EFFECT OF BINGO GAME STRATEGY ON PUPILS' ACHIEVEMENT IN MATHEMATICS

[1]ABIODUN OGUNTANA, [2]OWOLABI PAUL ADELANA, & [3]ADEBAYO MONSUR ISHOLA

[1]Department of Mathematics Education, College of Science and Information Technology, Tai Solarin University of Education, Ijebu-Ode, Nigeria

[2]Department of Science and Technology Education, Educational Technology Unit, University of Ibadan, Ibadan, Nigeria

[3]Department of Educational Technology, College of Specialised and Professional Education, Tai Solarin University of Education, Ijebu-Ode, Nigeria

E-mail: citibaba4real@yahoo.com **Phone No**: +234-801-656-51625

Abstract

The issues of poor achievement in Mathematics, especially at the primary schools, should bother all stakeholders including parents and the government specifically because Mathematics is at the heart of scientific and technological development. The need to checkmate the problem prompted the researchers to understudy games effect (Bingo Strategy) on achievement of primary school pupils in Mathematics. The pretest-posttest, non-equivalent control group quasi-experimental design was adopted and involved intact class of ninety (90) pupils. Four research instruments - Mathematics Achievement Test (MAT) (r = 0.76), Pupils' Quantitative Ability Test (PQAT), Teachers' Instructional Guide on Conventional Instructional Strategy (TIGCIS) and Teachers' Instructional Guide on Bingo Game Strategy (TIGBGS), aided data collection. The five hypotheses raised were tested using Analysis of Covariance (ANCOVA). The results showed a significant main effect of treatment ($F_{1, 90}$ = .423; P (0.006) < .05) on pupils' achievement; no significant effect of gender ($F_{1, 90}$ = .337; P (0.563) > .05) on pupils' achievement; a significant main effect of quantitative ability ($F_{1, 90}$ = 12.427; P (0.000) < .05) on pupils' achievement; there was no interaction effect of treatment and gender ($F_{1, 90}$= 0.690; P (.504) > .05) on pupils' achievement, and; a significant interaction effect of treatment and quantitative ability ($F_{1, 90}$= 4.782; P (.000) < .05) on pupils' achievement in Mathematics. The recommendations included that teachers should be trained on the use of games in teaching Mathematics so that they can be better equipped to handle pupils effectively in learning Mathematics efficiently.

Keywords: Gamification, Bingo games strategy, Achievement, Quantitative ability and Mathematics.

Introduction

Every nation desire to advance in science and technology. To achieve this objective, such nations pay important attention to the development of science and technology education. One science subject which has been said to be the mother of all other science subjects and which is very vital in the learning of science is Mathematics. In Nigeria, Mathematics is a science subject which is compulsory at both the primary and secondary schools. The subject is taught in view of instilling numeracy skills in pupils for sound reflective and scientific reasoning, for the development of the ability to adapt to changing environment and providing basic tools for further educational advancement.

According to the Encyclopedia Britannica (2010), Mathematics involves studying topics quantities (numbers), structures, space, and change. Mathematics finds its ways in many endeavours such as the Natural Sciences, the Medical Sciences, the Physical Sciences, Engineering and Technology amongst others. This subject is being taught right from pre-

primary school in order to provide the foundation on which later mathematical knowledge is built. The subject involves problem solving in the area of number work known as numeracy, measurement of shapes and calculating their perimeters, areas and volumes. It also involved simple calculation with rational numbers involving real life problems. Mathematics as an important subject has wide applications in daily life and in career progression and therefore, its imperativeness cannot be underscored because it instills in learners the vital skills to describe, investigate and transform the universe, especially in the 21st Century (Awofala, 2010). In view of the wide applications of Mathematics, it is hard to find any area of science that the concepts of Mathematics are not essential to explain concepts, theories and/or models (Odumosu, Oluwayemi & Olatunde, 2012). Mathematics therefore occupies a pivotal position in Science and Technology and the development of any nation that yearns for global recognition. Sound acquisition of mathematical concepts however requires unbiased concentration and undivided focus in view of its rigorous and problem-solving nature (Awofala, 2010).

At the primary and secondary levels in Nigeria, Mathematics is a compulsory, and all leaners must take and pass to promote to the next class. One level which seems to be so important that all other levels build on it is the primary school level. This elementary level is so important that it will determine the extent to which pupils like or hate the subject. The objectives of teaching Mathematics at the primary school level in Nigeria as stated in the National Policy on Education include instilling numeracy skills in pupils for sound reflective and scientific reasoning; development of the ability to adapt to changing environment and providing basic tools for further educational advancement in the child (FRN, 2014). Based on these general objectives, it can be deduced that Mathematics education inculcates in the child the basic skill of mathematical numeracy which in turn will problem solving abilities. As rightly stated by Swan and Marshal (2010), competency in Mathematics provides the child with the basic skills of manipulations useful in ordinary life in addition to having the basic skills of spatial relationship.

However, at this level of education, there have been identified challenges causing poor achievement in Mathematics. Karigi & Tumuti (2015) identified non-availability or irrelevant instructional aids, poor attitude on the part of teachers and pupils in addition to lack of motivation. Tukur & Abimbola (2013) identified lack of interest as well as amenities, lack and qualified mathematics teachers, lack of textbooks and large class size. Okigbo (2010) also stressed government's slow responses to educational interventions, outdated curriculum, parental socioeconomic status, school location, students' personal factors, home factors, lack of teachers and outdated or non-availability of textbooks as some of the factors affecting effective learning of Mathematics in primary schools. Several efforts are being made to ensure that primary school pupils' poor achievement in Mathematics does not linger so that Nigeria does not remain at the back seat when it comes to scientific and technological advancements since such cannot be achieved without sound Mathematics knowledge which begin at the primary school level. The Japan International Cooperation Agency (2012) posited that there is the urgent need to transform Mathematics lessons from being teacher-centred to learner-centred, thereby making the contents of the subject more meaningful to learners. The need to make Mathematics more meaningful and engaging and also to improve pupils' achievement in the subject necessitated this study.

Mathematics is both a broad and complex field and the creativity which is needed to study and effectively master Mathematical concepts cannot be properly conveyed through conventional teaching strategies (Lai, 2018). Recently, gamification, which according to Huang and Soman (2013), is the inculcation of gaming schemes into non-gaming environment (such as the classroom), is now getting more attention in the educational

system globally. This is because the use of games in education now affords schools the opportunity to resolve the challenges around learners' engagement as the concept motivates learners to undertake actions relating to learning activity. Deterding, Dixon, Khaled and Nacke (2011) stated that the term gamification was first used in 2008 but was only widely adopted in late 2010. It is a concept in which a designer infuse the motivational properties of a game into learning activities. Gamification techniques are now commonly used in education to increase students' motivation, thereby engaging them in learning tasks. Learners' engagement in gamified learning activities results in better learning outcomes. The utilization of games approach in education has become a trending method to initiate specific behaviours in modern day leaners and to also increase their interest (Huang & Soman, 2013). Appiah (2015) stated that gamification assists in motivating students towards studying due to instant feedback and also arouses learner' interest as well as stimulating them to learn. According to Zichermann (2011), gamification (games) in education rests on certain game systems inducing badges, points system, leaderboards, changing level and immediate response. These are used to build activities which assists players (learners) to develop active attitude towards learning, and as Matera (2015) observed, gamification has the ability to transform the way teachers instructs and the way students learn. Others supporting games' use include Iji, Abakpa and Takor (2013) who reported a significance difference in mean Mathematics achievement scores of learners facilitated using the conventional method and those facilitated through games. Also, the use of games have positive effect on pupils' achievement. In addition, majority of the results on past and recent studies on effects of using games revealed that games, when carefully applied to teaching and learning, have positive effects which in turn engage leaners effectively during learning activities. By using gamification as an approach in primary schools, level, pupils are gainfully engaged (Muntean, 2011). Furthermore, Anchor, Imoko and Ajai (2010) reported that games improved Mathematics achievement. Aside games as independent variable in this study, gender and quantitative abilities as moderating variables were also examined.

Gender differences in mathematic achievement has been an ongoing debate among science educators for long. The need to examine gender in Mathematics education stems from the socio-cultural differences between males and females as it has been concluded in some quarters that some vocations and professions requiring high in-depth scientific knowledge belong to men while the less scientific ones belong to women (Adigun, Onihunwa Irunokhai, Sada & Adesina, 2015). As noted by Gambari, Yusuf & Thomas (2015) and also by Awofala (2017), gender bias is still prevalent in Nigeria and has been identified a major factor amongst others which influences learners' achievement in sciences education. The need to investigate gender as a moderating variable in this study partly stemmed from the various views on its effect on leaners' performance in Mathematics. Gender is a complex and dynamic force to reckon with in education because it is intertwined in learning outcomes. While Ishaku (2015) reported no gender differences amongst leaners' achievements in Science, Iji, Abakpa & Takor (2013) reported a gender differences in Mathematics achievement.

The second moderating variable examined in the study is quantitative ability. Adesanya (2015) stated that it is the ability of learners to execute tasks which are related to the handling of numbers. This is the ability the ability of pupils to solve numerical and mathematical calculations accurately and in less time. It involves executing tasks which are related to figures manipulation and handling of numbers. Quantitative aptitude tests are designed to measure the numerical ability and accuracy of learners in mathematical calculations. Quantitative ability is synonymous with numerical aptitude, mathematical ability and figural ability, all of which are essential mathematical skills. Quantitative ability was examined in this study due to its low level of study at the primary schools. According to

Unodiaku (2014), quantitative skills in mathematics are skills that are essential in initiating and maintaining dominance in developed nations. In view of this, Unodiaku reported further that high level quantitative abilities in Mathematics will assist in producing citizens that are scientifically and mathematically sound to take up careers that will foster advanced scientific and technological development.

The approach employed in facilitating Mathematics in primary schools is paramount because, being a foundational level, it is directly proportional to the post-primary decisions and future aspirations of pupils. The need for Mathematics educators to shift completely from conventional teaching methods to the use of modern and engaging instructional methods cannot be overemphasized especially in this 21st Century where learning has shifted to student-centred pedagogy. The typical conventional approach where learners are taught mathematics using the talk and chalk method is fast paving way for modern instructional approaches which are more engaging and student-centered. The need for quality and effective instructional strategies has been a long-standing objective of science education. This is because the rate of learners' poor academic achievement in Mathematics and its resultant consequences on the production and development of future scientists have led to the search for modern instructional strategies which promote effective and improved Mathematics learning experience. The normal traditional or conventional instructional strategy which often tends to be passive is now of less relevance in the 21st Century classrooms and this paved the way for the introduction of new approaches to meet the demands of the 21st Century classroom. In contrast to conventional Science teaching methods, modern instructional strategies, examples of which include blended learning, learning in collaboration, project and inquiry-based approaches, flipped classroom, gamification, among others, now provide learners with opportunities to develop their abilities to adapt and change to fit new situations as reeled out by the demands of the 21st Century. Presently, it is expected that modern education will enable learners become effective problem solvers in their daily living and at the societal level. Based on the above background, this study examined the effect of Bingo game strategy on pupils' achievement in Mathematics in Oluyole Local Government Area, Oyo State, Nigeria.

Statement of the Problem

Over the years, pupils' achievement in Mathematics has not been encouraging and one of the major factors responsible for this is teaching methods. It has been observed that during the use of the traditional methods, learners are absent-minded due to the abstract nature of the concepts taught, they complain of boring class and eventually fail to understand the real concepts of Mathematics. This therefore leads to poor achievement in the subject. While the conventional teaching approach may have its own good sides, yet the modern classroom requires a more engaging and problem-solving approaches due to its abstract nature and especially in view of the foundational nature of the primary school. An approach which has been suggested by foremost educators globally is the use of gamification. While studies have been done on the use of games in Mathematics, yet very few have studied the effectiveness of Bingo games on Mathematics teaching and learning. Hence, this study attempted to fill this gap. Based on this, this study examined the effect of Bingo game (gamification) strategy on pupils' Mathematics achievement in Oluyole Local Government Area, Oyo State with the objectives of examining the main effect of treatment (Bingo game) on primary school pupils' achievement in Mathematics; find out the main effect of gender on primary school pupils' Mathematics achievement; examine the main effect of quantitative ability on pupils' achievement in Mathematics; determine the interaction effect of treatment and gender on pupils' Mathematics achievement, and; find out the interaction effect of treatment and quantitative ability on pupils' Mathematics achievement.

Hypotheses

He following hypotheses were tested in this study:

Ho_1: There is no significant main effect of treatment (Bingo game strategy) on pupils' Mathematics achievement.

Ho_2: There is no significant main effect of gender on pupils' Mathematics achievement.

Ho_3: There is no significant main effect of quantitative ability on pupils' Mathematics achievement.

Ho_4: There is no significant interaction effect of treatment (Bingo game strategy) and gender on pupils' Mathematics achievement.

Ho_5: There is no significant interaction effect of treatment (Bingo game strategy) and quantitative ability on pupils' Mathematics achievement.

Methodology

The study adopted the pretest-posttest, non-equivalent control group quasi-experimental design. There was no randomization of participants into treatment groups. The population of the study was made up of all primary school pupils in Oluyole Local Government Areas of Oyo State. However, two intact classes of ninety (90) pupils were selected from two randomly selected primary schools within the Local Government Area of study. Treatments (experimental and control groups) were applied on the selected schools using the Balloting method. Four instruments were designed in the study thus: Mathematics Achievement Test (MAT), Pupils' Quantitative Ability Test (PQAT), Teachers' Instructional Guide on Conventional Instructional Strategy (TIGCIS) and Teachers' Instructional Guide on Bingo Game Strategy (TIGBGS)

The Mathematics Achievement Test (MAT), with a reliability coefficient of 0.76, was a multiple choice test. Reliability of the instrument was ensured through the test-retest method. It consisted of two sections. Section I was designed to obtain pupils' personal data while Section II contained 20 multiple choice questions with four options to select a correct answer from. The MAT was designed by the researchers to measure pupils' knowledge of Mathematics in relation to length of objects/shapes and distances and perimeter of plane shapes. The Pupils' Quantitative Ability Test (PQAT), tested for reliability using test-retest method ($r = 0.81$), was also designed by the researchers. It was also a multiple-choice objective test which consisted of 20 items with four options each. The Teachers' Instructional Guide on Conventional Instructional Strategy (TIGCIS) was an outline of the steps involved in the presentation of Mathematics contents to the pupils in the control group using the conventional instructional strategy. The pupils in the control group were first tested using the pretest instruments of Mathematics Achievement Test (MAT) and Pupils' Quantitative Ability Test (PQAT) after which they were taught for six weeks using the conventional instructional strategy. Thereafter, the Mathematics Achievement Test (MAT) and Pupils' Quantitative Ability Test (PQAT) were re-administered to the pupils to check the effect of the conventional method used.

The Teachers' Instructional Guide on Bingo Game Strategy (TIGBGS) was also self-developed. It contained the steps involved in the presentation of Bingo game instructional strategy to pupils in experimental group. The pupils in this group were first tested (pretest) using the pretest instruments of Mathematics Achievement Test (MAT) and Pupils' Quantitative Ability Test (PQAT) after which the pupils were taught measurement of length and perimeter of objects using Bingo game as the instructional strategy. The class teachers of the school used for the experimental study taught their pupils how to play the Bingo game. The teachers played the game with the whole class first. Thereafter, the pupils were divided into groups of six pupils per group where the pupils were allowed to choose a leader for each of their groups.

After creating Bingo cards by writing the figures and expressions relating to the topics used in the study on a big cardboard, and then placed inside a box. Each group leader picked the cards one by one and read whatever was written on each. Smaller square cards which had already been distributed to the groups are then picked by any pupil who recognized the position that matched the statement or diagram shown to the group members by the group leaders. Pupils were left to play the game in groups while the teachers only ensure orderliness of pupils while playing the game. The fastest group places the card on the square box. The first group to place the small squares on a row, a column or a diagonal was the winner and the pupils in the group shouted BINGOO! This meant that the pupil was the winner in the group he/she belonged to. The game was then restarted by choosing another leader for each group. The whole experiment took six weeks to carryout. Analysis of Covariance (ANCOVA) was used to test the hypotheses raised.

Results

Ho_1: There is no significant main effect of treatment (Bingo game strategy) on pupils' Mathematics achievement.

Table 1: Result on main effect of treatment on pupils' achievement in Mathematics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	11.654[a]	3	3.885	.433	.730
Intercept	355.878	1	355.878	39.683	.000
Treatment	7.587	2	3.794	.423	.006
Achievement	6.788	1	6.788	.757	.387
Error	771.246	86	8.968		
Total	4355.000	90			
Corrected Total	782.900	89			

R Squared = .015 (Adjusted R Squared = -.019)

The results ($F_{1, 90}$ = .423; P (0.006) < .05) in Table 1 indicated a significant main effect of treatment (Bingo game strategy) on pupils' achievement in Mathematics. This result show that there was significant improvement in pupils' learning of Mathematics after Bingo game was used. This further showed that Bing games is effective in the teaching and learning of Mathematics. This necessitated the rejection of the null hypothesis and it was concluded that Bingo game strategy improved pupils' Mathematics achievement.

Ho_2: There is no significant main effect of gender on pupils' Mathematics achievement.

Table 2: Result on main effect of gender on pupils' achievement in Mathematics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	7.071[a]	2	3.535	.396	.674
Intercept	416.920	1	416.920	46.753	.000
Gender	3.004	1	3.004	.337	.563
Achievement	3.544	1	3.544	.397	.530
Error	775.829	87	8.918		
Total	4355.000	90			
Corrected Total	782.900	89			

a. R Squared = .009 (Adjusted R Squared = -.014)

The results ($F_{1, 90}$ = .337; P (0.563) > .05) in Table 2 show that gender has no main effect on achievement in Mathematics. In view of this finding, gender is not a factor of pupils' Mathematics achievement. Therefore, the stated null hypothesis was accepted to be true. The result implies that pupils' achievement in Mathematics is not dependent on their gender.

Ho_3: There is no significant main effect of quantitative ability on pupils' Mathematics achievement.

Table 3: Result on main effect of quantitative ability on pupils' achievement in Mathematics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	890.416[a]	14	63.601	11.601	.000
Intercept	16442.321	1	16442.321	2999.080	.000
Quantitative Ability	885.709	1	68.131	12.427	.000
Achievement	1.021	1	1.021	.186	.667
Error	411.184	75	5.482		
Total	141014.000	90			
Corrected Total	1301.600	89			

R Squared = .684 (Adjusted R Squared = .625)

The results (ANCOVA) ($F_{1, 90}$ = 12.427; P (0.000) < .05) in Table 3 show a significant main effect of quantitative ability on pupils' Mathematics achievement. In other words, pupils' quantitative ability is a predictor of their achievement in Mathematics because pupils with sound quantitative abilities are better off in solving mathematical problems due to their ability to reason logically and work with figures. The result implies that pupils' achievement in Mathematics is dependent on the level of pupils' quantitative abilities.

Ho_4: There is no significant interaction effect of treatment (Bingo game strategy) and gender on pupils' Mathematics achievement.

Table 4: Result on interaction effect of treatment and gender on pupils' Mathematics achievement

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	114.102[a]	6	19.017	1.329	.253
Intercept	17180.297	1	17180.297	1200.815	.000
Treatment * Gender	19.758	2	9.879	.690	.504
Achievement	4.779	1	4.779	.334	.565
Treatment	3.224	2	1.612	.113	.894
Gender	83.731	1	83.731	5.852	.018
Error	1187.498	83	14.307		
Total	141014.000	90			
Corrected Total	1301.600	89			

a. R Squared = .088 (Adjusted R Squared = .022)

The result ($F_{1, 90}$= 0.690; P (.504) > .05) in Table 4 revealed no significant interaction effect of treatment (Bingo game strategy) and gender on pupils' achievement in Mathematics. The result implies that the treatment and gender combined do not influence pupils' achievement in Mathematics, and to this result, the model contributes only 8.8% (R^2 = .088) to variance in pupil' achievement. In view of this, the null hypothesis was not rejected but rather accepted to be true.

Ho_5: There is no significant interaction effect of treatment (Bingo game strategy) and quantitative ability on pupils' Mathematics achievement.

Table 5: Result on interaction effect of treatment and quantitative ability on pupils' Mathematics achievement

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	941.417[a]	32	29.419	4.656	.000
Intercept	10673.849	1	10673.849	1689.169	.000
Treatment * Quantitative Ability	936.710	31	30.216	4.782	.000
Achievement	.001	1	.001	.000	.992
Error	360.183	57	6.319		
Total	141014.000	90			
Corrected Total	1301.600	89			

a. R Squared = .723 (Adjusted R Squared = .568

Based on the results ($F_{1, 90}$= 4.782; P (.000) < .05) in Table 5, there's a significant interaction effect of treatment (Bingo game strategy) and quantitative ability on pupils' achievement in Mathematics. This means that the treatment and quantitative ability together significantly influence pupils' achievement in Mathematics. To this result, the model contributes 72.2% (R^2 = .723) to variance in pupil's achievement. This shows that the treatment and a good level of quantitative ability positively influence pupils' achievement in Mathematics.

Discussion

The finding from the study showed the treatment (Bingo game strategy) has significant main effect on pupils' Mathematics achievement. This revealed that the use of games in Mathematics education has some potentials for effective learning of the subject. The finding agrees with the finding of Iji, Abakpa and Takor (2013) who reported significant difference in the mean achievement scores of learners taught using the conventional method and those taught using games in Mathematics. When carefully applied to teaching and learning, games have positive effects which in turn engage leaners effectively during learning activities. Hence, game-based instructional approach is effective for teaching Mathematics. Also, the finding revealed no significant main effect of gender on pupils' Mathematics achievement. This implies that gender does not influence pupils' achievement in Mathematics. Gender differences have been a subject of debate for long and have been investigated and reported severally (Akinsola & Animasahun, 2007; Dania, 2014). However Ishaku (2015) reported no gender difference in leaners' achievements in Science. In contrasts, Iji, Abakpa and Takor (2013) reported a significant difference.

Also, the findings revealed a significance main effect of quantitative ability on pupils' achievement in Mathematics. The result implies that quantitative ability has effect on pupils' achievement in Mathematics. This supports the position of According to Unodiaku (2014), quantitative skills in mathematics are skills that are essential in initiating and maintaining dominance in developed nations. Hence, high level quantitative abilities in Mathematics will assist in producing citizens that are scientifically and mathematically sound to take up careers that will foster advanced scientific and technological development. In addition, the study found no significant interaction effect of treatment (Bingo strategy) and gender on pupils' Mathematics achievement. This connotes that treatment and gender combined do not have significant interaction effect on pupils' achievement in Mathematics. Hence, the null hypothesis was not rejected. This supports Bala and Musa (2006), Akinsola and Animashaun

(2007) and Anchor, Imoko and Ajai (2010) who reported that while games improved Mathematics achievement, however the treatment and gender combined did not influence achievement in Mathematics.

Findings on the interaction effect of treatment (Bingo game strategy) and quantitative ability on pupils' Mathematics achievement revealed a significant interaction effect of treatment (Bingo games instructional strategy) and quantitative ability on pupils' achievement in Mathematics. This implies that the treatment and quantitative ability put together have significant influence on pupils' achievement in Mathematics. Hence, the null hypothesis was rejected. This corroborates Kebritchi, Hirumi and Bai (2010), Unodiaku (2014) who reported pupils' achievement based on the use of and a high level quantitative abilities.

Conclusion

Based on reports of the study, conclusion was made that when applied effectively, using games as an instructional approach in Mathematics education will significantly improve pupils' academic achievement in the subject just as games can also arouse students' interest and also motivate them due to its quick feedbacks and reward systems. Also, games can improve pupils' quantitative abilities thereby improving their achievement in Mathematics, although gender has no influence on these processes.

Recommendations

In view of the findings, it was recommended Mathematics teachers should be effectively trained on the use of gamification in teaching Mathematics. This training is essential so that teachers will be better equipped at handling games in achieving Mathematics learning objectives. Also, part of the training should include training Mathematics teachers on being mindful of the use of games in the classroom as overuse may do the opposite of the good intentions. In addition, pupils need to be well-guided when games are introduced into the classroom so that, being younger children, they do not view the exercise as being introduced for fun only. Furthermore, teachers should facilitate activities which can increase and improve on pupils' quantitative abilities as they use games in their learning. Finally, it is suggested that the school timetable be reworked to cater for effective use of games and related activities to be well accommodated in the classrooms.

References

Adesanya, O. A. (2015). Effects of problem-based learning and individualized instructional strategies on students learning outcomes in secondary school physics in Ogun State. Med. Project. Dept. of Teacher Education. University of Ibadan. p15

Adigun, J., Onihunwa, J., Irunokhai, E., Sada, Y., & Adesina, O. (2015). Effect of gender on students' academic performance in Computer Studies in secondary schools in New Bussa, Borgu Local Government of Niger State. *Journal of Education and Practice*, 6 (33), 2

Akinsola, M. K., & Animasahun, I. A. (2007). The effect of simulation-game environment on student's achievement in an attitudes to Mathematics in secondary schools. *The Turkish online Journal of Educational Technology,* 6, 3-11

Anchor, E. E. Imoko, B. I., & Ajai, J. T. (2010). Sex differentials in students' achievements and interest in geometry using Games and Simulations technique. *Necatibey Electronic Journal of Science and Mathematics Education* 4 (1), 1-10

Appiah, D. B. (2015). Gamification in education: improving elementary mathematics through engagement in hybrid learning in the classroom. A thesis submitted to the Department of General Art Studies, Kwame Nkrumah University of Science and Technology in partial fulfillment of the requirements for the degree of Master of Philosophy in Art Education. Pp15-16

Awofala, A. O. A. (2010). Impact of personalized instruction on senior secondary school learning outcomes in mathematics word problems. Unpublished Ph.D Thesis. University of Ibadan.

Bala, A., & Musa, B. (2006). Effect of the use of Number Base game on senior secondary school achievement in Number Bases. Abacus: *The Journal of Mathematical Association of Nigeria,* 31, 103-144

Dania, P. O. (2014). Effect of gender on students' academic achievement in secondary school social studies. *Journal of Education and Practice*, 5(21), 78 – 84.

Deterding, S., Dixon, D., Khaled R., & Nacke L. (2011). From game design elements to gamefulness: defining — Gamification Proceedings of MindTrek, 2011 Educause Learning Initiative (2012). Things you should know about Educational Design Research. Retrieved Wednesday, October 16, 2013, 9:55:04 AM

Encyclopedia Britannica (2010). *Encyclopedia Britannica Student and Home Edition.* Chicago: Encyclopedia Britannia.

Gambari, A. I., Yusuf, M. O., & Thomas, D. A. (2015). Effects of computer-assisted STAD, LTM and ICI cooperative learning strategies on Nigerian secondary school students' achievement, gender and motivation in Physics. *The Malaysian Online Journal of Educational Sciences,* 3(4), 11-26.

Huang, R., Prince, K. M., Barlow, A. T., & Schmidt, T. (2017). Improving mathematics teaching as deliberate practice through Chinese lesson study. *The Mathematics Educator*, 26(1), 32–55.

Huan, W. H., & Soman, D. (2013). A practitioner's guide to gamification of education.

Iji, C., Abakpa, B., & Takor, D. (2013). Improving the Teaching and learning of Mathematics Games. *International Journal of Social Science and Education,* 4: 1

Ishaku, C. (2015). Effects of problem-solving and discussion teaching methods on students' achievement in Genetics. Project report submitted to the Department of Science Education, Faculty of Education, University of Nigeria, Nsukka, pp45–46.

Japan International Cooperation Agency (2012). Strengthening of Mathematics and science education-Western, Eastern, Central and Southern Africa. Retrieved on 23rd July 2017 from www.jica.go.jp/./project05.html.

Karigi, M. W., & Tumuti, S. (2015). Students and teachers attitude factors contributing to poor performance in mathematics in Kenya National Examination Council in selected public secondary schools in Kiambaa division of central province, Kenya. *The Strategic Journal of Business Change and Management*, 2(58), 316-332.

Kebritchi, M. Hirumi, A., & Bai, H. (2010). The effects of modern Mathematics computer games on Mathematics achievement and class motivation. *Computers & Education* 55 (2), 427-443.

Lai, A. (2018). A study of gamification techniques in Mathematics Education.

Matera, M. (2015). *Explore like a pirate: Gamification and Game-inspired course design to engage, enrich and elevate your learners*. Dave Burgess Consulting, Inc.

Muntean, C. I. (2011). Raising engagement in e-learning through gamification. The 6th International Conference on Virtual Learning ICVL 2011. p. 7.

Okigbo, E. C. (2010). Comparative effectiveness of Mathematics game and instructional analogy as advance organizers on "pupils" achievement and interest in Mathematics. A Doctoral Dissertation. Nnamdi Azikiwe University, Awka, Nigeria. p20.

Swan, P., & Marshall L. (2015). Mathematics games: Time waster or time well spent? Faculty of education and Arts, Edith Cowan University, Joondalup, Western Australia, 6027 p.swan@ecu.edu.au I.marshall@ecu.edu.au

Tukur, M. Y., & Abimbola, N. G. A. (2013). Factors influencing effective learning of Mathematics at senior secondary schools within Gombe metropolis, Gombe State. I 4(25), 61-66.

Unodiaku, S. S. (2014). Effect of game-based instructional model on the pupils' achievement in Arithmetic at upper Primary Schools levels. www.ijste.org 4 (2), 14

Zichermann, G. (2011). *Gamification by Design*. O'Reilly Media, Sebastopol, CA, USA, 2011.