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EFFECTS OF COMPETITIVE AND JIGSAW COLLABORATION LEARNING STRATEGIES ON STUDENTS' INTEREST IN GEOMETRY AMONG SENIOR SECONDARY SCHOOL STUDENTS IN FCT, ABUJA, NIGERIA

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Abstract

This study investigated the Effects of Competitive and Jigsaw collaborative Learning Strategies on Students' Interest in Geometry among Senior Secondary School students in Abuja. The study employed a quasi – experimental design using pre-test posttest and non-equivalent control group. A sample of 245 SSII students, comprising of One Hundred and thirty -one (131) males and One Hundred fourteen (114) females were used for the study. A multi stage sampling techniques were used for the study. Instrument for data collection was Students' Geometry Interest Inventory (SGII) for competitive and jigsaw collaborative learning

Keywords; Competitive, Jigsaw collaborative. Learning strategy, Students and interest

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strategies. The instruments were validated by five experts in mathematics education, three Senior Lectures from Department of Science Education Federal University of Technology, Minna, two Principal Lectures from FCT – COE, Zuba as well as two teachers of mathematics from FCT-SEB. The reliability coefficient of the instruments were obtained using Cronbach Alpha was 0.87 and 0.79 for SGII for competitive and jigsaw collaborative learning strategies. Three research questions were raised and three null hypotheses that were tested at 0.05 level of significant. Ranks Mean were used to answered research questions and Mann Whitney U-test was statistical tool used for testing null hypotheses. The results revealed that the use of competitive learning strategy enhance students' achievement in geometry. Among other recommendations is that, mathematics teachers should be encouraged to adopt these strategies in the classroom.

INTRODUCTION

Education is not only an instrument that broadens the mental horizon of the human being, it is also the effective instrument that can make Nigeria become a Technology giant in Africa. Bashir (2018) posted that, attainment of any nation's visions is based principally on the successful attainment of educational objectives, especially those of Sciences, Technology, and Mathematics at all levels. Undoubtedly, no nation rises above the knowledge of its citizens in Sciences and Technology and mathematics which is the bedrock of science and technology.

Mathematics is an intellectually stimulated subject that affects every talent activity such as politics, economics, sciences and technology (Hassan *et al,* 2017). Mathematics is an important subject not only for getting academic qualification at college but is also a subject that prepares the students for the future. Consequently, mathematics is made compulsory (core) at both primary and secondary school levels in Nigeria.

The persistent mass failure in geometry concepts at senior secondary school level as pointed out by Chief examiners , however, the WAEC (2020) Chief examiners' report revealed that, students avoided questions drawn from

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geometry concepts like plane geometry, trigonometry, circle theorem, construction, bearings and distance. Those students who attempt question drawn from these concepts scored relatively low mark when compared with performance in the same paper on questions drawn from other areas. Etok *et al*, (2018) equally identified geometry one of the concepts perceived as difficult by the students and teachers. This meant that, there are some challenges affecting the learning of geometry concepts by the students which needs to be urgently addressed.

Geometry is a branch of mathematics that deals with the relationship of lines, angle and surfaces, it is also a concept of enjoyment and excitement, which offers students opportunities for creative work and moment of enlightenment and joy (Usman and Umar 2019). When ideas are discovered and insight gained, students are spurred to pursue mathematics beyond classroom walls, since practical approach is being used as teaching method Poor instructional learning strategies employed by the teachers have been identified as some of the factors that are attributed to low achievement in geometry in particular and mathematics in general (Udousoro, 2015). The researcher suggested that, essential strategies aimed mutually to reinforce practical approaches in order to develop students' thinking, particularly in the transition to geometry shape. Thus major challenge is implementing appropriate learning strategy in Mathematics classrooms that will enhance Mathematics learning especially geometry concepts. Successful teaching depends on the strategy the teachers adopt.

Learning strategies have considerable effect on students' achievement and interest in geometry. This is because when students attend to information, try to figure out the relationship between new and previous knowledge, remembering facts is linked to the appropriate learning strategy employed. From the primary through Secondary to the Tertiary level of Education, competitive and collaborative learning always exist, because one sees students

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either with friends debating (Competitive) or collaborating (Collaborative) when learning a concept (Olayede *et al,* 2016).

Competitive learning strategy is a social process that occurs when rewards are given to individuals based on how their performances are compared with the version of others, doing the same task or participating in the same event (Costin *et al*, 2016). Students engage in the win-lose struggle to determine who emerged as the best in a competitively structured classroom. In competitive classroom students perceive that they can obtain their goal only if other students in the class fail to get their own goal

Students' interest in geometry is another learning outcome. The learners' interest is a fundamental factor in obtaining right knowledge, skills, values, and attitudes that the curriculum seeks to attain. Interest in mathematics as a subject helps sustain concentration, purpose, commitment and cooperation with the teachers in the learning process also students' interests in geometry and mathematics at large could be enhanced through appropriate learning strategies (Ardodo and Gbore, 2015). Interest is the most vital strength in predicting students' achievement in geometry. Interest geometry is a source of motivation to seek out and participates in certain learning activities involving geometry as a concept in mathematics (Oludipe 2017).

The issue of gender in science has not yet been resolved, particularly in mathematics, many researchers both local and international have documented gender difference in mathematics achievement and interest as inconclusive. Hence, there is a need for a study to examine the influence of gender on students' achievement, retention and interest in mathematics when exposed to competitive and Jigsaw-collaborative strategies. Iman and Dada (2014) defined gender as a social role, responsibility and behaviour created in our families, societies and culture. Augustine (2015) sees gender as a cultural difference based on the biological division between males and females. Asoeqwu (2018) revealed that, females shown more interest in Geometry concepts when taught using Effective Modern Instructional approaches.

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Olosunde (2018) revealed that, there was no significant interaction effect of Simulation Games Strategy and gender interest. Farayola and Saludeen (2017) revealed that, there was significant interactive effect in the mean interest scores of male and female students taught Mathematics using collaborative learning strategy in favour of female students. Tali and Peter (2019) revealed that there was no significant difference in the interest rating scores of male and female students in Geometry. Anduaka *et al* (2018) revealed that, there was no significant interactive effect of Jigsaw instructional strategy on gender interest of students in Mathematics.

Statement of Research Problem

The persistent mass failure in geometry concepts years after years as reported by WAEC Chief Examiners (2019, 2020 and 2021). Students poor achievement in mathematics and geometry in particular has becomes issues of serious concerned to the stakeholders in academic sector as well as parents, teachers, government, the examination bodies and even the students themselves. Poor achievement in mathematics as a subject has implications on university admission where credit is required before entry.

It is noted that, students have difficulties in understanding geometric shapes, comprehending concepts, skills and generalization in geometry concepts, which resulted in avoiding questions drawn from geometry concepts or scoring relative low marks in an attempt to answer questions drawn from such areas.

Studies reviewed have also offered suggestions such as the use of Inquiry, Cooperative, Guided- Discovery, Discussion, and Problem Solving Instructional Strategies among others, as the way forward (Dike and Adebayo, 2017). To improve students' achievement and interest in geometry, students must be more active in the classroom and must creatively acquire knowledge, especially in understanding and solving mathematical problems. Students need the

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opportunity to develop, interact and share with friends through cooperative learning activities.

However, the research conducted by Usman and Umar (2019) uncovered poor instructional strategies employed by the teachers as one of the causes of poor achievement and lack interest in geometry concepts senior secondary schools students. In spite, the fact that several empirical studies have demonstrated effectiveness of competitive and collaborative learning strategies in students' achievement, and interest in many subjects such as Basic Science and chemistry when compared to conventional teaching strategy (Danjuma, 2015 and Nwankwo and Okigbo,2021). Mathematics teachers have not made much effort towards exploring this strategies in complementing secondary school mathematics instruction in Abuja. Hence, this study sets to determine the effects of competitive and Jigsaw collaborative learning strategies on students' interest in Geometry among senior secondary school students in Abuja, Nigeria.

Aim and Objectives

The aim of this study is to find out the effects of Competitive and Jigsaw collaborative learning strategies on students' interest in Geometry among Senior Secondary School Students in FCT. Specifically the objectives are to:

i. Assess the difference in the mean interest rating of senior secondary school students taught Geometry using competitive and Jigsaw collaborative learning strategies in FCT?
ii. Assess the difference in the mean interest rating of male and female students taught Geometry using Competitive learning strategy
iii. Assess the difference in the mean interest rating of male and female students taught Geometry using Jigsaw collaborative learning strategy

Research questions

i. What is the difference in the mean interest rating of senior secondary school students taught Geometry using competitive and Jigsaw collaborative learning strategies in FCT?

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ii. What is the difference in the mean interest rating of male and female students taught Geometry using Competitive learning strategy

iii. what is the difference in the mean interest rating of male and female students taught Geometry using Jigsaw collaborative learning strategy

Null hypotheses

HO_1: There is no significant difference in the mean interest rating of senior secondary Students taught Geometry using competitive and Jigsaw collaborative learning Strategies in FCT?

HO_2: There is no significant difference in the mean interest rating of male and female students taught Geometry using Competitive learning strategy.

HO_3: There is no significant difference in the mean interest rating of male and female students taught Geometry using Jigsaw collaborative learning strategy.

Methodology

The study employed a Quasi-experimental design which involves pre-test post-test group design. Quasi-experimental is a study which allows the researcher to manipulates an independent variables and observe the outcome. This is made of three groups, experimental group. Competitive and Jigsaw collaborative learning strategy and control group. Control group was exposed to lecture group. Pre-test was given for the purpose of determining the equivalent of the groups before treatment. Population of the study consist of 45, 287 senior secondary school students comprising of 25,080 females and 20,207 males drawn from 77 senior secondary schools in FCT Abuja.

The sample of this study was made up of two hundred and forty five (245) Senior Secondary two (SS II) students comprising of 114 females and 131 males as at 2023/2024 academic session. (FCT Secondary Education Board).

A multi-stage sampling technique was used for the study. Cluster sampling technique was used to divide the senior secondary schools in FCT into six (6)

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Area Councils. Simple random sampling techniques was used to select two (2) schools from the sampled schools for each of the group, control and experimental groups. Finally, simple random sampling technique was used to select the arms of class for the control and experimental groups from the sampled schools. Intact classroom was used for the study to avoid disrupted of the normal classes.

The instruments for data collection were Students Geometry Interest Inventory (SGII) for competitive and jigsaw collaborative learning strategies. The SGII consist of two sections; section A: student's demographic information and section B consist of twenty (20) questionnaire items from each. A five point likert scale were used in SGII.

The validation of instruments were based on face and content validity. It was done by three senior lecturers, one from the department of science education, FUT Minna and two principal lecturers from the department of mathematics FCT COE Zuba, Abuja as well as two teachers of mathematics from FCT with a minimum qualification of first degree with at least ten (10) years teaching experience.

The reliability coefficient of SGII for both competitive and Jigsaw collaborative learning strategy were obtained using Cronbach Alpha's reliability coefficient. The Cronbach Alpha's reliability coefficient is the average value one would get for all possible combinations of items when split into halves (Durodola, 2018). The reliability coefficient of SGII for both competitive and jigsaw collaborative learning strategies were 0.87 and 0.79 respectively. The reliability coefficients obtained were found to be reliable.

The process of data collection took six (6) weeks, first week was used to seek permission from the appropriate authorities and training of research assistants on the experiment and administration of the research instruments, the entire group were exposed to pre-test to determine the student's level of interest on the content of the study before the experiment. 2^{nd}, 3^{rd}, 4^{th}, and 5^{th}, week were used for intensive treatment. On the 6^{th} week, the groups were exposed to

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post-test. The duration for both pre-test and post-test was 30 minutes. Mann Whitney U-test was used to test the stated null hypotheses.

Results

HO_1: There is no significant difference in the mean interest rating scores of senior secondary school students taught Geometry using Competitive and Jigsaw collaborative learning strategies in FCT. To test this null hypothesis, Mann Whitney U –test was used as presented in table 1.

Table 1: Summary of the Ranks and Mann Whitney U-test for Competitive and Jigsaw Collaborative Learning Strategies

Group	N	Mean ranks	Sum of ranks	U	P-valve
Competitive	124	128.36	15,916.64		
Jigsaw collaborative	121	125.25	15,155.25	6,837.36	0.001
Total	245				

Table 1 presents the Mann Whitney U-test analysis on mean interest rating scores of students taught geometry using competitive and Jigsaw collaborative learning strategies. Competitive learning group (N=124) has a mean rank of 128.36 with the total sum of ranks of 15,916.64 and Jigsaw collaborative group (N=121) with a mean rank of 125.25 with the total sum of rank of 15155.25. The statistical significant difference was found (U=6,837.36, P< 0.05) df = 243. Therefore the stated null hypothesis there is no significant difference in the mean interest rating scores of senior secondary school students taught Geometry using Competitive and Jigsaw collaborative learning

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strategies was rejected. The result indicate that, students were more interested geometry when taught using competitive learning strategy.

HO_2: There is no significant difference in the mean interest rating of male and female students taught Geometry using Competitive learning strategies. To test this null hypothesis, Mann Whitney U –test was used as presented in table 2

Table 2: Summary of the mean Ranks and Mann Whitney U-test for male and female Students taught geometry using competitive learning strategy

Group	N	Mean ranks	Sum of ranks	U	P-valve
Male	65	67.29	4,373.85		
Female	59	61.07	3,603.13	1606.15	0.076
Total	124				

Table 2 presents the Mann Whitney U-test analysis on mean interest rating of male and female students taught geometry using competitive learning strategies. Competitive learning group (N=65) has a mean rank of 67.29 with the total sum of ranks of 4,373.85 and female group (N=59) with a mean rank of 61.07 with the total sum of rank of 3,603.13. The statistical significant difference was found (U=1,606.15 P< 0.05) at df = 122. Therefore the stated null hypothesis there is no significant difference in the mean interest rating scores of male and female students taught Geometry using Competitive learning strategies was retained.

HO_3: There is no significant difference in the mean interest rating of male and female students taught Geometry using Jigsaw collaborative learning strategies in FCT. To test this null hypothesis, Mann Whitney U –test was used as presented in table 3.

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Table 3: Summary of the mean Ranks and Mann Whitney U-test for male and female Students taught geometry using Jigsaw collaborative learning strategy

Group	N	Mean ranks	Sum of ranks	U	P-valve
Male	66	68.32	4,509.12		
Female	55	56.93	3,131.15	1331.880	0.000
Total	121				

Table 3 presents the Mann Whitney U-test analysis on mean interest rating scores of male and female students taught geometry using Jigsaw collaborative learning strategies. Competitive learning group (N=66) has a mean rank of 68.32 with the total sum of ranks of 4509.12 and female group (N=55) with a mean rank of 56.93 with the total sum of ranks of 3,131.15. The statistical significant difference was found (U=1,331.880, P< 0.05) at df=119. Therefore the stated null hypothesis there is no significant difference in the mean interest rating scores of male and female students taught Geometry using Jigsaw collaborative learning strategies was rejected.

Discussion and findings

The result of analysis shows that, there was difference in the mean interest rating of students taught geometry using competitive and Jigsaw collaborative learning strategies. The result also revealed that students taught geometry using competitive learning strategy had higher mean interest rating compared to those taught using Jigsaw collaborative learning strategy, this could be due to brainstorming exercise by the students which is characterize in a competitive classroom. This is line with Danjuma (2015) that students exposed

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to competitive learning strategy had a higher mean interest score than those exposed to non- competitive learning strategy. The result disagreed with Tali and Peter (2019) that students taught mathematics using collaborative learning strategy significantly achieved higher mean interest rating than those taught using non collaborative learning strategies.

The analysis result revealed that, there was no significant difference in the mean interest rating of male and female students taught geometry using competitive learning strategy. The result agreed with Oluyemo *et al* (2020) that, there was no significant relationship between male and female students' interest in geometry. The study also revealed that, there was no difference in the mean interest rating scores of male and female students taught geometry using Jigsaw collaborative learning strategy, the result disagreed with Allahanan *et al*, (2018) that, there was significant relationship between male and female students' interest in geometry, this could be as result of location the research was conducted or the design employed the researcher.

Conclusions

The following conclusions were derived from the study "Effect of competitive and Jigsaw collaborative learning strategies on learning outcomes in geometry among senior secondary schools students in Abuja, Nigeria" : It has provided empirical evidence that the use of competitive and Jigsaw collaborative learning strategies facilitates learning, thereby enhances students' achievement and interest in geometry. Competitive learning strategy is more effective than Jigsaw collaborative learning strategy in promoting students interest in geometry. Also the revealed that, gender has no effect on students interest rating taught geometry using competitive learning strategy while those taught geometry using Jigsaw collaborative learning strategy there was significant difference in mean interest rating scores of in favour of female students.

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Recommendations

From the findings of the study the following recommendations were made:

i. Since the study revealed that, competitive and Jigsaw collaborative learning strategies enhances students' achievement, interest and retention in mathematics, mathematics teachers should be encourage to incorporate these strategies in teaching and learning of mathematics.
ii. Mathematics teachers should reassess their classroom instructional practices because there is need for a shift from instructions practices that makes learners' passive listener to the practice that engages learners actively during instructional process.
iii. Findings from the study revealed that, most research assistants who are all mathematics teachers do not have full knowledge on how to employ competitive and Jigsaw collaborative learning strategies, it is recommended that, workshops and seminars should be organized by government for training mathematics teachers on how these strategies are employed.
iv. Also Science educators and teachers should see to the production of textbooks and teachers guides based on competitive and Jigsaw collaborative learning strategies.

REFERENCE

Allahnana, K. M, Akande, M. T, Vintseh, I. M, Alaku, E. A & Alaku, M. E (2018) "Assessment of Gender and interest in Mathematics Achievement in Keffi LGA, Nasarawa State" *International Journal of Operational research in Management, social science and Education 4(1), 127-140*

Anaduaka, Uche. S. Olaoye, A E & Sunday O.A (2018) "Effect of Jigsaw Instructional Strategy on Senior Secondary School Students' Mathematics Achievement" Retreived14th March,2021 *https//:wwwresearchgate.net/profiles/SundayAdewole/publication/3285.*

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

Ardodo, S. O & Gbore, L.O. (2015) "Prediction of Interest of Science Students of Different Abilities on their Academic Performance in Basic Science" *International Journal of Psychology and Counseling" 4(6), 68-78.*

Asoegwu, A O (2018). "Problem and Prospect of Gender and Mathematics and Technology (STM).Educational Curriculum Development" *Science Teachers' Association (STAN) 59TH Annual National Conference Proceedings.*

Augustine, M.C. (2015). "Effect Of Collaborative Learning Strategy On Performance Of Junior Secondary School Students of Low Ability In Basic Science in Fagge Local Government Education Authority, Kano State" *Unpublished M.Ed Thesis. University of Nigeria Nsukka, Nigeria.*

Bashir, A.U (2018) "The Use of Computer Instructional Package in Teaching Mathematics in Hausa Language" *Unpublished PhD Thesis. Federal University of Technology (FUT), Minna..*

Costin A. B, Alexandru, C, Diana, D., Alina T. M. & Adrian, C. F. (2016) "Balancing Competition and Collaboration in a Mixed Learning Method" *International Journal of Education and Information Technologies 5 (3)*

Danjuma, G S (2015), "Effects of Collaborative Learning Strategies on Upper Basics11 Students' Interest and Achievement in Basic science" Unpublished M.Ed. Thesis University of Nigeria, Nsukka. Retrieved 15th January, 2021

Dike, G & Adebayo, M. (2017). National Shame! One Million Fail SSCE Daily Sun 11th August 2017

Durodola, G. T, (2019) "Investigation into Individual and Instructional Factors Influencing Mathematics Creativity among Students of Federal Unity Colleges, North Central, Nigeria" *Unpublished PhD Thesis, Federal University Technology. Minna*

Etok, A.J, Gimba, R.W; Bashir, A.U & Hassan A.A, (2018) "Analysis of Students and Teachers Perception of Difficult Concepts in Senior Secondary School Mathematics Curriculum in Federal Capital Territory" *Journal of Science, Technology, Mathematics and Education JOSTED 14(4), 168-175*

Federal Republic of Nigeria (2013) "National Policy on Education" (6th Edition), *Lagos Federal Government Press.*

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

Farayola, P.I & Saludeen, K A (2017) "Problem solving difficulties of Pre –Services NCE Teachers of Mathematics, Oyo State."*Abacus: Journal of Mathematics Association of Nigeria (MAN) 49(1), 126-131.*

Hassan, A. A, Abari, M. Terseer, A, Benedict, U & Ndanusa, M.A (2017) "Impact of Practical Application of Mathematics on Senior Secondary School Students Interest and Achievement in Algebraic in Karu local Government Area of Nassarawa State" P*roceeding of 54th Annual Conference of Mathematical Association of Nigeria*

Iman, H & Dada, M. S. (2014) "An Investigation into Basic Education and Gender Equality in Gwagwalada Area Council, Federal Capital Territory (FCT), Abuja."*International Journal of Education and Management Sciences 1(2),108-111.*

Nwanakwo, M. U. & Okigbo, E. C.(2021) "Effect of Jigsaw Teaching Strategy on students' Academic Achievement and Retention of Anambra State Secondary school Students in Chemistry" *UNIZIK Journal of Educational Research and Policy Studies 7(1), 375-387*

Olayede, E.O, Ade, B & Ojo, A.A, (2016) "The Effect of Competitive, Cooperative and Individualistic Classroom Interaction Model on Learning Outcome in Mathematics in Nigeria Senior Secondary School". *Journal Scholarly Research Notice (JSRN) in Education, 12 (4), 78-88*

Oludipe, D, I. (2017) "Gender difference in Nigerian Junior Secondary School Students' Academic Achievement in Basic Science" *Journal of Educational and Social Research, Tai Solarin College of Education, Nigeria 5(2) 93-98.*

Olosunde, S. C (2018) "Effect of Interactive Approach: Instructional Package on Pre-Service Teacher's knowledge and Attitudes toward Mathematics, *Abacus: The Journal of Mathematical Association of Nigeria (MAN) 49(1), 152-162*

Oluyemo, A. A, Musbahu, A, Kukil, I. J, Anikweze, C. M& Shluko, M (2020) " Difference in Mathematics Interest and Achievement in Junior Secondary School Students in Niger State" *International of Research and Innovation in Social Science (IJRSS) 4(10), 359-366*

Tali, D. J. & Peter, D. (2019) "Effects of Collaborates Learning Approach on Upper Basic 11 Student Interest in Geometry in Pankshin Educational Zone" *Mathematics Association of Nigeria (MAN) 56th Conference Proceedings.*

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

Udousoro, U. J (2015). "Perceived and Actual Difficulties of Students in Secondary School Mathematics" *International Multidisciplinary Journal*, Ethiopia 7(6).

Usman, M. H. & Umar, I. O (2019) "Effect of Jurisprudential-model of Instruction on Performance and Interest in Geometry Concept among Senior Secondary School Students in Nasarawa State, Nigeria" *Mathematics Association of Nigeria (MAN) 56th Conference Proceedings.*

West Africa Examination Council (WAEC) Chief Examiner's report (2018, 2019, 2020 &2021) Lagos.

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]