

Geometry Attitude Questionnaire (GAQ)

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Abstract: The researchers developed Geometry Attitude Questionnaire GPT through the validations from senior lecturers in science education Ahmadu Bello University Zaria, Shehu Shagari College of Education Sokoto and Mathematics Teachers in Sokoto State. The Instrument was developed to assist researchers carrying out studies at JSS, SS or Tertiary institutions across the country and some African countries like Ghana. GAQ is a structured likert scale with four options, 1 strongly disagree (SD); 2 Disagree (D); 3 Agree (A); 4 Strongly Agree (SA). each item carries 1 mark. The contents of the GAQ consist of all Geometry content and methods of teaching (Students Team Achievement Division STAD and INQUIRY) of JSS. Difficult and simple areas of JSS 3 Mathematics curriculum of NERDC 2013 was used; and Basic Education Certificate Examination (BECE) pass questions papers were used to form GAQ. Reliability was carried out with two schools in Sokoto Metropolis using test retest method, and cronbach alpha was used to analyse the data. 0.72 was obtained as the reliability value, which shows that the instrument is reliable and can be used to conduct experimental study particularly at JSS 3 level in Nigeria and some others countries like Ghana.

Keywords: Geometry, Attitude, Questionnaire

Introduction

There are so many debates among mathematics educationist as what can improve students' performance, interest and motivation in learning Geometry, according to Gialamas, Keller, Cherif, and Hansen (2000), stated that "in order to improve and capture the students' attention and interest, a teacher needs to actively engage students in discovery activities that demonstrate the Mathematical concepts. To buttress this point, Jones and Brader-Araje (2002) viewed learning as an active process, taking students' prior knowledge into consideration, building on preconceptions, and eliciting cognitive conflict, in this, teachers should design instruction that goes beyond rote learning to meaningful learning that is more likely to lead to deeper, longer and lasting understanding (Isah, 2021).

Peterson and Hittie (2003) said “traditional practices of teaching based on 20th century factory model that encouraged students to sit in straight rows, listen to lectures, fill out worksheets, read from text under the watchful eyes of the teacher, no longer meet the diverse needs of today’s students. In this regard, some scholars such as John Dewey contested this model back in early 1900’s, Dewey believed that “rote study promoted shallow thinking and a dislike for learning. In view of this, Dewey agrees that learning should be socially constructed. This also agrees with the word of Kiernan (2015), who says “I believe in active, in-depth learning in the science classroom. This was supported by the old Chinese proverb that says “I hear and I forget; I see and I remember; I do and I understand”.

This study therefore, explored avenues through which teaching of Geometry in public Junior Secondary Schools in Sokoto State can be made effective. This implies the use of Students Team Achievement Division and Inquiry methods of teaching, which according to some scholars such as Gialamas and Kelle (2000); Chin, Lin, Chuan and Tuan (2007); Kolawole (2008); Akinbobola (2009) Chianson et al (2011); Alabekee, Samuel, and Osat (2015); is better than the previous methods. Student Team Achievement Division (STAD) and Inquiry methods are one among many teaching methods which improve attitude, retention and academic performance of students in learning Geometry.

Many scholars such as Idowu, (2018) have recognized numerous teaching methods in teaching mathematics education. Some of such methods include: demonstration, guided discovery, project laboratory, field trip, excursion, lecture and cooperative learning among others. In this study, lecture, Inquiry and STAD methods are going to be used to see if they could improve students’ attitudes, retention and academic performance of Junior Secondary School in Sokoto State Nigeria. In view of this, variables like retention, performance, attitude, STAD, Inquiry, and Lecture methods are defined as follows:

Students Team Achievement Division is simply a group of 4 learners working together to achieve common education objective within 6 weeks treatment of Geometry; While Inquiry method is a learning method where the learner with the support of more knowledgeable others (MKOS) discover solution to a given problem under investigation within 6 weeks (Isah 2022) .

Based on this I, ISAH PhD. (Mathematics Education) was born in Gidan Aduwa Mabera Iddi, Sokoto State. I started my Primary school in the year 1989-1995 at Tafida Aminu Model Primary School Sokoto then proceeded to Sheik Abubakar Gumi Memorial College Sokoto in the year 2001. In the year 2001-2004 I obtained Nigeria Certificate in Education in Mathematics and Computer Science at Shehu Shagari College of Education Sokoto in the year 2004. I also obtained degree in Science Education Mathematics at Usmanu Danfodio University Sokoto in the year 2007. I then proceeded to Ahmadu Bello University Zaria for Masters and PhD in Science Education Mathematics in the year 2010-2015 and 2016-2021 respectively.

I started teaching at Mabera Magaji Model Primary School Sokoto in the year 2001; I taught Mathematics at Tafida Aminu model primary school Mabera and Nana Girls Secondary School Sokoto in the year 2003 and 2005. I also taught Computer Studies at Sultan Muhammad Macido Institute for Quran and General Studies Sokoto in the year 2005-2012. I became a full time lecturer at Shehu Shagari College of Education Sokoto in the 2012-date as assistant lecturer handling Basic General Mathematics 1,2,3,4,5 and history of Mathematics respectively. Having under gone these stages; I experienced problems in teaching and learning particularly in Mathematics Education. Thus, I was encouraged to developed Instrument for teaching and learning Mathematics called Geometry Performance Test (GPT).

The Geometry Attitude Questionnaire (GAQ) is an instrument developed by the researcher to determine the attitude level of students to Geometry concepts using Experimental and control groups, and the purpose of this instrument was to determine whether students have favorable or unfavorable attitude level towards the use of STAD and Inquiry methods as well as lecture method. GAQ is a modified likert scale with 36 items, having 1 strongly Disagree (SD), 2 Disagree (D), 3 Agree (A), 4 Strongly Agree (SA).

The detail of the questionnaire was on the appendix A. The GAQ was administered to experimental groups before and after the treatment of Geometry Concept in order to determine the change in the attitude level of the students towards learning Geometry. The instrument was validated by specialist in the field of science education, psychology, and language in Ahmadu Bello University Zaria and Shehu Shagari College of Education Sokoto respectively. The suggestions of the experts lead to the reframing and elimination of ambiguous and inappropriate statements, which increases the 30 items to 36 items.

The questionnaire could also be used to ascertain the attitude level between the gender, location, and school type between learners under study. The researcher developed two questionnaires for two methods of teaching namely Student Team Achievement Division (STAD) and Inquiry Methods (IM). STAD is defined as a small group of 4 heterogenic learners working together to achieve common educational objectives within six weeks; and IM is defined as a learning method, where the learner with the support of more knowledgeable others (MKOS) discover solution to a given problem.

Steps to Use GAQ

The GAQ is use to test the attitude level of students as follows:

1. Administer GAQ before the treatment which is called pre-test o_1
2. Give the treatment for six weeks X_1 , than administer GAQ again; which is called Post-test o_2
3. After two weeks of treatment, the teacher re-administers GAQ which we called Post-Post-test to test the retention level of the students.

Conclusion

The Geometry Attitude Questionnaire (GAQ) is an instrument developed by the researcher to determine the attitude level of students to Geometry concepts using Experimental and control groups, and the purpose of this instrument was to determine whether students have favorable or unfavorable attitude level towards the use of STAD and Inquiry methods as well as lecture method. GAQ is a modified likert scale with 36 items, having 1 strongly Disagree (SD), 2 Disagree (D), 3 Agree (A), 4 Strongly Agree (SA). Three steps were developed as the hierarchy to the researcher should follow the guide as; Administer GAQ before the treatment which is called pre-test α_1 ; Give the treatment for six weeks X_1 , than administer GAQ again; which is called Post-test α_2 ; After two weeks of treatment, the teacher re-administers GAQ which we called Post-Post-test to test the retention level of the students.

APPENDIX A

Geometry Attitude Questionnaire (GAQ)

Dear respondent,

This questionnaire is designed to investigate students' attitude toward Student Team Performance Division (STAD) on Geometry. The researcher really appreciates your cooperation and participation.

Instruction: to respond to this questionnaire, please put a check mark in the appropriate box to choose your level of agreement or disagreement with the statements: 1 strongly disagree (SD); 2 Disagree (D); 3 Agree (A); 4 Strongly Agree (SA).

SECTION A: Bio-Data

Gender: 1. Male ☐ 2. Female ☐

Age: 10-12 ☐ 13-15 ☐ above 15 ☐

Location: Urban ☐ Rural ☐

School Type: Day ☐ Boarding ☐

SECTION B: Attitude of Student in STAD method on Geometry

| S/N | STATEMENT | SD | D | A | SA |
|-----|---|----|---|---|----|
| 1. | I prefer to join group activities always in learning geometry | | | | |
| 2. | I benefited a lot from group members, when learning geometry | | | | |
| 3. | STAD helps me to relate more with my group members in solving | | | | |

| | | | | | |
|-----|--|--|--|--|--|
| | geometry problems | | | | |
| 4. | I enjoy solving geometry problems with students who are more knowledgeable than me | | | | |
| 5. | I scored more marks in geometry during exams when I study under STAD | | | | |
| 6. | STAD enables me to retained what I learnt in geometry easily | | | | |
| 7. | When I solve geometry problems with other students I achieved more than when I studied alone | | | | |
| 8. | Group work makes the learning of geometry very easy to me | | | | |
| 9. | Learning under STAD method improves my level of creativity in geometry | | | | |
| 10. | Geometry learn under STAD is very interesting to me | | | | |
| 11. | STAD enhances my performance in learning geometry | | | | |
| 12. | Working under STAD improves my thinking ability in learning geometry | | | | |
| 13. | Working in a group of STAD encourages me to understand geometry very well | | | | |
| 14. | Working under STAD improves my creativity in learning geometry | | | | |
| 15. | I will not study Geometry after my secondary education | | | | |
| 16. | My scores in geometry is always poor if I study under STAD method | | | | |
| 17. | Geometry is one of the most boring topic in mathematics to me | | | | |
| 18. | I don't like to work with students who are better than me in solving geometry at all | | | | |
| 19. | Geometry learnt under STAD is not interesting at all | | | | |
| 20. | STAD did not improves my retention ability in learning geometry at all | | | | |
| 21. | Geometry is very difficult, when study under STAD | | | | |
| 22. | STAD did not improves my level of creativity in geometry | | | | |

| | | | | | |
|-----|--|--|--|--|--|
| 23. | STAD did not improve my performance in geometry at all | | | | |
| 24. | Working in a group of STAD discourages me to understand geometry | | | | |
| 25. | I did not enjoy learning geometry using STAD | | | | |
| 26. | Mathematics teachers are all mad, therefore I don't listen to them at all | | | | |
| 27. | When I study along, I performed poorly in geometry | | | | |
| 28. | Any time I hear the phrase geometry, I felt sick | | | | |
| 29. | I don't like studying geometry at all | | | | |
| 30. | I had never heard the phrase geometry in my life | | | | |
| 31. | I enjoy solving geometry problems in a group with the help of my teacher | | | | |
| 32. | The advice of my teacher encourages me to relate with my team in studying geometry | | | | |
| 33. | The teacher only facilitated in this work, but did not solve or give any answer to geometry problems | | | | |
| 34. | I did not enjoy solving geometry problems in a group with the presence of my teacher | | | | |
| 35. | The advice of my teacher did not encourage me to solve geometry problems | | | | |
| 36. | The explanation given by the teacher after group work made me understand geometry very well | | | | |

Geometry Attitude Questionnaire (GAQ)

Dear respondent,

This questionnaire is designed to investigate students' attitude toward Inquiry Method on Geometry. The researcher really appreciates your cooperation and participation.

Instruction: to respond to this questionnaire, please put a check mark in the appropriate box to choose your level of agreement or disagreement with the statements: 1 strongly disagree (SD); 2 Disagree (D); 3 Agree (A); 4 Strongly Agree (SA).

SECTION A: Bio-Data

Gender: 1. Male ☐ 2. Female ☐

Age: 10-12 ☐ 13-15 ☐ above 15 ☐

Location: Urban ☐ Rural ☐

School Type: Day ☐ Boarding ☐

SECTION B: Attitude of Student in Inquiry method on Geometry

| S/N | STATEMENT | SD | D | A | SA |
|-----|--|----|---|---|----|
| 1. | I prefer to join group activities always in learning geometry | | | | |
| 2. | I benefited a lot from group members, when learning geometry | | | | |
| 3. | Inquiry helps me to relate more with my group members in solving geometry problems | | | | |
| 4. | I enjoy solving geometry problems with students who are more knowledgeable than me | | | | |
| 5. | I scored more marks in geometry during exams when I study under Inquiry | | | | |
| 6. | Inquiry enables me to retained what I learnt in geometry easily | | | | |
| 7. | When I solve geometry problems with other students I achieved more than when I studied alone | | | | |
| 8. | Group work makes the learning of geometry very easy to me | | | | |
| 9. | Learning under /Inquiry method improves my level of creativity in geometry | | | | |
| 10. | Geometry learn under Inquiry is very interesting to me | | | | |
| 11. | Inquiry enhances my performance in learning geometry | | | | |
| 12. | Working under Inquiry improves my thinking ability in learning geometry | | | | |
| 13. | Working in a group of Inquiry encourages me to understand geometry very well | | | | |
| 14. | Working under Inquiry improves my creativity in learning geometry | | | | |

| | | | | | |
|-----|--|--|--|--|--|
| 15. | I will not study Geometry after my secondary education | | | | |
| 16. | My scores in geometry is always poor if I study under Inquiry method | | | | |
| 17. | Geometry is one of the most boring topic in mathematics to me | | | | |
| 18. | I don't like to work with students who are better than me in solving geometry at all | | | | |
| 19. | Geometry learnt under Inquiry is not interesting at all | | | | |
| 20. | Inquiry did not improves my retention ability in learning geometry at all | | | | |
| 21. | Geometry is very difficult, when study under Inquiry | | | | |
| 22. | Inquiry did not improves my level of creativity in geometry | | | | |
| 23. | Inquiry did not improve my performance in geometry at all | | | | |
| 24. | Working in a group of Inquiry discourages me to understand geometry | | | | |
| 25. | I did not enjoy learning geometry using Inquiry | | | | |
| 26. | Mathematics teachers are all mad, therefore I don't listen to them at all | | | | |
| 27. | When I study along, I performed poorly in geometry | | | | |
| 28. | Any time I hear the phrase geometry, I felt sick | | | | |
| 29. | I don't like studying geometry at all | | | | |
| 30. | I had never head the phrase geometry in my life | | | | |
| 31. | I enjoy solving geometry problems in a group with the help of my teacher | | | | |
| 32. | The advice of my teacher encourages me to relate with my team in studying geometry | | | | |

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|-----|--|--|--|--|--|
| 33. | The teacher only facilitated in this work, but did not solve or give any answer to geometry problems | | | | |
| 34. | I did not enjoy solving geometry problems in a group with the presence of my teacher | | | | |
| 35. | The advice of my teacher did not encourage me to solve geometry problems | | | | |
| 36. | The explanation given by the teacher after group work made me understood geometry very well | | | | |

Pilot Study Testing

A pilot study was carried out in Nana Girls, and Sultan Atiku Secondary Schools Sokoto metropolis with sixty 60 students (30 boys and 30 girls) from each schools to ascertain the reliability of the instrument. The schools selected for the purpose is similar to those schools of the main study in terms of location, ownership, and status level. GAQ was administered to these students using test retest method with an interval of 2 weeks, and split half method was used to test the reliability of GAQ.

The scores were split in to two equivalents halves arranged as odd and even numbered items. The scores of the two halves were correlated and Spearmen Rank Correlation Statistics was used to estimate the reliability of the instrument.

One hour was given to students which enabled them to answer the items. The researcher later marked the scripts and test-retest method was used to administered the instrument, later the data was analyzed using Cranach's alpha the results obtained is 0.92 as the reliability index for GAQ.

3.3.4 Validity of the Instrument

The content and face validity of the instrument was validated by subject experts from Science Education and psychology departments of Ahmadu Bello University Zaria, Mathematics and Psychology departments of Shehu Shagari College of Education and some secondary schools in Sokoto state. The experts include Professors and Senior Lecturers.

For the formulation of GAQ, after series of corrections by the experts, the researcher formulated 36 items of questionnaire ranges from strongly (SA). Agree (A), disagree (D), strongly disagree (SD) type of likert scale, when carried to psychologist in Shehu Shagari college of Education Sokoto. The experts advised that it should be reframed to structured likert scale and some items that touch the commitment of the facilitator need to be added, the researcher added 6 items on the activities of the facilitator during the activities of the study (See Appendices A and B).

3.3.5 Reliability Coefficient of GAQ Instrument

The reliability of the GAQ was determined through Guttman Split – Half Coefficient formula, and the result obtained is 0.92, which shows that the instrument is reliable and be used for data collection in the experimental study. (See appendix C)

APPENDIX C

Reliability

[DataSet1] C:\Users\Al-ameen\Documents\PILOT STUDY QUESTIONNAIR 1.sav

Warnings

determinant of the covariance matrix is zero or approximately zero. Statistics based on its inverse matrix cannot be computed and they are displayed as system missing values.

Scale: ALL VARIABLES

Case Processing Summary

| | N | % |
|-----------------------|----|-------|
| d | 31 | 51.7 |
| es luded ^a | 29 | 48.3 |
| al | 60 | 100.0 |

stwise deletion based on all variables in the procedure.

Reliability Statistics

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|------------------|--|------------|
| .721 | .699 | 30 |

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