GAME-BASED INSTRUCTIONAL APPROACH AND MATHEMATICS STUDENTS' INTEREST AND ACADEMIC PERFORMANCE IN ORUK ANAM LOCAL GOVERNMENT AREA, AKWA IBOM STATE

Abasi, Andrew U. (Ph.D.)
andrewumoeka@gmail.com
+2348033632264

&
George, Idara G. (Ph.D.)
idatageorge@gmail.com
+2348030722692

Department of Science Education
Akwa Ibom State University, Mkpat Enin, Nigeria

Corresponding Email: andrewumoeka@gmail.com
Phone**:** 08033632264

Abstract
This study investigated game-based instructional approach on junior secondary school students' interest and academic performance in geometry in Oruk Anam Local Government Area, Akwa Ibom State. Two research questions and two hypotheses guided the study. Quasi-experimental research design, specifically, pre-test posttest non-equivalent group was adopted for the study. The population of the study consisted of all government coeducational Junior Secondary School class two (JSS2) students of 2024 academic session. A sample of 115 JS 2 students drawn from intact classes in two randomly selected secondary schools was used for the study. Geometry Performance Test (GPT) and Mathematics Interest Questionnaire (MIQ) were used as instruments for data collection. The instruments were subjected to face and content validity. The reliability of the instruments was established using Cronbach Alpha and Kuder Richardson KR-21 with a reliability coefficient of 0.77 and 0.71 respectively. Independent t-test was used to test the hypotheses. Results revealed that there was no significant difference in the mean interest scores and performance of Mathematics students taught the concept of geometry using geoboard and card games instructional approach. The researchers recommended that Mathematics teachers should effectively utilized mathematical game such as geoboards and card games in teaching to capture the attention of the students in learning mathematics.

Keywords: *Geoboard, Card Games, Interest, Academic Performance, Geometry*

Introduction

In many facets of human existence, including science, technology, engineering and business, Mathematics is a crucial subject. As a result, Mathematics education is now a crucial part of academic curricula all around the world (Ojose, 2018, *Bessong et al, 2024*). In any human activity, there exists an element of Mathematics which could be inform of Algebra, Calculus, Geometry, Trigonometry or Statistics and they use signs, symbols and/or proofs to describe relationship(s). Hence, Mathematics as a school subject is taught primarily for the development of thinking skills, reflections on oneself, environment, social issues and organizing one's

experience for possible solution(s) to problems (Okpube & Anugwo, 2016). Mathematics is an indispensable tool in the study of science, humanities and technology. It is the foundation for any meaningful scientific endeavor and any nation that must develop in science and technology must have strong mathematical bedrock for its youths (Uhumuarbi & Umoru, 2018; Mbagwu et al, 2016, Akpama et al, 2017).

Odumosu, Oluwayemi and Olatunde (2018) described Mathematics as an essential ingredient in manufacturing industries, economic activities, bride of sciences, chief bride's maid of social sciences, ladies in waiting for engineering, cosmetology of arts and unavoidable servant of management sciences. It is not surprising that because of this, Mathematics is recommended as a core subject in both primary and secondary school in Nigeria and many countries of the world. According to Ado and Abasi (2021), Mathematics encourages the habit of self-reliance and assist learners to think and solve their problems themselves. In mathematics also, learners are challenged to make discoveries, lead them to analyse and interpret their experience and to make generalizations which they can subsequently apply new situations. Mathematics equally exposes learners to different ways of solving the same problem (Ado & Abasi, 2021; Oboqua et al, 2017; Olofu et al, 2024). It therefore means that Mathematics can be applied in every facets of life even in the small-scale business enterprises which is the life wire of every economic sector. The application of Mathematics to problem areas depends on the understanding of the concepts and the principles of Mathematics by the problem solver. This would enable the students experience, discover, discuss and change the misconception of Mathematics as an abstract and difficult to learn subject, especially as it concerns geometry related topics (Igyu et al, 2022; Olofu et al, 2020).

Geometry is a prominent topic in Mathematics and forms an integral part of most of the school curricula all over the world taking into account its considerable benefits and applications in real life. In its historical trends of development, geometry involves the relationship between lengths, areas and volumes of physical objects (Abasi, 2024, Adie et al, 2019; Meremikwu et al, 2022).In Nigeria's educational system, geometry forms an essential part of the Mathematics curriculum from the basic to the secondary school levels. One of the major objectives of geometry instruction is to help children develop an understanding of "geometric shapes and structures and to analyse their characteristics and relationships" (National Council of Teachers of Mathematics NCTM, 2010). The fundamental skills such as reasoning, proving, problem solving, communication, making connections, creative and innovative thinking, and inquiry can be enhanced and fostered by geometry learning (NCTM, 2010, Ushie et al, 2023). These are transferable skills that are needed to comprehend and master all other branches of mathematics as well as science. As we emphasize innovation in the school curriculum, applications of geometric knowledge are highly emphasized in the development of science and technology. Even within classroom instruction, students benefit from not only geometry and measurement skills but also from the specific content areas of the subject (Edoho & Abasi, 2020; Olowonefa et al, 2023, Niyi et al, 2024). Unfortunately, teachers and educators in different parts of the world are disappointed about the poor state of geometric skills in our mathematics classroom (Edoho & Abasi, 2019; Inyang, 2022).

Students interest and their overall performance in geometry lessons is consistently poor and in a decline state. Students are weak in understanding geometric principles, identifying geometry features in drawings and performing logical argument in proofs and solving multi-step problems. The overall effects of this weakness result in students' poor interest and achievement in mathematics (Edoho & Abasi, 2019). This ugly trend of students' poor performance in Mathematics has become a national disaster.

Despite the recognitions accorded to Mathematics due to its relevance, Elekwa (2015) remarked that students exhibit nonchalance attitude towards Mathematics, even when they know that they need it to forge ahead in their academic pursuit and in life. Such students who have

already conditioned their minds that Mathematics is the most difficult subject are usually not serious in learning of Mathematics and thus perform poorly in Mathematics assessment (Ado & Abasi, 2021). It has been noted that a lot of students struggle with the subject of Mathematics, which has a negative impact on their academic performance (Hazarika, 2020). This is largely due to a lack of enthusiasm, poor comprehension, and inefficient instructional strategies (Aliakbari & Faraji, 2017, Nja et al, 2025).

According to Abasi (2018b), this deplorable state of mathematics achievement is attributed to a number of factors ranging from teacher's incompetency on the subject matter, learners' attitude and perception, instructional strategies and materials as well as availability and utilization of mathematics laboratory kits. For a successful mathematics instruction to take place, it is pertinent that every mathematics teacher should engage the students actively with concrete materials to aid the teaching and learning process (Abasi, 2018a). This is because in our schools, Mathematics is one of the most poorly taught, widely hated and abysmally understood subjects. Students develop a high degree of phobia towards mathematics and even other mathematics related activities and subjects.

With the realization of the indispensability of Mathematics to the survival of human race, Mathematics educators have been concerned with ways in which students learn Mathematics (Abasi & Ado, 2021). Also, due to peculiarities, researchers in mathematics education Abasi and Umoinyang (2020); Ado, Abasi and Nwankwo (2017) and other prominent stakeholders, like Mathematical Association of Nigeria (MAN) and Science Teachers Association of Nigeria (STAN) have in recent times been beaming their search light on innovative pedagogies that could enhance the effectiveness of teaching and learning mathematics. However, none of these research efforts have been able to resolve this trend. In this respect, teachers have been advised to use teaching methods or approaches that would enhance students' interest in the learning thereby resulting into better performance (Ado & Abasi, 2014). Accordingly, Abasi, Okri and Arikpo (2022) asserted that the teaching and learning of mathematics requires an intensive application of manipulative resources that would appeal to all the senses of perception to improve the effectiveness of instruction as well as learning. Game-based learning approach clearly fit into this recommendations.

Game-based learning is a practical approach of obtaining new concepts and skills through the use of digital and non-digital games (Grace, 2019). Practical approach is a situation in which teachers employed the use of physical objects that can be touched, manipulated and utilized proficiently in the teaching and learning process. Practical work provides the most effective means by which understanding and comprehending of mathematical concepts can be improved. It enable students to reason out the mathematical ideas which are contained within the various activities, thus make them to become critical thinkers. The learners are then guided to find information and understand concept through appropriate activities and demonstrations which encourages them to discover patterns in mathematics leading to rules and formulae (Ado & Abasi, 2014). Hence, game-based learning centered on practical approach to learning mathematics.

The application of games in education can foster notable improvements in both learning and education outcomes (Kula, 2021; Syafii, 2021). Game-based instructional approach is a strategy that involves practical use of games to engage students and improve learning (Papastergiou, 2019). Because it allows students to study in a fun and engaging setting, game-based Mathematics learning has been proven to be an effective technique for teaching Mathematics (Egenfeldt-Nielsen, Nielsen & Larsen, 2016). The development of students' problem-solving and critical-thinking abilities can also be benefited from game-based Mathematics instruction (Egenfeldt-Nielsen *et al.,* 2016). This study therefore focuses on assessing the effect of two game based approaches viz: geoboard and card games on students' academic performance and interest in geometry.

Geoboard is a short form for geometrical board. Russel (2013) described a Geoboard as a manipulative that is used to support learning of geometry, measurement and numeracy. A Geoboard is made up of piece of wood and some nails. It can be used to demonstrate the properties of plane shapes, it also useful in the study of area and perimeter of plane shapes. On the other hand, card games refer to instructional games that use a deck of traditional cards to supplement the learning process and enhance Mathematics skills (Singh, Hoon, Nasir, Adlan, Rasid, & Chew, 2021). Card games kill two birds with one stone: as on one hand, it strengthens family and friendship bonds since everyone comes together to play the game; and in the process, children reap the benefits of acquiring mathematical knowledge amidst the fun (Shellenbarger, 2015). Card games have several resulting benefits, from sociological to developmental aspects because children build mental computation skills during play time in addition to imbibing key values such as sportsmanship and honesty (Family Education, 2017).

It is in recognition of the significant role of game-based instructional approach towards improving the academic performance of students in Mathematics, that the researchers examined the effect of geoboard and card games instructional approach on junior secondary school students' interest and academic performance in Mathematics in Oruk Anam Local Government Area.

Statement of the Problem

Many students struggled to learn Mathematics and most often do not achieved success through their learning. This may be that; they are unable to construct appropriate understanding of fundamental mathematical concepts through their learning strategies and, the teachers teaching approaches to Mathematics does not seem to help the students to surmount this difficulty. Thus, many students are left to perform consistently poor in internal and external examinations, despite the importance of Mathematics in Nigeria education system. It is disheartening that modern effective approaches for teaching and learning of important and compulsory subjects such as Mathematics at both primary and secondary schools are not being put to effect by teachers. Here, teachers still make extensive used of conventional teaching method, which do not promote active learning among students. Research evidence abound that game-based instructional approach is effective in enhancing students' academic performance. The researcher wishes to establish these claims by examining the effect of geoboard and card games on students' interest and academic performance in geometry in Oruk Anam Local Government Area.

Purpose of the Study

The main purpose of the study is to investigate the effect of game-based instructional approach on junior secondary school students' interest and academic performance in Mathematics in Oruk Anam Local Government Area of Akwa Ibom State. Specifically, the study sought to:

1. examine the difference in the mean interest scores of Mathematics students taught the concept of geometry using geoboard and card games instructional approach.
2. determine the difference in the mean performance scores of Mathematics students taught the concept of geometry using geoboard and card games instructional approach.

Research Questions

The following research questions were formulated to guide the study

i. What is the difference in the mean interest scores of Mathematics students taught the concept of geometry using geoboard and card games instructional approach?
ii. What difference exists in the mean performance scores of Mathematics students taught the concept of geometry using geoboard and card games instructional approach?

Hypotheses

1. There is no significant difference in the mean interest scores of Mathematics students taught the concept of geometry using geoboard and card games instructional approach.

2. There is no significant difference in the mean performance scores of Mathematics students taught the concept of geometry using geoboard and card games instructional approach.

Methods

Quasi-experimental research design, specifically, pre-test posttest non-equivalent group was adopted for the study. The population of the study comprised all Junior Secondary two (JS2) students in the 14 public secondary schools in Oruk Anam Local Government Area with an enrolment of 3,013 JS2 students in 2024 session (Akwa Ibom State Secondary Education Board, 2024). The sample size consists of 115 JSS 2 students from two intact classes in two schools. This sample was arrived at by selecting 2 government owned secondary schools in the area of study using simple random sampling. The simple random sampling was done using the hat and draw method in which folded piece of papers were selected without replacement. In each of the two selected schools, one intact class with fifty-four (59) students and another intact class with fifty-six (56) students from another school were sampled. With simple random sampling technique each school was assigned to as experimental group I that is (geoboard game) and experimental group II (card game) respectively. The instruments used for data collection were "Geometry Performance Test (GPT)" and "Mathematics Interest Questionnaire (MIQ)".The instruments were constructed by the researcher. The GPT instrument consisted of 20 multiple choice test items with four options lettered A-D on the concept of geometry drawn from the JS 2 Mathematics scheme of work while the MIQ contains 10 items to assess students' interest in Mathematics, arranged in a 4-point likert scale of Strongly Agreed (SA), Agreed (A), Disagreed (D) and Strongly Disagreed (SD). Two lesson notes on geometry using for geoboard and card games were also constructed for teaching experimental group one and experimental group two respectively. The instrument was content and face validated by two experts in measurement and evaluation. A test blue print was developed with content relevance and ambiguity of expression corrected and suggestions made by experts were used to restructure the instrument, each question carrying 1 mark. Upon validation of the instrument a trial test was conducted with an intact class of 50 JSS 2 students outside the area of the study to establish the reliability of the instrument. A reliability coefficient of 0.77 and 0.71 for the MIQ and GPT respectively were obtained using Cronbach Alpha and Kuder Richardson KR-20 estimate which showed a high reliability for the instruments. After obtaining approval from the principal of the selected schools, the researcher first administered the pre-test and pre-interest questionnaire to the students in the two schools and obtained their scores to ascertain their pre-entry ability before treatment. After the instructional process, post-test and the post-interest questionnaire were administered to the students to assess their academic ability and interest after treatment. On completion, the instruments were collected and appropriately parcelled for easy identification during scoring and collation. Each correct answer on the GPT were scored 1 mark while the responses on the MIQ were rated as follows:
Strongly Agree (4 points), Agree (3 points), Disagree (2 points),and Strongly Disagree (1 point).

Results

The data generated from the retrieved instruments were analysed using independent t-test statistics to test the hypotheses at 0.05 level of significance.

Hypothesis one: there is no significant difference in the mean interest scores of Mathematics students taught the concept of geometry using geoboard and card games instructional approach.

Table1: Independent t-test result on students' interest in Mathematics based on treatments (N = 115)

Treatment groups	N	Mean	SD	df	t-cal.	P
Geoboard	59	53.07	9.60			
				113	-0.22	.830
Card game	56	53.43	9.26			

Not Significant at P>0.05 level of significance

As shown in table 1, the analysis of the post-interest scores of the two groups of students taught the concept of geometry using geoboard and card games is not significant (t-cal = -0.22; df = 113 @ 0.05 level of significance), indicating a no statistical significance difference between the mean interest scores of the two groups. Therefore, the null hypothesis is upheld since the calculated t-value with corresponding probability value of .830 is greater than the declared probability value of 0.05 level of

significance. This implies that there is no significant difference in the mean interest scores of Mathematics students taught the concept of geometry using geoboard and card games instructional approach. Thus, both geoboard and card game were found to be effective in enhancing students' interest in mathematics when taught the concept of geometry.

Hypothesis Two: there is no significant difference in the mean performance scores of Mathematics students taught the concept of geometry using geoboard and card games instructional approach.

Table 2: Independent t-test result on students' academic performance in Mathematics based on treatments (N = 115)

Treatment groups	N	Mean	SD	df	t-cal.	P
Geoboard	59	19.73	4.91			
				113	1.21	.230
Card game	56	18.54	5.67			

Not Significant at P>0.05 level of significance

As shown in table 2, the analysis of the post-test scores of the two groups of students taught the concept of geometry using geoboard and card games is not significant (t-cal = 1.21; df = 113 @ 0.05 level of significance), indicating a no statistical significance difference between the mean scores of the two groups. Therefore, the null hypothesis is upheld since the calculated t-value with corresponding probability value of .830 is greater than the declared probability value of 0.05 level of significance. This implies that there is no significant difference in the mean performance scores of Mathematics students taught the concept of geometry using geoboard and card games instructional approach. Thus, both geoboard and card game were found to be effective in enhancing students' academic performance in the concept of geometry in mathematics.

Discussion of Findings

Data in table 1 determine the difference in the mean interest scores of students in mathematics when taught the concept of geometry using geoboard and card game instructional approach. The results of findings showed that there is no significant difference in the mean interest scores of students in mathematics when taught the concept of geometry using geoboard and card game. Thus, the use geoboard and card game in teaching and learning the concept of geometry in mathematics were found to be effective in boosting students' interest in the subject. This result could be attributed to the fact that students taught using geoboard and card game engaged more in hands-on activities which helped in bridging the gap between abstract learning. The use of these instructional approaches as a game-based practical approach to learning engages students actively, giving them the opportunity to share their thoughts, play with their peers, correct misconceptions and fear always associated to learning mathematics which resulted in developing and building on already existing passion and interest towards learning mathematics. The result of this finding is in line with the findings by Ezeugwu, Onuorah, Asogwa and Ukoha (2016), Ado and Abasi (2014) and Abasi (2024) who showed that students taught using hands-on instructional approaches such as game-based, practical approach and origami were better enhanced in their interest towards mathematics than their counterparts taught without.

Data in table 2 determine the difference in the mean performance scores of students in mathematics when taught the concept of geometry using geoboard and card game instructional approach. The findings revealed that there is no significant difference in the mean performance scores of students in mathematics when taught the concept of geometry using geoboard and card game. Thus, the use geoboard and card game in teaching and learning the concept of geometry in mathematics were found to be effective in enhancing students' performance in the subject. The use of these instructional approaches as a game-based practical approach to learning engages students actively, thereby enhancing their academic performance in mathematics. The result of this finding is in line with the findings by Olajide, Ekwueme and Ndioho (2020) and Abari and Andrew (2021) who showed that students taught using geoboard were better enhanced in their academic performance in mathematics than their counterparts taught without.

Conclusion

Based on the findings of this study, the researcher concluded that geoboard and card games instructional approach are effective ways of boosting students' interest thereby improving their performance in geometry and mathematics in general, because it allows for students' active engagement, giving them the opportunity to share their thoughts, play with their peers, correct misconceptions and fear always associated to learning mathematics.

Recommendations

Based on the findings of this study, the researchers offered the following recommendations relevant for the improvement of Mathematics education.

1. Mathematics teachers should effectively utilized mathematical games such as geoboard and card games in teaching the concept of geometry specifically and in the general teaching of Mathematics concepts as it has been proven to enhanced students' interest and performance in the subject.
2. Government should make adequate provisions for funding and equipping of school Mathematics laboratories with mathematical kits to promote and encourage the use of Mathematics games in teaching in schools to aid the teacher and students in effective instructional delivery.

References

Abari, M. T. & Andrew, K. D. (2021). Effects of geoboard on the performance of junior secondary school student in geometry in Makurdi Metropolis of Benue State. *International Journal of Advances in Engineering and Management (IJAEM),* 3(12), 225-228

Abasi, A. U. (2018a). Teachers' instructional strategies and upper basic students' academic achievement in mathematics in Essien Udim Local Government Area of Akwa Ibom State. *International Journal of Educational Benchmark,* 9(3) 76-83.

Abasi, A. U. (2018b). Availability and utilization of mathematics laboratory kits in teaching and learning of junior secondary school mathematics in Mkpat Enin Local Government Area of Akwa Ibom State. *Journal of Issues in Mathematics,* 19(1) 56-63.

Abasi, A. U. (2024). Enhancing junior secondary school Students' spatial ability in the concept of geometry in Mathematics using Origami-based instruction. *Ibadan Journal of Educational Studies, 21(2), 12-20.*

Abasi, A., Okri, J. & Adie, P. (2022). Instructional manipulatives and students' academic performance and retention in mathematics in Mkpat Enin Local Government Area of Akwa Ibom State, Nigeria. *Prestige Journal of Counseling Psychology,* 5(2), 1-12

Abasi, A. U. & Umoinyang, I. E. (2020). Innovative mathematical pedagogical methods and strategies for improving the teaching and learning on mathematics. *Journal of Science Teachers Association of Nigeria,* 55(1) 114-123.

Abasi, A. U. & Ado, I. B. (2021). Effect of Problem-solving Method on Secondary School Students' Academic Achievement and Attitude in Mathematics in Uyo Local Government Area of Akwa Ibom State. *The Journal of Mathematical Association of Nigeria,* 46(1) 342-352.

Adie, E. B, Okri, J. A, Anditung, P. A (2019). Influence of School Science Facilities on Senior Secondary Students' Learning Outcome in Mathematics in Central Education Zone, Cross River State, Nigeria *Multidisciplinary Journal of Research and Development Perspectives,* 23159936, 28-36, https://www.mjrdp-unical.com

Adigun, O. T. (2018). Students' interest in learning mathematics as a means of economic recovery. *Journal of Curriculum and Instruction, 1(2), 1-9.*

Ado, I. B. & Abasi, A. U. (2021). Programmed-based Instructional Method and Students' Academic Performance and Retention in Mathematics in Uyo Local Government Area of Akwa Ibom State. *International Journal of Education and Ethical Issues in Research* 2(1) 76 -87.

Ado, I. B. & Abasi, A. U. (2014). Effect of practical approach on basic 7 mathematics students' interest and performance in fraction in Uyo Akwa Ibom State of Nigeria. *Journal of Education and Practice, 5(28), 77-80.*

Ado, I. B.,Abasi, A. U.& Nwankwo, F. M. (2017). Information and communication technology (ICT) as resource for teaching surface area of solid shapes in mathematics in Bayelsa State of Nigeria. *IOSR Journal of Research & Methods in Education,* 7(1) 43-48.

Akpan, A. O. (2022). Infographics as Instructional Resources for teaching Basic Science and Technology in Junior Secondary Schools in Akwa Ibom State. A Journal of Basic Education in Nigeia, 8, 197-218.

Aliakbari, M., & Faraji, R. (2017). A survey of factors contributing to pupils' poor performance in mathematics. *Procedia-Social and Behavioral Sciences, 15(2011), 1455-1460.*

Akpama, S. I., Bessong, C. D. & Bessong, N. O.(2017). Attainment of the Sustainable Development Goals (SDGS): The Relevance of Adult Basic Education .*Education For Today: Journal of the Faculty of Education*, University of Calabar. *13* (1) 13-19.

Bessong, C.D., Ewuru, A.A., Bessong, N.O., Omang, T.N, Olori, G.I, Patrick, E.O, Olofu, P.A & Olori, C.N. (2024) Digital Literacy and it's Effect on Learners' Civic Engagement in Adult and Vocational Education in Nigeria. masyarakat, Kebudayaan & Politik 37(4), 418-431

Edoho, E. A. & Abasi, A. U. (2019). Effect of guided-discovery instructional strategy on performance and interest of upper basic students towards geometry in Uyo Local Government Area, Akwa Ibom State, Nigeria. *Nigerian Journal of Science and Science Education,* 8(3) 42-53

Edoho, E. A., Asuquo, I. M., Anditung, P. A. & Abasi, A. U. (2020). Improving senior secondary school students' academic achievement and retention in mathematics and basic science using collaborative concept mapping instructional strategy (ccmis). *European Journal of Scientific Research*, 156(1) 108-117.

Egenfeldt-Nielsen, S., Nielsen, T. H. & Larsen, H. B. (2016). *Essentials of game-based learning: A systematic approach.* London: Routledge

Elekwa, U. C. C. (2015). Effects of collaborative teaching/learning strategies on the Mathematics achievement of senior secondary school students in Abia State of Nigeria. *Unpublished PhD thesis Submitted to Faculty of Education, University of Port Harcourt.*

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 basic education level. *Global Journal of Pure and Applied Mathematics*, 12, 3727-3744.

Family Education (2017). The Importance of playing games with your preschooler [Online]. *Available: http://goo.gl/ulk6Kg.*

Grace, L. D. (2019). *Doing things with games: Social impact through play.* Routledge.

Gutierrez, A. (2014). Development and effectiveness of an educational card game as supplementary material in understanding selected topics in Biology. *CBE Life Sci Educ*, 3(1), 76–82.

Igyu C. O, Adie E. B, H. A. Ogah, & P. A. Anditung. (2022). Interactive effect of variation teaching strategy on the algebraic motivation, understanding and performance in basic five in Benue State, Nigeria *Multi-Disciplinary Journal of Science and Technology Education*, 2276-8144, 65-71 www.vmjste.net

Inyang, I.O. (2022). Tax revenue and fiscal development: A pragmatic framework for economic governance in Cross River State, Nigeria. *Multidisciplinary Journal of Research and Development Perspectives, 11(2), 71-79*Hazarika, D. (2020). Factors affecting mathematics achievement of secondary school pupils in India. *International Journal of Research in Education and Science*, 6(3), 514-523.

Kula, S. S. (2021). Mind games with the views of classroom teachers. *International Journal of Research in Education and Science (IJRES),* 7(3), 747-766.

Manzano, R. (2015). The art and science of teaching/using games to enhance student achievement. *Educational Leadership,* 67(5), 71-72.

Mbagwu, F. O., Bessong, C. D. & Anozie, O. O. (2016). Contributions of Tourism to Community Development. Review *of European Studies*, Canadian Centre of Science and Education *8*(4) 121-130.

Meremikwu, A. N, Ibok E. E, Adie, E. B, Inah, L. I, Tawo, C, N, Okri, J. A. (2022). Guidance Services as Predictors of Students' Academic Achievement in Mathematics in Eket Education Zone Akwa Ibom State, Nigeria *International Journal of Research and Innovation in Applied Science*, 7(10), ISSN: 2454-6194.

National Council of Teachers of Mathematics (NCTM) (2010). *Mathematics professional development.* Reston, VA: The National Council of Teachers of Mathematics, Inc.

Niyi, J. O., Kingsley, E. & Olofu, P. A. (2024). Political interference and tertiary institutions in Nigeria. *Indonesian Journal of Social Development,* 1(3), 1-9.

Nja, C.B.; Okri, J.A.; Sanda, F.A.; Adie, E.B.; Ibok, E.E.; Obi, J.J.; Oko, B.A.; Ukpepi, B.C.; Inah, L.I.; Olofu, P.A. & Ukume, G.D. (2025). The efficacy of the blended learning instruction: The correlate between peculiarities and outcomes. *Lanna Journal of Interdisciplinary Studies,* 7(1), 133-149. Scopus

Oboqua, E. D., Bessong, C. D. &Bessong, N. O. (2017). Implementation of Some Millennium Development Goals (MDGS) and Poverty Reduction in Akamkpa and Biase Local Government Areas of Cross River State. *Special Needs Education, Journal of the Department of Special Education,* University of Calabar. *3,* 121-130.

Odumosu, M. O., Oluwayemi, P. & Olatunde, D. E. (2018). Mathematics as a tool in technology acquisition and economic development in transforming Nigeria: *A proceeding of Mathematical Association of Nigeria (MAN) Annual National Conference, pp. 199-207.*

Ojose, B. (2018). Mathematics education in Nigeria: challenges and prospects. *Eurasia Journal of Mathematics, Science and Technology Education*, 14(6), em1568.

Olofu, P. A. & Hur-Yagba, C. N. (2020). Effective classroom management: A critical and fundamental task for beginning secondary school teachers in Nigeria. *International Journal of Educational Benchmark*. 18(2), 152-159.

Olowonefa, G. S. & Olofu, P. A. (2023). Management of Universal Basic Education in Nigeria: Challenges and way forward. *Best Journal of Innovation in Science, Research and Development,* 2(9), 97-105.

Okpube, N. M & Anugwo, M. N. (2016). Card games and algebra tic tacmatics on achievement of junior secondary II students in algebraic expressions. *International Journal of Evaluation and Research in Education (IJERE),* 5(2), 93-100.

Olajide, D., Ekweme, C. O. & Ndioho, O. F. (2020). Geobaord application on geometry teaching and senior secondary school students' academic performance in Degema Local Government Area, Rivers State. *International Journal of Multidisciplinary Research (IJMR),* 6(3), 262-268

Olofu, P. A., Bessong, C. D. & Usua, O. B. (2024). Homegrown school feeding programme and basic school students' enrolment and retention rate in Cross River State, Nigeria. *Interdisciplinary Journal of Science Education (IJ-SED), 5(1), 80-89.*

Otunu-Ogbisi, R. O. (2019). Societal mathematics and education reform: An agent of positive change in the new age. *Abacus: The Journal of Mathematical Association of Nigeria*, 34(1), 132-139.

Papastergiou, M. (2019). Digital game-based learning in high school computer science education: Impact on educational effectiveness and pupil motivation. *Computers & Education*, 52(1), 1-12.

Russell, D. (2013). Using ageoboard in mathematics. Retrieved May 24, 2024 from *www.math.about/od/manipulative/a/using–ageoboard*

Shaffer, D. W., Squire, K. R., Halverson, R. & Gee, J. P. (2015) Video games and the future of learning. *Phi Delta Kappan*, 87(2), 104-111.

Shellenbarger, S. (2015). How family card games teach math, memory and self-confidence. *The Wall Street Journal [Online]. Available: https://www.wsj.com/articles/benefits-of-a-family-card-game-1428444818.*

Singh, P., Hoon, T. S., Nasir, A. M., Adlan, M. R., Rasid, M. S. & Chew, C. M. (2021). Card game as a pedagogical tool for numeracy skills development. *International Journal of Evaluation and Research in Education (IJERE),* 10(2), 693-705.

Splash Learn (2023). Geometry in daily life - Definition, applications, uses, examples. *Available at https://www.splashlearn.com/math-vocabulary/geometry-in-daily-life*

Syafii, M. L., Kusnawan, W. & Syukroni, A. (2020). Enhancing listening skills using games. International *Journal on Studies in Education (IJonSE)*, 2(2), 78-107.

Uhumuarbi, P.O. & Umoru, G.E. (2018). Relationship between internet in mathematics and science and technology among polytechnic Students. A case study of Auchi polytechnic. *Nigeria Journal of Professional Teachers*, 1(1), 71- 76.

Ushie, G. B., Olofu, P. A., Ekpenyong, V. O., Ukpanukpong, F. A. & Abuokwen, A. A. (2023). Parental socio-economic factors and child abuse tendencies in Obudu Local Government Area of Cross River State. *Kampala International University Journal of Education,* 3(2), 166-172.