ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Impact of a Researcher-Made Game-Based Learning (GBL) Package in the Mathematical Performance of the Grade 7 Students

Eula Marie E. Padlan
Morong National High School
Corresponding Author email: *eulamarie.emp@gmail.com*

Received: 11 February 2025 **Revised**: 21 March 2025 **Accepted**: 22 March 2025

Available Online: 25 March 2025

Volume IV (2025), Issue 1, P-ISSN – 2984-7567; E-ISSN - 2945-3577

DOI: 10.63498/nxz2st235

Abstract

Aim: This study determined the impact of the researcher-made Game-Based Learning (GBL) package on the Mathematical Performance of Grade 7 students at Morong National High School. Specifically, it aimed to compare the performance of students who engage in GBL activities to those who follow traditional instructional methods in terms of their mathematical proficiency.

Methodology: This study used an experimental design involving two groups: an intervention group and a control group. The intervention group, consisting of students who used the GBL package, and the control group, composed of students who followed traditional instructional methods, were assessed before and after the intervention. The participants were two Grade 7 sections at Morong National High School, randomly assigned to either group. The GBL package consisted of interactive games that aimed to improve students' understanding of Statistics. The control group followed the traditional method of teaching, which included lectures and worksheets. Both groups were given pre-tests to assess their baseline mathematical performance and post-tests to measure any improvements after the intervention. The data collected were analyzed using descriptive statistics (mean and standard deviation) and inferential statistics, specifically an independent t-test, to determine if there was a significant difference in the post-test scores between the two groups.

Results: The analysis revealed that the intervention group had a mean pre-test score of 8.5, compared to 8.575 for the control group, indicating similar baseline performance. Following the intervention, the intervention group significantly outdid the control group, with a mean post-test score of 32.9, compared to the control group's score of 18.35. This resulted in a mean gain score of 24.4 for the intervention group, while the control group had a mean gain score of 9.775. The standard deviation for the pre-test scores was 3.80 for the intervention group and 4.06 for the control group, reflecting a slightly higher variance in the control group. After the intervention, the standard deviation for the intervention group decreased to 3.35, while the control group's post-test standard deviation was 4.33, indicating a more consistent performance improvement in the intervention group. The calculated Cohen's D value of 6.75 demonstrates a very large effect size, signifying a substantial impact of the intervention on the intervention group's mathematical performance. Furthermore, the p-value of 0.00 strongly supports the statistical significance of the observed differences between the groups, confirming that the improvement in the intervention group is not due to random chance.

Conclusion: The results of this study demonstrate the significant impact of the Game-Based Learning (GBL) package on the mathematical performance of students in the intervention group compared to the control group. These findings emphasize the effectiveness of researcher-made GBL as an impactful instructional tool for enhancing students' learning outcomes in mathematics

Keywords: Game-Based Learning (GBL), mathematical performance, educational intervention, impact

INTRODUCTION

Technology has brought changes to the nature and scope of education. Educational transformation is necessary because the success of said economic transformation depends on the success of a futuristic education plan

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

(Leal Filho et al., 2018). Globalization has formed a new path in worldwide education, and teachers play an active role in the teaching and learning process. In this regard, pedagogy is stressing more about the roles of the students in the learning sessions, specifically how it is compatible with 21st-century learning methods (Amran et al., 2019). According to Kamarudin et al. (2019), student interest in teaching and learning is low when the conventional approach is employed. Effective teaching requires the use of various methods and techniques that engage students and facilitate the impartation of knowledge. As such, teachers must identify and utilize the most appropriate and effective teaching approach to ensure that students understand the subject matter and are equipped with the necessary skills and knowledge for their future endeavors.

Subsequently, the role of Mathematics in developing crucial skills for the 21st century cannot be overstated. Mathematics plays a critical role in shaping students' cognitive abilities and academic achievements therefore, there is a need to improve Mathematical instruction. (Padlan, et al., 2023) As such, teachers must adapt their instructional models and tools to cater to the characteristics of the current generation. Mathematics is integral to the learning process as it fosters creativity, develops systematic and critical thinking, and allows for the solving of complex problems. In today's education system, Mathematics helps students assimilate new ideas, adjust to changes, identify patterns, deal with ambiguity, and solve unusual problems to remain competitive.

Despite the essential role of Mathematics in developing crucial 21st-century skills, many students struggle to grasp its concepts, particularly in the latter part of the academic year when Statistics is introduced. At Morong National High School, students exhibit significant difficulty in understanding mathematical concepts, and this issue is further magnified when dealing with data interpretation, probability, and inferential statistics in the 4th quarter. Many students lack the foundational mathematical skills needed to comprehend statistical concepts, leading to low engagement and performance. Additionally, students often struggle with critical thinking and problem-solving when required to analyze and interpret data, making it difficult for them to apply statistical knowledge to real-world situations.

This problem is not unique to Morong National High School. Other schools also report similar challenges, where students find it difficult to transition from computational mathematics to abstract and applied concepts like Statistics. One major issue contributing to this struggle is the traditional approach to teaching, which remains teacher-centered and heavily dependent on rote memorization rather than active learning strategies (Bature, 2020). In many cases, teachers face difficulties in integrating technology and innovative teaching strategies due to limited resources, lack of training, or rigid curriculum requirements. This results in students perceiving Statistics as a complex and intimidating subject rather than an essential tool for problem-solving and decision-making.

Furthermore, students' fear and anxiety towards Mathematics, particularly Statistics, negatively impact their ability to engage with the subject matter. Math anxiety remains a persistent issue among learners, affecting their confidence and willingness to participate in discussions and activities (Khasawneh, et al. 2021). The inability to visualize and interpret statistical data further exacerbates this issue, as many students rely heavily on procedural knowledge without truly understanding underlying statistical principles.

Another critical problem is the lack of differentiation in instruction. Given that students have diverse learning styles, a one-size-fits-all approach often fails to address their unique needs. Students who struggle with Statistics may require more interactive and engaging methods, such as hands-on activities, simulations, or gamified learning experiences, to develop a deeper understanding of the subject. However, due to time constraints and curriculum pacing, teachers often find it challenging to implement such strategies effectively.

Raising the quality and scale of innovations in education will positively affect education itself and benefit the whole of society. The state's duty was to establish and maintain an innovative educational system that would lead to higher learning outcomes. It was stipulated in Republic Act No. 9155, 2001, Chapter 1 Section 7, under the "Powers, Duties, and Functions" that the school shall *"Introduce new and innovative modes of instruction to achieve higher learning outcomes."*

Additionally, the prevalence of technology in classrooms necessitates strategic utilization to enhance learning experiences. This aligns with the vision outlined in the DepEd Order No. 21 s. 2019 Policy Guidelines on the K to 12

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Basic Education Program and wit. *"The Department envisions Information and Communications Technology (ICT) as a powerful tool and an important medium in delivering curriculum content"*

Addressing these issues requires a shift in teaching methodologies and instructional strategies to promote meaningful learning. In line with 21st-century education, one applicable instructional technique is Game-Based Learning. Game-based learning in education is now one of the major learning trends of the 21st century (Ahmad & Iksan, 2021) and it has received an increasing amount of academic attention in recent years (Zou, 2020). The use of student-centered approaches, such as Game-Based Learning (GBL), has been shown to increase engagement and improve learning outcomes (Tejada-Simon, 2024). Game-based learning is a Mathematics teaching technique that creates a balance between classroom learning and educational games while enhancing learning efficiency through student-centered learning activities (Lasut & Bawengan, 2020). It is also one of the more creative and entertaining methods, and, indirectly, students will pay attention to the teacher's lessons. This is due to the fact that playing games is innate to the students. Additionally, educational games may encourage the students to enjoy learning, to feel comfortable approaching a variety of difficulties along the way, and to overcome these challenges with focus, self-assurance, and patience, all of which are crucial for higher education in the development of lifelong learners (Liu et al., 2021).

This strategy is also founded in constructivist learning, which emphasizes the importance of experiential learning through social interactions with the environment and their peers (Hourdequin et al., 2017). Substantial data indicates that Game-based learning is becoming increasingly popular as an effective learning approach utilized to create an engaging learning environment. Based on the empirical evidence from recent studies, the effectiveness of digital games in the education context has further proven the potential of Game-Based Learning to boost motivation, engagement, and social influences (Hernández-Lara & Serradell-Lopez, 2018). According to Khairuddin and Mailok (2019), the Game-based learning approach is used to stimulate and motivate the students to participate more actively in the learning process, to make the learning process more enjoyable, and to assist the students in comprehending the lessons more effectively. The Game-based learning technique enables teachers to include active learning in their lessons, to increase the student's interest and engagement, and to receive instant feedback from the students' performance. However, it should be noted that teachers should pay close attention to how gamification affects their students' interactions, emotionality, and cognitive activity—three aspects of the educational process.

The Researcher-made GBL Package initiative arises from the understanding that traditional methods may not always fully engage and motivate students, especially in learning areas of Mathematics like Statistics, which can be perceived as challenging or intimidating by some learners. The package is designed to leverage the inherent appeal of Game-Based Learning to foster a more interactive, immersive, and enjoyable learning experience for Grade 7 students, specifically in the context of Statistics. By incorporating elements of Game-Based Learning into the teaching of statistical concepts, the GBL Package aims to enhance Mathematical Performance, promote a deeper understanding of Statistics, and cultivate a positive attitude towards Mathematics.

One of the key advantages of the developed GBL Package is its accessibility and ease of use, as it is integrated into PowerPoint—a widely familiar tool among teachers and students. This familiarity ensures that educators can seamlessly incorporate the GBL Package into their lessons without requiring extensive training. Likewise, students can engage with the learning materials independently, allowing for self-paced learning and reinforcing concepts outside of classroom instruction. By utilizing PowerPoint as the primary platform, the GBL Package provides a versatile and user-friendly approach to Game-Based Learning that accommodates both teacher-led instruction and autonomous student engagement. This dual functionality enhances the overall learning experience, making Mathematics, particularly Statistics, more engaging and comprehensible for learners.

Objective

This study was conducted to determine the impact of the Researcher-Made Game-Based Learning (GBL) Package on the Mathematical Performance of Grade 7 students in Morong National High School.

Specifically, it aimed to answer the following questions:

1. How can the pretest and posttest results of the students be described with respect to the control and intervention groups?
2. Is there a significant difference in the pre-test and post-test results of the experimental and control groups?

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

3. Is there a significant difference in the test results between the control and intervention groups?

Hypothesis

There is no significant difference between the pretest and post-test scores of the intervention group at 0.05 alpha level of significance.

There is no significant difference in the test results between the control group and the intervention group at 0.05 alpha level of significance.

METHODS

Research Design

Experimental design was used to identify the impact of the researcher-designed Game-Based Learning Package. Experimental design is one of the most accurate forms of research because it provides specific scientific evidence. This helps to ensure that the two groups are equivalent in terms of history and other preexisting circumstances or conditions that may influence the results.

Population and Sampling

The study involved two sections of Grade 7 students, randomly assigned to either the control or intervention group. A total of 80 students participated, selected through a randomization process using value assignment in an Excel file to ensure an unbiased distribution. Each student was assigned a random number using the RAND() function in Excel, and the list was sorted accordingly. The first half of the sorted list was assigned to the control group, while the remaining half was assigned to the intervention group. The generated values were then converted into fixed numbers to finalize group assignments.

This randomized selection process ensured comparability between groups before implementing the intervention. The study employed an experimental design to assess the impact of the Researcher-Made Game-Based Learning (GBL) Package by comparing pretest and posttest scores of both groups.

Instrument

The instruments used in this study include a researcher-made pretest and posttest, which were validated by experts in the field to assess the mathematical performance of students in both the experimental and control groups. The pretest was administered before the intervention to measure students' initial understanding of the concepts, while the posttest was conducted after the intervention to determine any improvement in their performance. To ensure content validity and alignment with the learning competencies, a Table of Specifications (TOS) was developed by the researcher, ensuring that the test items appropriately covered the required topics and cognitive levels.

A researcher-made Game-Based Learning (GBL) package served as the primary instructional tool for the intervention group, incorporating interactive and engaging activities to enhance learning. Meanwhile, the control group received traditional instruction using standard lesson exemplars aligned with the curriculum. Additionally, lesson exemplars and learning modules were assigned for both groups to ensure consistency in instructional delivery.

These instruments ensured a structured and valid assessment of student learning before and after the intervention.

Data Collection

The data were gathered, read, and analyzed following the objective of the study and in adherence to all protocols in the conduct of research.

The researcher employed an experimental design with pre-test and post-test control groups to examine the impact of Game-Based Learning (GBL) on students' mathematical performance. Two pilot sections of Grade 7 students at Morong National High School during the 2023–2024 school year, designating one as the intervention group, which received GBL interventions, and the other as the control group, which followed traditional instruction. To measure the effectiveness of GBL, the researcher administered pre-tests to both groups before the intervention and post-tests after its implementation. The GBL intervention involved a researcher-made game-based learning package, incorporating

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

interactive games aligned with the mathematics curriculum. The researcher then conducted a statistical analysis of the pre-test and post-test scores to determine the significance of GBL in improving students' mathematical performance.

Treatment of Data

Appropriate statistical tools were employed by the researcher to arrive with valid and accurate findings. These are essential to interpret the data gathered, as well as to make a sound inference of the population.

Pre-test and post-test scores of the students were analyzed by calculating descriptive statistics such as the mean and standard deviation for both the experimental and control groups. This provides a clear comparison of how the performance of the students in both groups were described before and after the intervention. A paired-sample t-test was used to examine if there is a significant difference in the pre-test and post-test results within the intervention group. Similarly, an independent t-test was conducted to compare the post-test results of the intervention group with the control group to determine if the GBL package had a significant impact on the students' performance. The final analysis focused on comparing the test results between the two groups, as addressed in the third research question. The independent t-test assessed if the GBL package led to a statistically significant difference in performance between the intervention group and the control group.

Overall, the data treatment process enables a comprehensive understanding of the impact of the GBL package on students' Mathematical performance, providing evidence for the effectiveness of this innovative learning method.

Ethical Considerations

This study adhered to ethical research standards to ensure the protection and well-being of all participants. Informed consent was obtained from students and parents before data collection, ensuring that participation was voluntary and that individuals were fully aware of the study's purpose, procedures, and potential implications. Participants were assured that they could withdraw at any stage without any consequences.

To maintain confidentiality and anonymity, all collected data were kept strictly confidential, with student identities anonymized in reports and analyses. The data were used exclusively for research purposes and were securely stored to prevent unauthorized access.

Additionally, the study upheld the principles of beneficence and non-maleficence, ensuring that no harm—whether physical, psychological, or academic—was inflicted on participants. The research intervention was designed to enhance learning outcomes without causing undue stress or disadvantages to any group. Fairness and equity were observed in the selection of participants, and the research was conducted with transparency and integrity, adhering to the ethical guidelines set by the Department of Education (DepEd).

RESULTS and DISCUSSION

The study aims to determine the impact of the Game-Based Learning (GBL) package on the mathematical performance of Grade 7 students by comparing pre-test and post-test results from the experimental and control groups. The analysis will answer the research questions about the differences in the students' performance before and after the intervention and compare the two groups.

DESCRIPTION OF PRE-TEST AND POST-TEST RESULTS

To assess the initial mathematical performance of the students and the effect of the intervention, descriptive statistics were used to summarize the pre-test and post-test scores of the experimental and control groups. The following table presents the means and standard deviations for both tests:

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Table 1
Descriptive Statistics of Pre-test and Post-test Scores

	PRE-TEST		POST-TEST	
GROUP	Mean	SD	Mean	SD
EXPERIMENTAL	8.5	3.80	32.9	3.35
CONTROL	8.575	4.06	18.35	4.33

Table 1 shows that the intervention group had a mean pre-test score of 8.5, which increased to 32.9 in the post-test, reflecting a substantial improvement in performance. In comparison, the control group had a pre-test mean of 8.575, which increased to 18.35 in the post-test. Although both groups improved, the intervention group showed a more significant gain in their performance, suggesting the positive impact of the GBL package. This result highlights the potential of Game-Based Learning in enhancing student performance, as it not only increases engagement but also helps students grasp challenging concepts more effectively. According to Ding et. al (2018) Game-Based Learning is considered to be an effective tool in education for quickening learning, teaching challenging material, and encouraging systemic thinking.

SIGNIFICANT DIFFERENCE IN PRE-TEST AND POST-TEST SCORES

To determine if there was a significant difference between the pre-test and post-test results for each group, paired sample t-tests were conducted.

Table 2
Paired-sample t-test Results for Pre-test and Post-test Scores

GROUP	T-VALUE	DEGREES OF FREEDOM (DF)	P-VALUE	INTERPRETATION
EXPERIMENTAL	-33.99	38	0.000	Significant
CONTROL	-8.28	38	0.000	Significant

*p<0.05

Table 2 show that both the experimental and control groups had statistically significant improvements in their post-test scores ($p < 0.05$). The intervention group exhibited a larger t-value of -33.99, indicating a stronger impact of the GBL intervention. The control group also demonstrated improvement, but with a smaller effect size (t-value = -8.28). These results further emphasize the effectiveness of Game-Based Learning in fostering student improvement, as the intervention group showed a more pronounced enhancement in performance. This aligns with the findings of Sahin and Yilmaz (2020), who also demonstrated that Game-based Learning has a favorable and significant impact on the academic achievement and attitude of students, reinforcing the idea that GBL can be a powerful tool for learning.

SIGNIFICANT DIFFERENCE BETWEEN EXPERIMENTAL AND CONTROL GROUPS

An independent t-test was performed to compare the post-test scores between the experimental and control groups.

Table 3
Independent t-test Results for Post-test Scores Between Experimental and Control Groups

GROUP COMPARISON	T-VALUE	DEGREES OF FREEDOM (DF)	P-VALUE	INTERPRETATION
EXPERIMENTAL VS. CONTROL GROUP	-33.99	38	0.000	Significant

*p<0.05

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

As indicated in Table 3, there is a statistically significant difference between the post-test scores of the experimental and control groups ($p < 0.05$). The intervention group, with a mean score of 32.9, significantly outperformed the control group, whose mean score was 18.35. This result strongly suggests that the GBL package was more effective in improving the mathematical performance of the students compared to traditional teaching methods. The enhanced performance of the intervention group further supports the value of game-based learning in creating more engaging and effective learning experiences. Hui and Mahmud (2023) also state that GBL has positively impacted students in learning Mathematics and encourages educators to integrate it into the classroom, which is consistent with the findings of this study.

Conclusions, and Recommendations

This study aimed to assess the impact of the researcher-made Game-Based Learning (GBL) package on the mathematical performance of Grade 7 students at Morong National High School. The participants were divided into two groups: the intervention group, which received the GBL intervention, and the control group, which used traditional teaching methods. The results showed a significant increase in the mean post-test score of the intervention group (32.9) compared to the control group (18.35). The paired-sample t-test and independent t-test analyses revealed statistically significant improvements in both groups, with the intervention group showing a larger effect. Based on these findings, it can be concluded that the GBL package was effective in improving students' mathematical performance and increasing their engagement and participation in learning.

Therefore, it can be concluded that Game-Based Learning (GBL) had a positive effect on the mathematical performance of students, particularly in the intervention group. The significant difference in the mean gain scores between the two groups supports the effectiveness of GBL in enhancing students' understanding of mathematical concepts and boosting their interest in learning. These results demonstrate the potential of GBL as a tool for deepening students' understanding of mathematics.

In light of the success of the researcher-made GBL package in this study, it is recommended that the GBL approach be incorporated into regular classroom instruction to further improve students' performance and engagement in mathematics. Teachers should also be provided with training on how to effectively integrate game-based strategies into their lessons. Additionally, future research should explore the long-term effects of GBL on student learning and its application in other subject areas. Studies with larger sample sizes would also help strengthen the findings and explore potential challenges in implementing GBL in different learning environments.

Acknowledgment

The researcher would like to extend her heartfelt gratitude to the following individuals for their invaluable support and contributions: the students, whose dedication and participation made this study possible; the life partner, for their unwavering encouragement and love; the family, for their constant support and understanding; the friends, for their encouragement and belief in the research; and God, for His guidance and blessings throughout the entire process.

REFERENCES

Al Khateeb, M. A. (2019). Effect of mobile gaming on mathematical achievement among 4th graders. *Int. J. Emerg. Tech. Learn*. 14, 4–7. doi: 10.3991/ijet.v14i07.10315

Ahmad, N. F., & Iksan, Z. (2021). Penerapan Kemahiran Proses Sains melalui Pembelajaran Sains Berasaskan Permainan Digital. *Sains Insani*, 6, 75–81. https://doi.org/10.33102/s

Amran, H. A., Majid, R. A., & Ali, M. M. (2019). Cabaran Guru Pendidikan Khas Pada Abad Ke-21 Challenges for Special Education Teachers in 21st Century. *International Journal of Educational Psychology and Counseling*, 4, 113–122.

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Bature, I. (2020). The Mathematics Teachers Shift from the Traditional Teacher-Centred Classroom to a More Constructivist Student-Centred Epistemology. *Open Access Library Journal*, 7, 1-26. doi: 10.4236/oalib.1106389.

Dahalan, F., Alias, N., & Shaharom, M.S.N. (2024). Gamification and game-based learning for vocational education and training: A systematic literature review. *Educationd and Information Technogies*, 29, 1279–1317. https://doi.org/10.1007/s10639-022-11548-w

Department of Education. (2019). Policy guidelines on the K to 12 Basic Education Program (DepEd Order No. 21, s. 2019). Department of Education, Philippines. https://www.deped.gov.ph

Ding, L., Er, E., & Orey, M. (2018). An exploratory study of student engagement in gamified online discussions. *Comp. Educ*. 120, 213–226. doi: 10.1016/j.compedu.2018.02.007

Hernández-Lara, A. B., & Serradell-Lopez, E. (2018). Do business games foster skills? A cross-cultural study from learners' views. *Intangible Capital*, 14, 315–331. https://doi.org/10.3926/ic.1066

Hourdequin, P., York, J., & deHaan, J. W. (2017). Learning English and other 21st century skills through games: Lessons for Japanese higher education from learning spaces in New York City. 33, 1559–1565.

Hui, H. B., & Mahmud, M. S. (2023). Influence of game-based learning in mathematics education on the students' cognitive and affective domain: A systematic review. *Front. Psychol*. 14:1105806. doi: 10.3389/fpsyg.2023.1105806

Kamarudin, H., Ain, N., & Malek, A. (2019). Powertoon clues. *International Journal of Modern Language and Applied Linguistics*, 2, 30–34. https://doi.org/10.24191/ijmal.v2i3.7624

Khairuddin, N. S. B., & Mailok, R. B. (2019). View of Pembelajaran Berasaskan Permainan Dalam Mata Pelajaran Sejarah Menggunakan Teknik Mnemonik. *Journal of Information and Communication Technology in Education*. Retrieved from http://ojs.upsi.edu.my/index.php/JICTIE/article/view/3583/2341

Khasawneh, E., Gosling, C. & Williams, B. (2021). What impact does maths anxiety have on university students?. *BMC Psychol* 9, 37 (2021). https://doi.org/10.1186/s40359-021-00537-2

Lasut, E. M. M., & Bawengan, J. J. (2020). The effectiveness of ICTs integration in enhancing student motivation in learning English. In Proceedings of the 4th Asian Education Symposium (AES 2019). (pp. 211–215). https://doi.org/10.2991/assehr.k.200513.047

Leal Filho, W., Raath, S., Lazzarini, B., Vargas, V. R., de Souza, L., Anholon, R., & others. (2018). The role of transformation in learning and education for sustainability. *Journal of Cleaner Production*, 199, 286–295. https://doi.org/10.1016/j.jclepro.2018.07.017

Liu, Y. C., Wang, W.-T., & Lee, T.-L. (2021). An integrated view of information feedback, game quality, and autonomous motivation for evaluating game-based learning effectiveness. Journal of Educational Computing Research, 59, 3–40. https://doi.org/10.1177/0735633120952044

Padlan, E., Bonifacio, L. & Iway, M. (2023). Utilization of Math USAD (Umpisahan Sa Addition Hanggang Division) and Its Effects on Mathematical Performance of Grade 7 Students: An Action Research. *Psychology and Education: A Multidisciplinary Journal*, 12(10), 1-7. https://doi.org/10.5281/zenodo.8305383

Republic Act No. 9155 | GOVPH. (2001, August 11). Official Gazette of the Republic of the Philippines. https://www.officialgazette.gov.ph/2001/08/11/republic-act-no-9155/

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Sahin, D., & Yilmaz, R. M. (2020). The effect of augmented reality technology on middle school students' achievements and attitudes towards science education. Comp. Educ. 144, 103710. doi: 10.1016/j.compedu.2019.103710

Tejada-Simon, M. V. (2024). Exploring the impact of game-based learning and creative active-learning activities on student engagement and academic performance: A case study in the basic sciences for pharmacy education. *Advances in Physiology Education*. https://doi.org/10.1152/physiol.2024.39.S1.935

Zou, D. (2020). Gamified flipped EFL classroom for primary education: Student and teacher perceptions. *Journal of Computers in Education*, 7, 213–228. https://doi.org/10.1007/s40692-020-00153-w