Andragogi Jurnal Pendidikan dan Pembelajaran
Vol 4, No. 2, September 2024, DOI: https://doi.org/10.31538/adrg.v4i2.1325
E-ISSN 2807-8233 pp. 153-165

Effect of Gamification-Based Teaching on Junior Secondary School Student's Academic Performance in Mathematics in Kwara State

Justina Ojoma Attah[1], Oyeronke Olufumilola Ogunlade[2], Bridget Idowu Otemuyiwa[3]

[1] Department of Educational Technology, University of Ilorin, Ilorin-Nigeria;
[2] Department of Educational Technology, University of Ilorin, Ilorin-Nigeria
[3] Nigerian Educational Research and Development Council (N.E.R.D.C.) Sheda

Keywords:
Gamification, Gamification-Based Teaching, Academic Performance, Mathematics

Abstract

Gamification is a cutting-edge pedagogical approach to addressing student social behaviour, motivation, and academic performance in the classroom, particularly in subjects that are perceived to be difficult such as mathematics where there was a perceived failure. Hence, this study investigated the effect of gamification-based teaching on junior secondary school student's academic performance in mathematics in Kwara State. The study adopted a quasi-experimental pretest-posttest, non-equivalent group design. The population was all junior secondary students in Kwara State while the target population were all junior secondary students in J.S.S. 2 in Kwara-North Senatorial district. A purposive sampling technique was used to select two junior secondary schools based on the availability of computer laboratories. A total of 122 students (experimental group 64; control group 58) were involved. Three instruments were used for data collection. Split-half was used to test the reliability of the instruments and coefficients of .89 were obtained Data collected were analyzed using descriptive and inferential statistics at 0.05 level of significance. The study revealed that; gamification-based teaching had a significant effect on the experimental group ($F(1,54) = 1.826$; $p < 0.05$) and female students in the experimental group significantly performed better than male students after the treatment. This study concluded that the use of gamification-based teaching in mathematics enhanced teaching-learning effectiveness in mathematics. The study, therefore, recommended among others, that mathematics teachers should use gamification in teaching mathematics to reduce the level of abstractness associated with teaching-learning of mathematics.

Kata kunci:
Gamifikasi, Pengajaran Berbasis Gamifikasi, Performa Akademik, Matematika.

Article history:
Received: 15-08-2024
Revised 13-08-2024
Accepted 15-09-2024

Abstrak

Gamifikasi adalah pendekatan pedagogis mutakhir untuk mengatasi perilaku sosial, motivasi, dan kinerja akademik siswa di kelas, terutama pada mata pelajaran yang dianggap sulit seperti matematika yang dianggap gagal. Oleh karena itu, penelitian ini menyelidiki pengaruh pengajaran berbasis gamifikasi terhadap prestasi akademik siswa sekolah menengah pertama dalam matematika di Negara Bagian Kwara. Penelitian ini menggunakan desain kuasi-eksperimental pretest-posttest, desain kelompok non-ekuivalen. Populasi penelitian ini adalah seluruh siswa sekolah menengah pertama di Negara Bagian Kwara, sedangkan populasi targetnya adalah seluruh siswa sekolah menengah pertama di J.S.S. 2 di distrik Kwara-North Senatorial. Teknik purposive sampling digunakan untuk memilih dua sekolah menengah pertama berdasarkan ketersediaan laboratorium komputer. Sebanyak 122 siswa (kelompok eksperimen 64; kelompok kontrol 58) dilibatkan. Tiga instrumen digunakan untuk pengumpulan data. Split-half digunakan untuk menguji reliabilitas instrumen dan diperoleh koefisien sebesar 0,89. Data yang dikumpulkan dianalisis dengan menggunakan statistik deskriptif dan inferensial pada tingkat signifikansi 0,05. Hasil penelitian menunjukkan bahwa; pengajaran berbasis gamifikasi memiliki pengaruh yang signifikan pada kelompok eksperimen ($F(1,54) = 1,826$; $p<0,05$) dan

siswa perempuan pada kelompok eksperimen secara signifikan memiliki kinerja yang lebih baik daripada siswa laki-laki setelah perlakuan. Penelitian ini menyimpulkan bahwa penggunaan pengajaran berbasis gamifikasi dalam matematika meningkatkan efektivitas belajar-mengajar matematika. Oleh karena itu, penelitian ini merekomendasikan antara lain bahwa guru matematika harus menggunakan gamifikasi dalam mengajar matematika untuk mengurangi tingkat keabstrakan yang terkait dengan belajar-mengajar matematika.

Corresponding Author:
Justina Ojoma Attah
Department of Educational Technology, University of Ilorin, Ilorin-Nigeria; attahjutsina8@gmail.com

INTRODUCTION

Education is a tool that enables students to gain knowledge and skills; it also plays a crucial role in the advancement of individuals and societies. Educational technology is the fulcrum of education as it is the use of tools, technologies, processes, procedures, resources, and strategies to improve learning outcomes in a variety of settings, including formal, informal, non-formal, lifelong, on-demand, workplace, and just-in-time learning. Information and communication technology (ICT) integration provides strong support for mathematics instruction. It improves science education by encouraging comprehension of difficult concepts, easing the inquiry and modelization processes, and promoting the creative process that is crucial in STEM (science, technology, engineering, and mathematics) (Napal, 2020). However, the lack of focus on the design of appealing and inspiring learning approaches and the technology gap between teachers and students have frequently led to students' demotivation and subpar academic performance. As a result, a variety of strategies have been developed, including gamification, which encourages learners' motivation, involvement in their learning, and cooperation while also raising their level of engagement with the course materials (Denny, 2015; Nehring et al., 2018; Serrano, 2019). One of the newest techniques and technologies is gamification, which has been shown to increase motivation, and engagement and boost academic performance among students while decreasing classroom boredom (Nwachukwu & Johnson, 2020). Gamification is the application of game components in an environment that is not a game (Dahalan et al., 2023).

Gamification is the idea of incorporating game design aspects into non-game contexts to inspire and boost user engagement for knowledge acquisition or complete an activity to inspire and promote performance, it uses the advantage of the players' instincts (Adeoye, 2023). Gamification-based teaching refers to the use of game mechanics and elements, such as levels, game storylines, quests, progress bars, and achievement systems, to involve students in the teaching-learning process by encouraging learning, inspiring action, and supporting students in problem-solving (Rao, 2022). Gamification-based teaching, which is centred on the process of integrating fun into learning activities, refers to the tactics, methods, and components utilised by teachers to engage students in their learning (Forndran & Zacharias, 2019; Segura-Robles et al., 2020). Gamification-based teaching boosts student engagement and makes them

more eager to interact with instructional material by changing the behaviours that result in the neglect of learning opportunities (Adeoye, 2023).

Furthermore, elementary school students are frequently bored and have short attention spans. The cognitive and social development of a youngster includes playing video games. When students are permitted to play and participate in hands-on activities rather than being made to memorize information (formula) from books, they learn more (Clark et al., 2018). Therefore, it is necessary to include fun elements in their lessons to keep their interest and improve their performance (Reeves, 2015), even in important classes like mathematics, which is frequently viewed as an abstract subject and is feared by many students. Given the many advantages that gamification provides, game elements must be incorporated into mathematics. Numerous fields of science and technology can be accessed through mathematics. The development of science and technology, as well as the study of the physical sciences and engineering fields, all depend on the study of mathematics (Yadav, 2020). Mathematics is essential for fostering self-esteem, building character, and opening doors for inquiry and creativity. Without utilizing mathematics in some way, it is challenging to have a normal existence (Karakolidis et al., 2016). According to Dele-Ajayi et al. (2019), mathematics is integral to both short and long-term planning. It also plays a crucial role in our daily activities. Before being promoted to senior secondary school, every junior secondary school student must offer and pass at least one subject in the Basic Education Certificate Examination (BECE), specifically Mathematics (Okoi & Esomonu, 2021). One of mathematics' overarching goals is to develop reasonable and methodical thinking habits. The instillation of values and fostering of autonomous thoughts in the minds of the learners are two objectives of junior secondary school education that are in line with these goals (FRN, 2013).

Junior secondary education is another name for upper-basic education. Children between the ages of 12 and 15 attend this form of instruction. It is the final three years of elementary education in Nigeria. According to the Federal Ministry of Education (2016), at least 70% of students who attempt the Basic Education Certificate Examination (BECE) by the end of junior secondary school must receive at least a credit pass in the required topics. As a result, students ought to strive to meet this benchmark. However, students perceive mathematics to be one of the junior secondary education curriculum's most difficult topics. The fact that math lessons frequently involve a lot of talking and writing is one of the causes (Chand et al., 2021). The Basic Education Certificate Examination (BECE) results for junior secondary school students provide additional clarification for these claims.

Table 1: Junior Secondary School Students' Performance in Mathematics at the Basic Education Certificate Examination (BECE)

Year	No of candidates	Percentage of candidates with grade A	Percentage of candidates with grade C	Percentage of candidates with grade P	Percentage of candidates with grade F
2014	40430	4771(11.80%)	18477(45.70%)	13245(32.76%)	3521(8.71%)
2015	41153	9930(24.13%)	12443(30.24%)	9880(24.01%)	8232(20.00%)
2016	41721	6987(16.75%)	17029(40.82%)	11768(28.21%)	5957(14.28%)
2017	42892	4676(10.90%)	19609(45.72%)	14618(34.08%)	3989(9.30%)
2018	43435	4700(10.82%)	19785(45.55%)	14724(33.90%)	3866(8.90%)
2019	43548	4355(10.00%)	19952(45.82%)	15249(35.02%)	3992(9.17%)

According to a norm of 50%, Table 1 shows that students' performance on the Basic Education Certificate Examination (BECE) is dropping, with the majority of students scoring below average. Some of the reasons why students' arithmetic performance has been persistently poor and low over the years have been attributed to the delivery mode of instruction (Adeneye, 2012). Several issues, including inadequate content and context of education, are faulted for secondary school students' persistent poor performance in mathematics (Radii et al., 2015). To curb this, educators should select the best teaching strategy to deliver the course material. To engage learners and boost their interest in mathematics, nothing more than effective teaching methods and technologically based solutions are needed (Komolafe & Oyarinde, 2020). One strategy that can help with this is gamification. In addition to improving student attentiveness, gamification in teaching and learning has the potential to support teachers in conducting more constructive student evaluations rather than using worksheets or observation-based methods (Sanmugam et al., 2014).

When implementing a gamification-based teaching approach for mathematics, the Quizalize software was used to administer gamified online tests to students to evaluate their academic performance on the subjects covered. According to Sailer et al. (2017) and Werbach (2014), quizalize gamification apps have two sets of objectives: educational objectives that correspond to the content, and entertaining objectives that are connected to user experiences and result in enjoyment and fulfilment. Quizalize uses elements like points, badges, leaderboards and feedback to boost students' motivation, engagement, and academic success (Miller, 2016). To give task-level feedback, each student's performance can be scored and evaluated using the Quizalize app, which can also display the right answers to questions that the users did not get right. Following the completion of the students' responses, the Quizalize application computes each student's performance on the platform. As a result of this approach, students learn more, which boosts their performance (Quizalize, 2017). While gamifying mathematical topics, several qualities or elements that may obstruct communication must be handled. These include gender, age, attitude, school type, technology self-efficacy, and computer self-efficacy. Math achievement is influenced by factors like gender, socioeconomic status,

and parental education level (Suleiman & Hammed, 2019). Gender was considered a moderating variable in this study because of its strategic significance in affecting gamification-based mathematics teaching and learning. Academics have investigated the effects of gender on students' learning outcomes in great detail. Conversely, gender's impact on gamification-based teaching has not yet been determined. According to Omeodu and Fredrick (2019), gender does not influence how well children succeed academically while using instructional tactics. In contrast, cognitive learning exhibits gender disparities. Female learners perform better when they are required to apply the knowledge they have learned to solve puzzles, quests, and quizzes because they have a better understanding of the game content and objectives in the digital game-based learning process (Liang-Yi & Rong-Chi, 2017). Therefore, it is necessary to carry out this research to support or refute the results of previous studies.

At the formative and primary levels of school, mathematics continues to be a required subject. The ability to reason analytically, as well as to organize thoughts and communicate ideas clearly, are all aided by mathematics. However, concerns have grown about how poorly junior secondary school students perform in mathematics. This assertion is further supported by a report from the Kwara State Ministry of Education and Human Development's examination and statistics unit, which is presented in Table 1. Some studies have blamed several issues, including the teacher's teaching methodology, for the underwhelming performance of the students. The conventional approach is a common strategy used by teachers to teach mathematics in secondary schools. With this approach, the student is merely a passive listener and spectator who does not participate in the teaching or learning process. These instructional challenges could be defeated with the appropriate integration of gamification into classroom activities. This study was conducted to investigate the effect of gamification-based teaching on students' academic performance in mathematics in junior secondary schools in Kwara State, Nigeria. The main purpose of this study was to investigate the effect of gamification-based teaching on students' academic performance in mathematics in junior secondary schools in Kwara State. Specifically, this study 1) determined the difference in the pre and post-test performance mean scores of the experimental and control groups; 2) examined the difference in the mean scores of male and female students' performance in the experimental and control groups;

This study addressed two key research questions: the first explored the differences in the mean performance scores between the pre-test and post-test of the experimental and control groups, while the second examined the differences in the mean performance scores of male and female students across these groups. To investigate these questions, two hypotheses were tested at a 0.05 level of significance. The first hypothesis posited that there would be no significant main effect of the treatments on the mathematics performance of junior secondary school students. The second hypothesis proposed that gender would have no significant effect on the academic performance of students in mathematics following the treatment.

RESEARCH METHOD

The study used a non-equivalent group design using a 2x2x2 factorial, quasi-experimental pre-test-post-test format. The population for this study was all junior secondary students in Kwara State. The target population for this study was all junior secondary students in basic 2 (J.S.S 2) in Kwara-North. Two junior secondary schools in Kwara-North L.G.A. were chosen using a purposive sample technique because they feature functional and well-equipped computer labs. School B served as the control group, whereas School A served as the experimental group. The two groups were intact classes. The following instruments were used to collect data for the study: A Mathematics Concepts Performance Test (MCPT), A Gamified Lesson Plan and a Quizalize application. To ensure the reliability of the instrument, a pilot study was carried out with Ten junior secondary school students from a non-participating school. The data collected were analysed using split-half Reliability coefficients and a value of .89 was obtained. The instruments were accepted for use in the study based on the high-reliability index. Before the start of the treatment, an MCAT pre-test was given to the experimental and control groups. This enables the researcher to know in advance how well the students performed academically in the subject and whether there would be any appreciable differences in the performance of the students before exposing them to therapies. The experimental group was taught mathematics using a gamification-based teaching strategy. While the control group was taught using a conventional learning strategy. The treatments lasted for 6 weeks. The post-test of MCPT was administered after the treatment. Both descriptive and inferential statistics were used to examine the data that had been gathered. Descriptive statistics using Frequency counts, mean scores, and percentages were used to answer the research questions, while inferential statistics using paired sample t-test was used to test the hypothesis.

RESULT AND DISCUSSION

Result

Research Question One: What are the differences in the pre and post-test performance mean scores of the experimental and control groups?

Table 2

Paired Sample T-test showing the difference between Pre and Post Mean Scores of Treatment Groups

Test Variable (performance)	Grouping Variable (Pre-and-Post performance		N	Mean	Std. Dev	df	t	Sig (P)	Remark
Perfomance in Mathematics	Control	Pretest	58	27.41	10.85	57	1.99	.052	Not Significan
		Post-test		23.79	8.90				

	Experimental	Pretest	64	33.75	9.30			
						63	17.89	.000	Significant
		Post-test		69.31	14.15			

Table 2 shows the difference between the pre and post-treatment mean scores of the treatment groups. The table shows that there was a difference in the pre and post-performance mean scores of the two treatment groups: control (df = 57; t = 1.99; p>.05), experimental (df = 63; t = 17.89; p<0.05), based on these analyses, it can be deduced that there was a difference in the pre and post-treatment mean scores of the treatment groups.

Research Question Two:

What is the difference in the mean score of male and female students' performance in experimental and control groups?

Table 3

Mean Analysis of Male and Female Students' Performance Experimental and Control Groups

Treatment Groups	**Gender**	**Frequency**	**Pre-Test Mean**	**Post-test Mean**
Control	Male	34	27.94	22.35
	Female	24	26.67	25.83
Total		**58**	27.41	**23.79**
Experimental	Male	28	33.39	65.89
	Female	36	34.03	71.97
Total		**64**	**33.75**	**69.31**

Table 3 shows the mean analysis of male and female students' performance in the experimental and control groups. On the pre-test, male participants had a mean score of 24.41 while the female students had a mean score of 31.67 whereas on the post-test the male students had a mean of 22.35 while the female students had a mean of 25.83. This implies that the male students had a higher mean score on the pre-test however, the female students had a higher mean score than their male counterparts on the post-test. In the experimental group, the male student had a mean score of 33.39 while the female had a mean score of 34.03 after treatment was administered the male students had a mean score of 65.89 whereas the female students had a mean score of 71.97. Therefore, it can be inferred that the female students performed better than the male students after the treatment was administered.

Discussion

This study investigated the effect of gamification-based teaching on junior secondary school student's academic performance in mathematics in Kwara State. Two research groups were involved in the study. The experimental group was taught using gamification-based teaching and the control group was taught using a conventional

teaching strategy. At the end of the experiment, junior secondary school students were assessed and their performance in the post-test was obtained and analyzed. The pre- and post-treatment mean scores of the treatment groups differed, according to the results of the first research question. This suggests that the adoption of gamification-based instruction has an impact on junior-senior high school students' mathematics performance. This result is consistent with that of Caballero et al (2022), who found that gamification enhanced academic performance for the experimental group when compared to the control group, suggesting that it has a favourable effect on students' academic success. The reason for the agreement is that although this study employed the Quizalize gamification software, Caballero et al (2022) adopted a Filipino gamification app. It was clear that the treatment (gamification) was responsible for the student's increase in academic performance. However, the results of this study differ from those of Faghihi et al. (2014), who found no statistically significant change in performance.

The second question's research findings showed that following the treatment, female students did better than male students. This suggests that gender stereotypes, which encourage female students to display interest in mathematics relative to their male counterparts, may be to blame for the variations in performance. The results of this study support those of Costa et al (2019) and Jaradat et al (2018), who found significant gender disparities. The perspectives and attitudes of the students toward gamification are significantly different, according to Koivisto and Hamari's (2014) report. Compared to male users, female users considered gamified experiences to be more enjoyable. This data does not, however, support the claim made by Veltri et al (2014) that men are more likely than women to find computer games attractive.

Findings from the first research hypothesis showed that the post-performance mean score of those exposed to gamification-based teaching was significantly different from their counterparts exposed to the conventional teaching method. Kasahara et al (2019) reported that students improved code metrics under gamification conditions. Similarly, Park et al (2019) found that the performance-contingent rewards produced statistically significant learning enhancement compared to completion-contingent rewards. Also, Ukala (2018) revealed among others that the ways the classroom can be gamified through the integration of a new approach to the learning process and pedagogy by incorporating technological change in the classroom using mobile devices as the new generation of learners are immersed in the digital world from birth. Unarguably, the findings of these studies are in agreement with the findings of this current study. The reason for the agreement lies in the fact that gamification-based teaching significantly influences the performance of students in core subjects.

This result is consistent with those of Udeani and Akhigbe (2020), whose research showed that adding game elements like leaderboards, points, badges, and challenges to lessons significantly increased students' motivation, success, and attitude toward learning biology. Smiderle et al (2020) and Osakwe et al (2022) are other studies that support the findings of the current study. They attested that gamification-based teaching

produced statistically significant learning enhancement when compared to the traditional method. This is because gamification approaches can assist schools in providing inclusive activities by enhancing students' engagement, interaction, and sense of competition (Alomari et al, 2019). The results, however, do not support Kimble's (2020) claim that there is no evidence that students who use gamification have more grade-level abilities acquired than students who do not. The difference is that this study was able to demonstrate an improvement in student performance and a shift in how students behaved toward mathematics, whereas Kimble's study (2020) demonstrated that student performance remained unchanged even after exposure to gamified learning.

CONCLUSION

The research investigated the effect of gamification-based teaching on junior secondary school student's academic performance in mathematics in Kwara State. Results showed that junior secondary school student's performance in mathematics had greatly improved because of the introduction of gamification-based instruction. It was also determined that gamification-based instruction is a highly effective strategy for raising student achievement. The results of this study also showed that while gender had no significant impact on junior secondary school student's performance in mathematics.

According to the study's findings, the following recommendations were deemed appropriate. First, secondary school teachers and students in Nigeria secondary schools should be motivated to be more ICT compliant to use the gamified instructions in mathematics instructions. Additionally, Mathematics teachers should be adequately sensitized through workshops, seminars, and conferences on the use of gamified instruction for instructional delivery at the junior secondary school level

REFERENCES

Adeneye, O. A. (2012). An analysis of the new 9-year Basic Education Mathematics Curriculum in Nigeria. Journal of Acta Didactica Napocensia, 5(1), 1-10.

Adeoye, M.A. (2023). Influence of Gamification Elements on Students' Academic Performance. Indonesian Journal of Teaching in Science 3(2), 105-112.

Alomari, I., Al-Samarraie, H., & Yousef, R. (2019). The Role of Gamification Techniques in Promoting Student Learning: A review and synthesis. Journal of Information Technology Education: Research, 18(1), 395-417.

Audsley, S. M. (2019, August 14). 6 Reasons to Study Mathematics. Keystone: https://www.phdstudies.com/article/6-reasons-to-study-mathematics/

Caballero, L. S., Ferrer, M. M., & Tiria, R. A. (2022). The Role of Gamification in the Academic Performance of Junior High School Students in Language Subject. International Journal of Scientific Research in Multidisciplinary Studies, 8(3),

Clark, D. B., Smith, E. T., Hostetler, A., Fradkin, A., & Polikov, V. (2018). Polikov, Substantial Integration of Typical Educational Games into Extended Curricula. Journal of Learning Sciences, 27(2), 265–318

Chand, S., Chaudhary, K., Prasad, A., & Chand, V. (2021). Perceived Causes of Students' Poor Performance in Mathematics: A Case Study at Ba and Tavua Secondary Schools. Frontiers in Applied Mathematics Statics, 7(6), 1-13.

Costa, C., Alvelos, H., & Teixeira, L. (2019). Investigating the Use and Acceptance of Technologies by Professors in a Higher Education Institution. Int. J. Online Pedagogy & Course Design, 9(2), 1-20.

Dahalan, F., Alias, N., & Shaharom, M. N. (2023). Gamification and Game Based Learning for Vocational Education and Training: A Systematic Literature Review. Education and Information Technologies, 1(1), 1-5.

Denny, P. (2015). Generating Practice Questions as a Preparation Strategy for Introductory Programming Exams. Proceedings of the 46th ACM Technical Symposium on Computer Science Education (ACM, Kansas City, Missouri, USA, 2015).

Dele-Ajayi, O., Strachan, R., Alison, P., & Sanderson, J. (2019). Games for Teaching Mathematics in Nigeria: What Happens to Pupils' Engagement and Traditional Classroom Dynamics? IEEE Access, 1(1), 1-9.

Faghihi, U., Brautigam, A., Jorgenson, K., Measures, E., & Maldonado-Bouchard, S. (2014). How Gamification Applies for Educational Purposes Especially with College Algebra. Procedia Computer Science, 41(1), 182-187.

Forndran, F., & Zacharias, C. R. (2019). Gamified experimental physics classes: A promising active learning methodology for higher education. European Journal of Physcology, 40(1), 17-22.

Gravemeijer, K., Stephan, M., Julie, C., Lin, F. L., & Ohtani, M. (2017). What Mathematics Education May Prepare Students for the Society of the Future? International Journal of Science and Mathematics Education, 15(1), 105-123.

Jaradat, M., Imlawi, J. M., & Al-Mashaqba, A. (2018). Investigating the moderating effects of self-efficacy, age, and gender in the context of nursing mobile decision support systems adoption: A developing country perspective. International Journal of Interactive Mobile Technologies (IJIM), 12(2), 113-129.

Karakolidis, A., Pitsia, V., & Emvalotis, A. (2016). Mathematics Low Achievement in Greece: A Multilevel Analysis of The Program for International Student Assessment (PISA) 2012 data. Themes Science Technology Education, 9(1), 3–24.

Kasahara, R., Sakamoto, K., Washizaki, H., & Fukazaw, Y. (2019). Applying gamification to motivate students to write high-quality code in programming assignments. Annual Conference on Innovation and Technology in Computer Science Education, ITiCSE.

Kimble, T. (2020). The Impact of Gamification on the Mathematics Achievement of Elementary Students. Doctor of Education in Teacher Leadership Dissertations. 43.

Koivisto, J., & Hamari, J. (2014). Demographic Differences in Perceived Benefits from Gamification. Computers in Human Behavior, 35(1), 179-188.

Komolafe, O. G., & Oyarinde, O. N. (2020). The Effect of Storytelling, Points and Level Elements of Gamification on Secondary School Students Academic Achievement Toward Physic In Ondo Metropolis, Nigeria. International Journal of new trends in educational planning and Management, 1(2), 57-67.

Lebuna, J. C., Elloran, E. J., Losañes, R., Genegaban, R., Solinap, J. P., Gotera, R. J., Gemarino, C.M., Geca, R. B. & Nicmic, A. M. (2022). Gamification and Learners' Motivation in the New Normal. The 3rd International Conference on Information Technology and Security, 1(1), 73-81.

Liang-Yi, C., & Rong-chi, C. (2017). The Effect of Gender on Motivation and Student Achievement in Digital Game-based Learning: A Case Study of a Contented-Based Classroom. EURASIA Journal of Mathematics Science and Technology Education, 13(6), 2309-2327

Napal, M. (2020). Integration of ICT in STEM education. Retrieved from Sustainable Education and Approaches: www.sciprofiles.com

Nehring, N., Baghaei, N., & Dacey, S. (2018). Improving students' performance through Gamification: A user study. (B. McLaren., Ed.) International Conference on Computer Supported Education (CSEDU), 213–218.

Nwachukwu, U. M., & Johnson, P. A. (2020). Effect of Gamification on Performance and Interest of Students in Basic Technology in Rivers State. International Journal of Innovative Information Systems & Technology Research, 8(2), 26-36.

Okoi, O. A., & Esomonu, N. M. (2021). Centralized Secondary School Examination, Basic Education Certificate Examination and Mathematics Test Anxiety as Predictors of Students' Achievement in Mathematics. International Journal of Educational Research Review, 234-239.

Omeodu, M. D., & Fredrick, F. C. (2019). Effect of Game Teaching Method on Students' Mathematics Achievement in Aboh-Mbaise Local Government Area, Imo State. International Journal of Innovative Social and Science Educational Research, 7(3), 18 -23.

Osakwe, J., Iyawa, G., Ujakpa, M., & Mateus, J. (2022). Gamifying Learning in High Schools: Perceptions of Students in Selected African Countries. IST-Africa 2022 Conference Proceedings (pp. 1-9). IST-Africa Institute and IIMC.

Özgür, H., Çuhadar, C., & Akgün, F. (2018). Current trends in gamification research in education. *Kastamonu Education Journal*, *26*(5), 1479-1488.

Park, J., Kim, S., Kim, A., & Yi, M. Y. (2019). Learning to be better at the game: Performance Vs. Completion Contingent Reward for Game-Based Learning. Computer in Education 1(1), 1-7.

Quizalize blog. (2017). Incorporating digital quizzes into your everyday classroom routine. Best teaching practices, www.Quizalize.com.

Radišić, J., Videnović, M., & Baucal, A. (2015). Math Anxiety – Contributing School and Individual Level Factors. European Journal of Psychology of Education, 30(1)

Rao, H. (2022). Gamification in Higher Education: A Systematic Literature Review with Particular Reference to Octalysis as the Futuristic Framework for Further Research. Journal for Leadership and Instruction, 21(2), 38-47.

Ramirez, G., Chang, H., Maloney, E. A., Levine, S. C., & Bedock, S. L. (2016). On the Relationship between Math Anxiety and Math Achievement in Early Elementary School. The Role of Problem-Solving Strategies. Journal of Experiential and Child Psychology, 14(1), 83-100.

Reeves, D. (2015, July 10). 7 Ways to Increase a Student's Attention Span. Retrieved from Ethiopia: https://www.edutopia.org/discussion/7-ways-increase-students-attention -span

Sailer, M., & Sailer, M. (2021). Gamification of in-class activities in flipped classroom lectures. British Journal of Educational Technology, 52(1), 75–90.

Sanmugam, M., Abdullah, Z., & Zaid, N. (2014). Gamification: Cognitive Impact and Creating a Meaningful Experience in Learning. Conference: ICEED 2014,6th International Conference on Engineering Education, 1-7.

Segura-Robles, A., Fuentes-Cabrera, A., Parra-González, M. E., & López-Belmonte, J. (2020). Effects on Personal Factors Through Flipped Learning and Gamification as Combined Methodologies in Secondary Education. Frontier Psychology, 1(1),1103-1111.

Serrano, K. (2019). The effect of digital game-based learning on student learning: A literature review. Graduate Research Papers. 943.

Smiderle, R., Rigo, S. J., & Marques, L. B. (2020). The impact of gamification on students' learning, engagement, and behaviour based on their personality traits. Smart Learn. Environ, 7(3), 1-5.

Subhash, S., & Cudney, E. A. (2018). Gamified Learning in higher education: A systematic review of the literature. Computer in Human Behaviour, 87(1), 192-206.

Suleiman, Y., & Hammed, A. (2019). Perceived causes of students' failure in mathematics in Kwara State junior secondary schools: implication for educational managers. International Journal of Educational Studies in Mathematics, 6(1), 19–33.

Ukala, C. C. (2018). Gamifying the Classroom with Mobile Devices to Enhance Students' of Public Junior Secondary. European Journal of Research and Reflection in Educational Sciences, 6(3), 41-48.

Veltri, N. F., Krasnova, H., Baumann, A., & Kalayamthanam, N. (2014). Gender differences in online gaming: A literature review. 20th Americas Conference on Information Systems, AMCIS 2014.

Yadav, S. (2020). Role of Mathematics in the Development of Society. International Journal of Research and Analytical Reviews (IJRA), 6(4), 295-305.