of technological era without adequate and sufficient knowledge of Mathematics. The study of Mathematics enhances one's understanding of the world through the use of symbols and abstract representation of phenomena. It is a subject that is very important for the academic excellence of people irrespective of the programme of study. Knowledge of Mathematics is applied in almost every school subject. In Nigeria, Mathematics features prominently as one of the core subjects in the curricula of basic schools, senior secondary schools and colleges of education (Ernest and Okyere, 2016)[4]

According to Ekwueme (2013), [3] Mathematics is seen as the study of measurement, relationships and properties of quantities and set. Mathematics is all about logical analysis, deduction, calculation within this pattern and structures. In the research carried out by Azmidar, Darhim and Dahlan (2017),[2] it was indicated that students' interest in Mathematics is still low because most students have perceived Mathematics as very difficult, boring and not practical. This is as a result of teaching-learning strategies used by the teacher to pass information to the students. The major tasks of every Mathematics teacher should be how to make the teaching of the subject meaningful and attractive to learners so as to arouse the learners' interest by using physical or concrete objects to teach a particular concept in Mathematics (Ernest and Okyere, 2016) [4]. Also, instructors need to create conductive and productive environment for learning to take place as little or no learning can take place in a non-conducive environment. Mathematics should be presented in a way that meets learners' needs and arouse their interest. Instructional resources which are educational inputs are of vital importance to the teaching of any subject in the school curriculum, most especially Mathematics which seems a bit abstract to learners. Hence, psychologists and Mathematics educators are of the view that Mathematics should not be taught as a teacher dominant lesson, but instead, lesson must focus on learners' knowledge construction and hence should be placed at the centre of the teaching-learning process to enable the students explore and interact with materials to aid knowledge acquisition. According to Andrew (2015) [1], there are three views of teaching which are transmission, transaction and transformation. Transmission is a teacher-centred approach in which the teacher is the dispenser of knowledge, the arbitrator of truth and the final evaluator of learning. A teacher's work from this perspective is to supply students with a designated body of knowledge in an arranged order while the transformation approach helps both the teachers and

the learners to discover their full potentials. The transmission approach is also known as traditional teaching method or teacher-centered instruction, the teacher acts as a reservoir of knowledge. The teacher who sees himself as the sole supplier of knowledge takes control over almost every activity in the teaching-learning process. The teacher's duty is to transmit or explain facts and procedures to leaners. Learners are only asked to check if they are following the taught procedures. Such approach makes the classroom boring and the students become tired and bored, encourages passive attitude among learners and make the students feel they have nothing to contribute. This method of teaching is called non-participatory teaching method because students do not participate in the lesson, instead the lesson is carried out through explicit teacher's explanation via lectures and teacher-led demonstration. This method of teaching has made the students redundant in the class, and then the use of manipulative came into practice in order to enable the students to be active in the class especially in Mathematics classes. Jacob, Bolaji, Kajuru, Mu, Musa and Bala (2017) [6] recommended that concrete Manipulatives Approach be used by students of Geometry in learning as it helps to form positive attitude in learning Geometry.

The use of manipulative has been in existence for ages. The use of Mathematics manipulative was justified by the Chinese Philosopher, Confucius (551BC-479BC) on the basis of an expression in the early days:

I hear and I forget
I see and I remember
I do and I understand

The early teachers believed that whatever one does, one will never forget easily and one tends to understand it better. Since the early1900s, manipulatives have come to be considered essential in teaching Mathematics at the elementary school level. In fact, for decades, the national council of teachers of Mathematics (NCTM) has recommended the use of manipulative in teaching mathematical concepts at all levels of education. Mathematical concepts such as Geometry should be taught in a more meaningful and interesting way by using manipulatives. Manipulatives are physical tools of teaching, engaging students visually and physically with objects such as coins, blocks, sticks, puzzles, Geoboard, et cetera. Manipulatives in Mathematics education is also known as an object which is designed so that a learner can perceive some mathematical concepts by manipulating it. The use of manipulatives is constructive because students are actively engaged in discovery during the learning process. A good example of manipulatives that can be used to teach Geometry is Geoboard. Geoboard is a mathematical manipulative that can be used to teach Geometry. Geoboards are Mathematics manipulatives used to support early geometric measurement and numeracy concept. A Geoboard is a square board with pegs that students attach rubber bands to (Russell, 2017) [8]. Geoboards are also grid pegs that can hold rubber bands in positions. Geoboards are also mathematical manipulatives used to explore basic concepts in plane Geometry such as perimeters, area, and characteristics of triangles and other polygons. Plane shapes can be better explained by representing the shapes on Geoboards as presented in Figure 1:

## II. STATEMENT OF THE PROBLEM

As important as the subject Mathematics is the learners are not interested in it and this affects the students' academic performance. This may be as a result of so many factors such as the attitude of the learners themselves, the attitude of the teachers and non-mastery of the subject matter by the teacher, et cetera. Learners see Mathematics as one of the most difficult subjects to learn. Most teachers make the teaching-learning process so boring and discouraging because they have turned Mathematics classes to history classes; by telling stories and making the teaching so abstract thereby discouraging the students from having interest in the subject hence, the Federal republic of Nigeria (FRN, 2014) [5] in the National Policy on Education stated that there is need for functional education for the promotion of a progressive united Nigeria. To this end, school programmes need to be relevant, practical and comprehensive, while interest and ability should determine the individual's direction in education.

## III. OBJECTIVES OF THE STUDY

1. Determine the difference in interest between students taught Geometry using Geoboards and those taught using the conventional lecture method.
2. Differentiate between the interest of male and female students taught Geometry with Geoboard.

## IV. RESEARCH QUESTIONS

Two (2) research questions were raised and answered in this study.

1. What is the difference in interest level between students taught Geometry using Geoboards and those taught using the conventional lecture method?
2. What is the difference in interest level between male and female taught Geometry with Geoboard?

***Hypotheses***

The following null hypotheses were tested at 0.05 significant level.

**$HO_1$:** There is no significant difference between the interest level of students taught Geometry using Geoboard and those taught using the conventional lecture method.

**$HO_2$:** There is no significant difference between the interest level of male and female students taught Geometry using Geoboard.

## V. METHODOLOGY

This study adopted Quasi experimental design. This is due to lack of complete random assignments of respondents.

The population of the study consists of all the senior secondary school one (S.S.S.1) Students in Degema Local Government Area of Rivers State which is made up of three hundred and seventeen (317) students from ten (10) schools in the Local Government Area. The sample consists of two government schools that were selected by the researcher from the Local Government Area. Two schools were randomly selected. One of the schools was used as experimental group. The total population sample was one hundred (100) students. Seventy-four (74) students were used for the experimental group while twenty-six (26) students were used for the control group.

A two-stage simple random sampling technique was used to assign each of the schools into control and experimental group. The control group was taught using conventional lecture method, while the experimental group was taught using Geoboards as manipulatives. The instrument for data collections for this study was questionnaire. Questionnaires were administered to both experimental and control groups. The questionnaire consists of twenty items questions administered to 100 students from two different schools in the same local Government Area. The instrument was validated by experts in the field of Mathematics. The reliability of the instrument was determined using Cronbach Alpha and 0.81 was obtained. The research questions were answered using mean and standard deviation while z- test was used to test the hypothesis at 0.05 level of significance.

## VI. RESULTS AND DISCUSSION

***Research Questions 1:***

What is the difference in interest between students who taught Geometry using Geoboards and those who taught using the conventional lecture method?

### I. TABLE I

**MEAN AND STANDARD DEVIATION (SD) ANALYSIS OF DIFFERENCE IN INTEREST BETWEEN STUDENTS TAUGHT GEOMETRY USING GEOBOARDS AND THOSE TAUGHT USING THE CONVENTIONAL LECTURE METHOD**

| | Groups | Strategy | N | ẍ | SD |
|---|---|---|---|---|---|
| Interest | Experimental | Geoboard Instruction | 74 | 57.53 | 5.68 |
| | Control | Conventional method | 26 | 58.38 | 7.42 |
| | Mean difference | | | -0.85 | |

The result on table 1 revealed that the number of experimental and control groups is 74 and 26 respectively. Mean scores of student's interests using Geoboards and conventional method are 57.53 and 58.38 respectively which their standard deviations are 5.68 and 7.42. Based on their mean scores, it is deduced that the students exposed to conventional method had a slightly higher interest in Geoboard than those taught using Geoboard.

***Research Questions 2*:**

What is the difference in interests between male and female students taught Geometry with Geoboards?

### II. TABLE III

**MEAN AND STANDARD DEVIATION (SD) ON DIFFERENCE IN INTEREST BETWEEN MALE AND FEMALE STUDENTS TAUGHT GEOMETRY USING GEOBOARDS**

| | Sex | n | ẍ | SD | Std error mean |
|---|---|---|---|---|---|
| Interest | Male | 48 | 56.63 | 4.67 | 0.67 |
| | Female | 26 | 59.19 | 6.99 | 1.37 |

The results on table 2 revealed that the number of male and female students is 48 and 26 respectively. Mean scores of students are 56.63 and 59.19 respectively which their standard deviations are 4.67 and 6.99 for male and female students respectively. Based on their mean scores, it is deduced that male students had a moderate higher mean score than the male students. This means that the female students showed slightly more interest in the Geoboard when taught Geometry.

***Hypothesis 1*:** There is no significant difference between the interest of the student taught Geometry using Geoboard and those taught using conventional lecture method.

### III. TABLE III

**Z-TEST ANALYSIS ON DIFFERENCE BETWEEN THE INTEREST OF STUDENTS TAUGHT GEOMETRY USING GEOBOARD AND THOSE TAUGHT USING THE CONVENTIONAL LECTURE METHOD**

| Interest | | |
|---|---|---|
| **Groups** | Experimental | Control |
| **Strategy** | Geoboard instruction | Conventional method |
| **N** | 74 | 26 |
| **ẍ** | 57.53 | 58.38 |
| **SD** | 5.68 | 7.42 |
| **df** | 98 | |

| | | |
|---|---|---|
| **Z-cal** | -0.61 | |
| **Z-crit** | 1.960 | |
| **Sig. 2-tailed** | 0.544 | |
| **Level of sig** | 0.05 | |
| **Decision** | $H_0$3 Accepted | |

Table 3 revealed that z-cal (-0.610) < z – crit (1.960) and it implies that it is not significant, that is, the null hypothesis is accepted.

***Hypothesis 2*:** There is no significance difference between the male and female students taught Geometry using Geoboard.

**IV. TABLE IV**

**Z-TEST ANALYSIS ON DIFFERENCE BETWEEN THE INTEREST OF MALE AND FEMALE STUDENTS TAUGHT GEOMETRY USING GEOBOARD**

| **Interest** | | |
|---|---|---|
| **Gender** | Male | Female |
| **N** | 48 | 26 |
| **ẍ** | 56.63 | 59.19 |
| **Std** | 4.67 | 6.99 |
| **Df** | 72 | |
| **Z-cal** | -1.889 | |
| **Z-crt** | 1.960 | |
| **Sig. 2-tailed** | 0.063 | |
| **Level of sig** | 0.05 | |
| **Decision** | $H_0$4 Accepted | |

Table 4 showed that z-cal (-1.889) < z-crt (1.960) and it implies that it is not significant thereby the null hypothesis is accepted.

Findings from this study showed that the students exposed to conventional method had a slightly higher interest in Geoboard than those taught using Geoboard techniques.

However, there is no significant difference on the interest of students taught Geometry using Geoboard and those taught using conventional lecture method. The result corroborates with Jacob, Bolaji, Kajuru, Mu, Musa and Bala (2017) [6] which stated that students' attitude was rated positive in the Geometry concept taught due to use of concrete manipulative Approach in Geometry Performance Test. It also emphasized that Mathematics should be presented in a way that meets leaners' need and arouse their interest.

One of the statements by Azmidar, Darhim and Dahlan (2017) [2], indicated that students' interest in Mathematics is still low because most students have perceived Mathematics as a very difficult, boring and non-practical subject. This is as a result of teaching-learning process used by the teacher to pass information to the students. Categorically, Ernest and Okyere, (2016) [4] earlier stated that the major tests of every Mathematics teacher should be how to make the teaching of the subject meaningful and attractive to learners so as to arouse the learners' interest by using physical or concrete objects to teach a particular concept in Mathematics. So, instructors need to create conducive and productive environment for learning to take place as no or little learning can take place in a non-conducive learning environment.

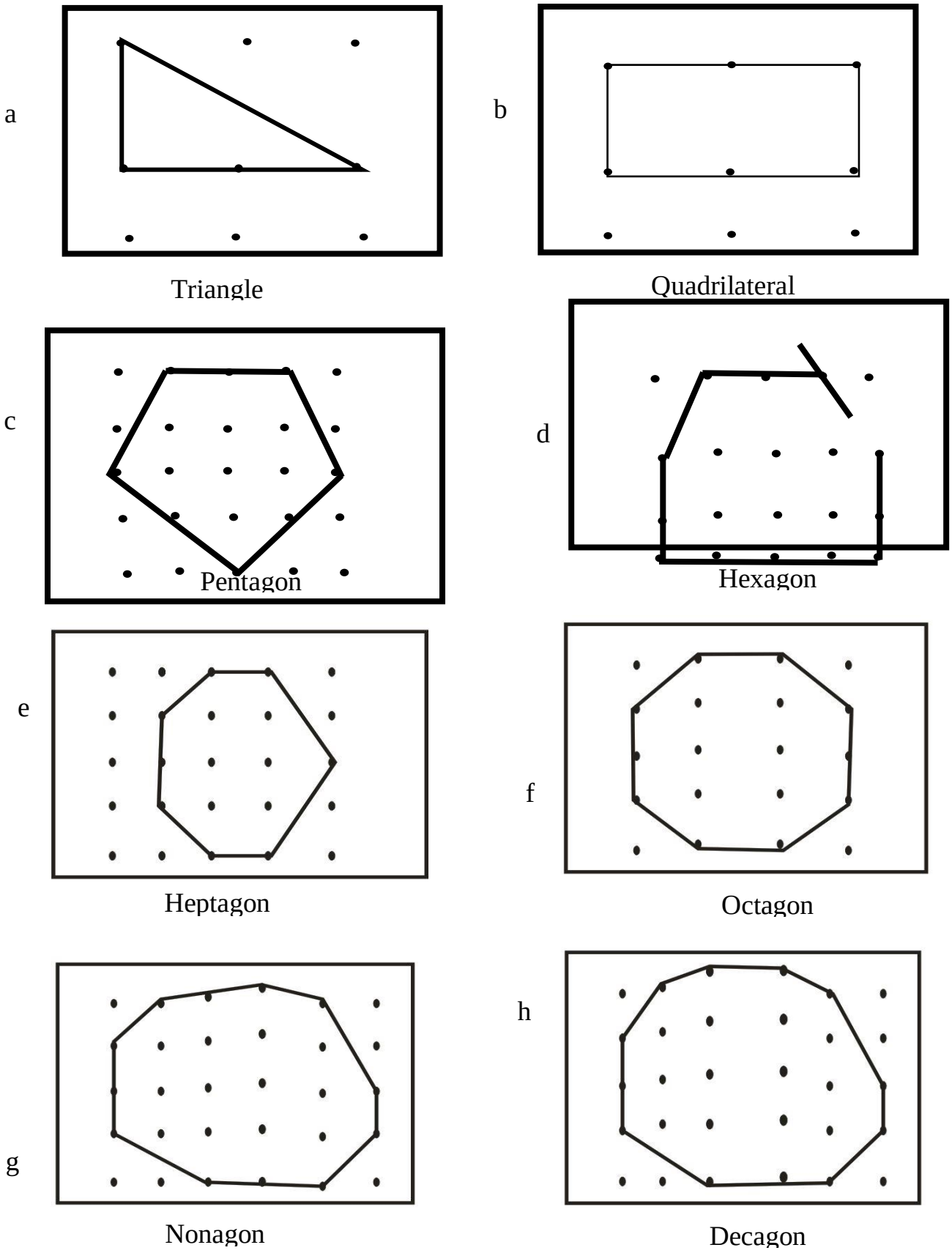


**Fig 1: Geoboards displaying different types of polygonscolumns**

## VII. CONCLUSION AND RECOMMENDATIONS

The results of the study showed that Geoboard technique in teaching of Geometry improved the students' interest in the teaching-learning process. Gender did not significantly influence students' interest in Geometry across the groups. Also, the use of manipulative provides ways for students to learn concepts through developmentally appropriate hands-on experience. Manipulative can make great impact on learners and have been shown to be of immense advantage to learners who are intellectually handicapped or those who have difficulty with the use of English in comprehending mathematical terms (Oti, 2016) [7].

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

1. Teachers should always make Mathematics class an interesting one to the students by using concrete objects to pass instructions to the learners.
2. Geoboard funds should be prepared and included in the course content as support links to appropriate authentic materials and tasks in Geometry.

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