



Effects of Mathematics Game Strategy on Senior Secondary School Students Learning Outcomes.

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ABSTRACT

The study investigated the effect of Mathematics game strategy on senior secondary school students learning outcomes (academic achievement and interest). A pre-test, post-test, control quasi-experimental design was employed for the study. The study comprises a sample size of hundred (100) respondents from two randomly selected senior secondary schools (SS1) in the Ijebu-Ode Local government area of Ogun State, Nigeria. The instruments for data collection were Mathematics Achievement Test (MAT) and Mathematics Interest Scale (MIS). Six hypotheses were formulated and tested at a 0.05 level of significance. Data collected were analyzed using Analysis of covariance (ANCOVA). The findings revealed that there is a significant main effect of Mathematics game strategy on the academic achievement and interest of senior secondary school students. Also, it was shown that there is no significant interaction effect of treatment and gender on the achievement and interest of senior secondary school students in Mathematics. The findings further reveal no significant main effect of gender on both academic achievement and interest of senior secondary school offering Mathematics. It was recommended that senior secondary school teachers should inculcate the use of Mathematics game strategy in the teaching and learning process of Mathematics.

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INTRODUCTION

Mathematics has been recognized as one of the subjects vital in people's lives, which can be in science, technology, business, or in other works of life to produce persons who will be orderly, logical, accurate, and precise in thought (Akorede *et al.*, (2019)). Alechenu (2012), described mathematics as the "queen" of the sciences without which it would be difficult for people to study other sciences like physics, chemistry, biology, and computer science. Also, Ifamuyiwa *et al.*,(2018) opine that mathematics is a subject that cuts across all the sciences, hence students are encouraged to take up science-related subjects in order to bring about industrial and technological development in Nigeria.

According to Abakpa and Iji (2011) reports that teaching and learning of Mathematics consistently generate interest

among scholars over the years, as Mathematics is an intellectually stimulating subject that affects every talent of human activities such as politics, economics, science, and technology. Hence it is the model by which scientific concepts are understood and apply. In the view of Wadikwu, *et al.*, (2017), asserts that Mathematics is a branch of information that manages estimations, numbers, and amounts. It is noted that the teaching and learning of mathematics at all levels of the educational system in Nigeria can be described to be in a depressed state, as students find it difficult to understand Mathematics.

Anigbo (2016) investigated factors affecting Secondary School Students' Mathematics interest and achievement. The factors are student factor, teacher factor, government factor, infrastructural problem, instructional strategy, class size, and

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mathematics anxiety. Offiah (2011) also points out that the desire to improve students' interest and achievement in Mathematics through more effective instructional strategies and increasing awareness of the importance of learner-centeredness in teaching-learning situations in order to help the learner learn more.

Okechukwu et al., (2014) report that mathematics educators have been concerned with how students learn mathematics effectively with utmost interest and better achievement, hence there is a need to use mathematical games to harness students' intellectual power. Sedat and Ozlem (2017) report that game improves oral communication, social interaction, creativity and problem-solving skills of students. It also increases the effectiveness of teaching by generating a collaborative learning environment and creating discussion platforms. Also, the use of game approaches in classrooms helps to increase the level of the mathematical consciousness of students (Marcus, et al., 2016). Mathematics games strategy is a way of setting rules and outcomes with clear Mathematics parameters.

Therefore Mathematical games may be used to introduce concepts as a prelude to explicit teaching or learning practical skills to consolidate a concept after teaching in schools, Okechukwu et al., (2014). Nekang (2018) reports that Mathematical games help students to explore elementary number concepts such as counting, sequence and series, number and numeration, basic number operation, one-to-one correspondence, and computation strategies. Thus, students learn and perfect their mathematical skills in a play-way, which removes the hatred of the students towards learning Mathematics.

Nekang (2018) further asserts some of the values of teaching and learning mathematics through games which are recreation, stimulating mathematical thinking, opportunities for computational practise, creating in students potential to develop familiarity with numbers, supporting the school to home relationship, concentration, and skills needed often leads to discovery and creativity.

Kpolarie et al., (2014) stressed that academic achievement is the outcome of education as it indicates the extent to which the student, teacher, curricular and educational institution has achieved the predetermined

educational goals. They further concluded that academic achievement is commonly measured with examinations that assess important procedural knowledge such as skills, and declarative knowledge such as facts that students have learned. Yeh et al., (2019) assert that students with continuously low achievement in mathematics may eventually lose their interest and refuse to learn further.

Ezeugwu et al., (2016) report that children may be intellectually and physically capable of learning yet they may never learn until their interest is stimulated. Once the students are stimulated, they will continue to learn as long as the teacher is capable of sustaining their interest in the subject matter. Interest has to do with preparedness or mastery of a subject – matter that can enable the learner to cope with further or next higher level of learning of the related learning task (Idigo, 2015).

The issue of gender in the process of learning and teaching Mathematics cannot be overlooked as Mathematics tends to be regarded as a masculine domain. Also, many people and society as a whole believe that females are less mathematically capable than males' gender. Asante (2010) asserts that gender issue in mathematics achievement and ability has remained a source of concern as educational stakeholders seek to address the under-representation of female at the highest levels of mathematics. But studies have shown that gender issues in the learning of mathematics cannot be explained in a simplified manner because there are a multiplicity of forces and environments that operate apart from gender, which influences a child's learning of mathematics. The issues of gender in mathematics may vary due to socioeconomic status and ethnicity, school environment, the mindset of the teacher among other things.

Despite the introduction and implementation of different teaching methods/strategies suggested by researchers, the achievements of students in mathematics have persistently been poor, hence the need of exploring the effect of Mathematics game strategy as a teaching methodology which may improve the academic achievement and interest of secondary school students in mathematics.

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Objectives of the Study

The objectives of this study are to determine:

1. Effects of Mathematics games strategy on academic achievement of the students in Mathematics.
2. Effect of gender on students' academic achievement in Mathematics.
3. The interaction of effect Mathematics game and gender on students' achievement in Mathematics.
4. Effect of Mathematics game on students' interest in mathematics.
5. The effect of gender on students' interest in mathematics
6. The interaction effect of Mathematics games and gender on students' interest in Mathematics.

Hypotheses

The following null hypotheses are generated for this study

- H0₁:** There is no significant main effect of treatment on students' achievement in mathematics.
- H0₂:** There is no significant main effect of gender on students' achievement in mathematics.
- H0₃:** There is no significant interaction effect of treatment and gender on students' achievement in mathematics
- H0₄:** There is no significant main effect of treatment on students' interest in mathematics.

H0₅: There is no significant main effect of gender on students' interest in mathematics.

H0₆: There is no significant interaction effect of treatment and gender on students' interest in mathematics.

METHODOLOGY

A pre-test, post-test, control Quasi-experimental Research design was adopted for this study. The population for the study comprised all public senior secondary schools in the Ijebu-Ode Local Government Area of Ogun State, Nigeria. The sample for this study comprises 100 respondents of Senior Secondary School one (SSS1) student of an intact class from two (2) selected public Senior Secondary Schools.

INSTRUMENTATION

Mathematics Interest Scale (MIS) and Mathematics Achievement Test (MAT) were used to elicit information from the students. MIS is made up of 20 items on a four-point scale ranging from strongly agree to strongly disagree to assess students' interest in Mathematics while MAT is a 50 multiple-choice items question to assess students' academic achievement in Mathematics. A teaching guide was also used to guide the experimental group in other not to experience the same learning process as the control group that was taken through the conventional teaching. Both instruments have a reliability coefficient of 0.70 for MAT and 0.81 for MIS. The data were analyzed using analysis of covariance.

DATA ANALYSIS

Table 1: Analysis of Covariate (ANCOVA) of Students' Achievement Scores on treatment, gender, and the Interaction

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	256.926 ^a	11	23.357	3.497	0.002
Intercept	1340.878	1	1340.878	200.767	0.000
Game Strategy	253.168	7	36.167	5.415	0.000
Gender	.081	1	.081	.012	0.913
Game Strategy * Gender	3.093	3	1.031	.154	0.926
Error	253.794	38	6.679		
Total	4418.000	50			
Corrected Total	510.720	49			

The table above is used to answer hypotheses one to three

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Hypothesis One: There is no significant main effect of treatment on Students' achievement in Mathematics.

The table1 revealed that the effect of the Mathematics Game Strategy on students' achievement in Mathematics at 0.05 significant level. The F-stat. value of 5.42 for treatment is significant at 0.000 which is less than 0.05 alpha levels and thus null hypothesis is rejected, it is therefore concluded that there is a significant main effect of treatment (Mathematics Game Strategy) on senior secondary school students' achievement in Mathematics. It also indicates that there is a significant difference in the mean achievement scores of students who were taught with Game Strategy as an instructional guide and those who were exposed to the traditional methods of teaching.

Hypothesis Two: There is no significant main effect of gender on Students' achievement in Mathematics

From Table 1 above, the F-stat value of 0.15 for gender is not significant at 0.91 which is greater than the 0.05 level of significance and thus the null hypothesis was accepted. We, therefore, conclude that there is no significant main effect of gender on students' achievement in Mathematics. This implies that gender does not affect the students' achievement in Mathematics.

Hypothesis Three: There is no significant interaction effect of treatment and gender on Students' achievement in Mathematics

From Table 1 above, the F-stat value of 0.15 for treatment and gender interaction effect is not significant at 0.93 which is greater than the 0.05 level of significance, thus the null hypothesis was accepted. We, therefore, conclude that there is no significant interaction effect of treatment and gender on students' achievement in Mathematics.

Table 2: Analysis of Covariate (ANCOVA) of Students' Interest scores on treatment, gender, and Interaction

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	134.063 ^a	31	4.325	1.263	.306
Intercept	2671.472	1	2671.472	780.414	.000
Treatment	126.161	27	4.673	6.365	.029
Gender	15.275	1	15.275	4.462	.049
Treatment* Gender	2.805	3	.935	.273	.844
Error	61.617	18	3.423		
Total	5276.000	50			
Corrected Total	195.680	49			

The table above is used to answer hypotheses four to six

Hypothesis Four: There is no significant main effect of treatment on students' interest towards Mathematics

Table 2 revealed that the F-stat. value of 6.37 for treatment is significant at 0.029 which is less than 0.05 alpha levels and thus the null hypothesis is rejected hence it is concluded that there is a significant main effect of treatment on students' Interest in Mathematics.

Hypothesis Five: There is no significant main effect of gender on Students' Interest in Mathematics

From Table 2 above, the F-stat value of 4.46 for gender effect on student's interest is significant at 0.049 which is less than 0.05 level of significance and thus the null hypothesis is rejected, hence there is a significant main effect of gender on students' Interest towards Mathematics.

Hypothesis Six: There is no significant interaction effect of treatment and gender on Students' Interest in Mathematics

From Table 2 above, the F-stat value of 0.27 for treatment and gender difference interaction is not significant at 0.84 which is

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greater than the 0.05 level of significance and thus the null hypothesis is accepted, therefore it is concluded that there is no significant interaction effect of treatment and gender on students' interest towards Mathematics.

CONCLUSION

The following conclusion was drawn based on the findings of this study that Mathematics Game Strategy for teaching affected students' achievement in and interest towards Mathematics at Senior Secondary School level that is the strategy improves the academic achievement and interest of the learners. It is also concluded that there is no interaction effect of treatment and gender on the academic achievement in and interest towards Mathematics in senior secondary schools in Ijebu ode local government area of Ogun State, Nigeria.

RECOMMENDATIONS

The following recommendations were provided based on the findings of the study:

- (i) The teachers should ensure the use of the Mathematics game strategy as an alternate method in the process of teaching and learning Mathematics at the secondary level of education in order to encourage the students towards having an interest in Mathematics.
- (ii) Parents should encourage their children to have the necessary textbooks to encourage them to solve problems personally in order to boost their academic achievement and increase their interest in learning Mathematics.
- (iii) Ministries and all stakeholders should step up teachers' supervision to curb laziness and sluggishness on the part of teachers to ensure proper usage of the instructional strategy in schools
- (iv) Further studies can be carried out on junior and primary schools in Nigeria in different subject areas.

REFERENCES

Abakpa, B.O. & Iji, C.O. (2011). Effect of mastery learning on Senior Secondary School Students' achievement in geometry. *Journal of Science Teachers Association of Nigeria*, 1, 165–176.

Akorede A. Asanre, Taiwo O. Abiodun, and Toyin A. Odupe. (2019). Content Coverage and Students attitude as Predictors of Senior Secondary Academic Achievement in Mathematics. *Islamic University Multidisciplinary Journal (IUMJ)*. Vol. 6, 164 - 167.

Alechenu, S.O. (2012). Gender-related differential item functioning in Mathematics multiple-choice test items set and administered by National Examination Council. *Journal of Mathematical Science Education*, 6(2), 34-41.

Anigbo, L. C. (2016). Factors affecting students' interest in mathematics in secondary schools in Enugu State. *International Journal of Education and Evaluation*, 2(1), 22-28.

Asante, K.O. (2010). *Sex differences in Mathematics performance among senior high students in Ghana*. Retrieved from <http://www.faqs.org/periodicals>.

Ezeugwu, J.O., Onuorah, J.C., Asogwa, U.D. & Ukoha, I.P. (2016) Effect of Mathematics game-based instructional techniques on students' achievements and interest in algebra at the basic educational level. *Global Journal of Pure and Applied Mathematics*. 12(4), 3727-3744

Idigo, E. C. (2015). *An effective method of Retaining Students Interest in Mathematics in Secondary Schools in Enugu East Local government Area of Enugu State*. Unpublished UG Thesis, Institute of Ecumenical Education, Thinker's Corner, Enugu, in Affiliation with (ESUT), Enugu.

Ifamuyiwa, A. S., Abiodun, T. O. & Asanre, A. A. (2018). Student Representation ability in secondary school Mathematics themes involving word problems as related to achievement in Mathematics. *Journal of Science teachers association of Nigeria*. Vol. 53, 125 -135

Kpolarie, P. J., Joe. A. I., & Okoto, T. (2014). Academic achievement prediction: Role of interest in learning and attitude towards school. *International*

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- Journal of Humanities Social Science and Education*, 1 (11), 73 – 100.
- Marcus, A., Pery, B., Dockett, S., & MacDonald, A. (2016). Children noticing their own and others' Mathematics in play. In B. White, M. Chinnappan, & S. Trenholm (Eds.). *Opening up mathematics education research* (Proceedings of the 39th annual conference of the Mathematics Education Research Group of Australasia) 439-446)
- Nekang, F. N. (2018). The use of mathematical games and secondary school students' achievement in mathematics in the fake division, the southwest region of Cameroon. *Journal of Education and Entrepreneurship*. 5 (1), 20-31.
- Offiah, F.C. (2011). Cooperative learning interaction in the science classroom for national development and interaction. *UNZIK Journal of STM Education*. 2(1), 20-31.
- Okechukwu S. Abonyi, Nkechi M. Maduagwuna, Julius O. Ugama (2014). Effect of Mathematical Game on Students Achievement in Quadratic Expressions. *International Journal of Scientific & Engineering Research*, 5(6), 678-684
- Sedat T. & Özlem D. T. (2017). The Effect of Game-Assisted Mathematics Education on Academic Achievement in Turkey: A Meta-Analysis Study. *International Electronic Journal of Elementary Education*. 10(2), 67-74
- Wadukwu, T., Kevwe, O. A., Eseose, M., & Nwaukwu, C. (2017). Psychological factors and students' academic achievement in Mathematics in Ughelli-South Local Government Area of Delta State. *Journal of Education*, 5(10), 8-21.
- Yeh, C. Y. C., Cheng, H. N. H., Chen, Z., Liao, C. C. Y. & Chan, T. (2019). Enhancing achievement and interest in mathematics learning through Math-Island. *Research and Practice in Technology Enhanced Learning*. 14(5), 103-112.