Journal of Innovative Technology Convergence
Vol. 3, No. 2 December 2021, pp. 11-20

Digital Gaming: Implication to Undergraduate Students' Study habits, Academic Achievement and Time Management

Janet A. Orioque [1], Haide D. Selpa [2]

Abstract: Digital technology had a huge impact on the lives of the younger generation, particularly the students. Mobile and internet involvement are used to facilitate their socialization process. Time spent on a digital device is an important component of their lives. Their attraction to the digital world prevents them from concentrating on their studies. The main aim of this study was to examine whether undergraduate students are engaged in digital gaming and its effect on their study habits and academic achievement with time management as a mediating variable. It employed a descriptive-correlational research design, utilizing questionnaires as an instrument in obtaining relevant data. The statistical treatment used were frequency, means, and Pearson *r*. Results showed that majority of the students spent high in digital gaming; had very good time management skills; good study habits and academic achievement. That is, frequency and length of time in digital gaming had no effect on students and academic achievement. Contributory of which is the students' good time management, hence their academic achievement was significantly not affected. These results led the researchers to conclude the importance of time management among students. Generally, digital gaming cannot significantly affect the study habits and academic achievement of students especially those who possess good time management skills, this study can be investigated further to strengthen the findings.

Keywords: digital gaming, study habits, academic achievement, time management, descriptive-correlational design

1. Introduction

Technology has a huge impact on all aspects of society and is always changing. One example is a digital game that can be played on a digital device such as a computer or a cellphone. Games are systems in which players engage in an artificial conflict that is defined by rules and has a measurable outcome.

[1] College of Graduate Studies, Palompon Institute of Technology, Palompon, Leyte, Philippines
Email: janet.orioque@pit.edu.ph
[2] College of Technology and Engineering, Palompon Institute of Technology, Palompon, Leyte, Philippines
Email: haide.selpa@pit.edu.ph

Received [September 6, 2021]; Revised [November 20, 2021]; Accepted [December 2, 2021]

Published by InnoCon Publishing
ISSN 2704-4440

It's a type of art in which players make judgments on how to manage resources using game tokens in order to achieve a goal [1]. Computer games (hence referred to as '*games*') have become an important component of our social and cultural landscape [2], they are especially popular among children and teenagers, for whom they are the most popular computer activity at home [3-5]. A study of UK students aged 7-16 years old found that the majority of them were regular domestic game players [6], while another study [7] found that online gaming was one of the main reasons for domestic internet use among Greek students aged 12–16 years old. Games, thus, play a vital role in young people's lives outside of school, eliciting a deep sense of connection and fascination [8-10]. Challenge, fantasy, and curiosity are all important game features that lead to this level of engagement [11].

The college demographic appears to be the most active gamers, owing to a lack of parental supervision and more flexible schedules that allow for more playtime [12]. The advent of video games, like any other invention in society, prompted the inquiry, "*What are the negative impacts or consequences?*" According to [13], there appears to be an increased interest in the study, particularly in the domain of video gaming.

One of the key concerns in the current study is whether or not playing video games has a negative or positive impact on academic achievement. Anand [12] found a negative relationship between the amount of time spent playing video games and students' Grade Point Average (GPA) and Scholastic Aptitude Test (SAT) results in one research. The author concluded that as time spent playing increased, GPA and SAT scores fell. However, the author did acknowledge that using SAT scores has limitations because they are a one-time standardized assessment. Using a GPA is more credible because it represents a continuous measurement of school performance. The study of Skoric *et al.* [14] took it a step further and looked at the difference between video game addiction and basic participation. Despite the lack of a clear definition of addiction, they discovered that those addicted to gaming regularly did poorly in school, despite the fact that there was no link between time spent playing or involvement and academic achievement. Chiu *et al.* [15] looked into addiction (again, no exact definition was provided) and found that when a student was addicted to gaming, their school performance suffered. They discovered that gaming addiction has a tangible influence on academic achievement since the student is too engrossed in the game to conduct homework or study. Others have discovered a link between video game participation and poor academic performance. Anderson and Dill [16] investigated video games and aggression, concluding that not only does gaming affect performance directly, but it also causes an increase in hostility, which is frequently associated with school issues and poor academic achievement.

Similarly, Wack and Tantleff-Dunn [17] discovered a negative link between GPA and academic performance, however, the relationship was not significant in their study. Jackson *et al.* [18] discovered that gaming time was a negative predictor of academic performance, with those who played video games more frequently receiving lower grades than those who did not.

However, there are plenty of studies to suggest that interactive video games can improve academic performance [14]. According to Din and Calao [19], playing games causes an increase in visual-spatial skills, which are useful in science and engineering.

A study that involves Kindergarten students who played educational video games on the Sony Light span, which is a game system similar to the Sony Play station One, made significant gains in spelling and reading over the control group; however, there was no significant gain in math. This shows that playing video games aids in the development of language skills. Complex games according to Smyth [13], can help students succeed in school by encouraging problem-solving, critical thinking, and creativity. According to Skoric *et al.* [14], whereas game addiction causes poor academic achievement, moderate engagement does not. They discovered a link between gameplay and test scores in English, implying that gaming can improve test scores. North Carolina State University is even experimenting

with the synchronous online graduate course that integrates video game design with the science curriculum [20]. To summarize this overview of recent literature on the relationship between video game usage and academic performance, Annetta *et al.* [20] aptly state the dilemma in researching this topic: "There is no definitive answer to the question of whether video games affect academic performance." As the literature review demonstrates, much has been said to support both positive and negative aspects of the topic. To shed light on this topic, we aim to examine the effect of digital gaming on study habits and academic achievement among undergraduate students.

Five research questions guide this study: 1) What was the extent of digital gaming as to: a) frequency and b) length of time? 2) What was the level of study habits, time management, and academic achievement of the respondents? 3) Are there significant relationships between the extent of digital gaming and each of the following: a) study habits b) academic achievement? 4) Does time management intervene in the effect of computer gaming on study habits and academic achievement? 5) Does the extent of digital gaming affect students' academic achievement?

1.1 Literature Review

1.1.1 Evidence of impact and outcomes for games in education

Previous reviews indicate that knowledge acquisition was the most frequently investigated outcome in educational game studies [22][23], with less than one-third of the studies investigating problem-solving skills [21], and affective and motivational outcomes were investigated more frequently in entertainment game studies [22]. Despite the fact that educational game studies show variable degrees of success depending on an academic topic, learner preference, and participant age [23], Game-Based Learning (GBL) has been shown to favorably influence attitudes and cognitive gains [23]. However, there is a scarcity of high-quality scientific research about how games in the classroom can influence the development of 21st century abilities [24]. Skills that are relevant in the twenty-first century are vastly different from those that the educational system currently prioritizes [25]. Critical thinking, creativity, teamwork, and communication are defined as 21st century learning and creative skill sets [26]. By promoting only one correct answer, imposing high-stakes failure, and prioritizing uniformity and standardization, traditional educational systems often stifle originality [27]. Furthermore, 21st century abilities are harder to acquire. Additionally, traditional evaluation methods such as standardized testing make it impossible to assess 21st century competencies [27]. Games, on the other hand, demand the development of 21st century talents that are in high demand in the new digital economy [28].

1.1.2 Digital Games

Students in higher education were not always inspired by digital games. The usage of games had not affected the motivation or engagement of a group of Singaporean college students who were found to have a high level of intrinsic motivation [29]. In fact, students in Singapore who were accustomed to digital game-based learning expressed concern. Further evaluations of student learning revealed that a combination of lecture and digital learning is still required [30]. Familiarizing students with technology take a long time, which delays learning even further. Instructors face difficulties in adjusting to these variances [31]. Another aspect influencing student acceptance of digital games in the classroom is students' mindset, which is habituated to a positive learning style through the lecture format [32].

1.2 Framework of the Study

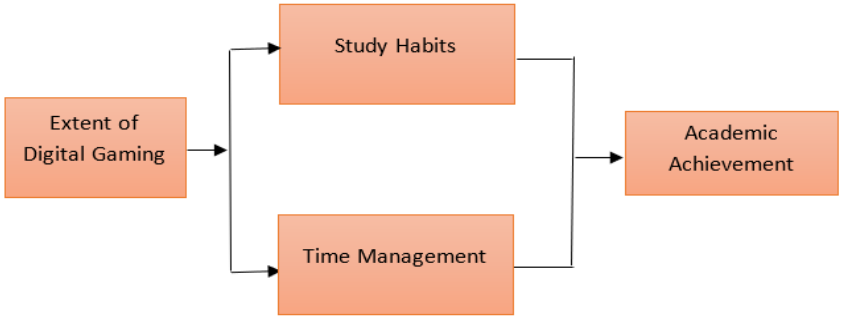

Figure 1. Schematic diagram of the study

Figure 1 presents the schematic diagram of the study. It visualizes the relationship of the extent of students' digital gaming, study habits, and academic achievement. As shown, the extent of digital gaming is being moderated by the students' time management. As such, it is possible that students may engage in digital gaming, however, the effect maybe positive or negative depending on how the students manage their time. That is, he/she may engage himself/herself in computer gaming but if time is properly managed or regulated by giving time to his/her studies, then the most likely academic achievement will not be affected. On the other hand, if a student's time management is poor, then there is a possibility that digital gaming would hamper one's academic achievement.

The following hypotheses were tested:

1. The extent of digital gaming is not significantly related to a) study habits and b) academic achievement.
2. There is no significant relationship between Time management with study habits and academic achievement.

2. Methodology

2.1 Research Design

This paper utilized a descriptive-correlational research design. It involved the primary investigator in observing and describing a current condition and behavior (digital games usage, time management, study habits, academic achievement). The study was conducted in Palompon, Leyte, Philippines, with the respondents drawn from undergraduate students of Palompon Institute of Technology (PIT).

2.2 Research Instrument

The research Instrument used in this study was a survey questionnaire consisting of three sets with the following: Set A was designed to determine the extent of digital gaming of the respondents, which sought the frequency and length of time they engaged in gaming. Set B determined the students' study habits while Set C was formulated to seek responses related to their time management. Sets B and C questionnaires were both Five-point Likert type and the scores were interpreted utilizing the following scale:

Score Range	Interpretation
4.21-5.00	Excellent
3.41 – 4.20	Very Good
2.61 – 3.40	Good
1.61 – 2.60	Fair
1.00 – 1.60	Poor

Moreover, the students' academic achievement was measured in terms of the student's General Weighted Average (GWA) gathered from the School Automate System.

3. Results and Discussion

In this study, an analysis of the relationships between variables and the effect of digital gaming on students' study habits and academic achievement was conducted. The extent of digital gaming was measured in terms of the frequency and length of time they played digital games. These are presented in Tables 1 and 2.

3.1 Frequency of Digital Gaming

Table 1 shows the frequency of digital gaming of undergraduate students. As shown, the majority of the students (n = 74) engaged themselves in digital gaming usually 1 to 3 times per week (low digital gaming). Another group reported to have played digital games (n = 35) about 4 to 6 times a week (Moderate), a few of them (n = 10) revealed a high computer gaming (7 to 9 hours per week) and (n = 1) for 10 times or more.

Table 1. Frequency of Student' Digital Gaming

Frequency of Computer Gaming (per week)	***n***
1 – 3 (Low)	74
4 – 6 (Moderate)	35
7 – 9 (High)	10
10 times or more (Very High)	1
Total	**120**

Table 1 result indicates that most of the students played digital games however they limit it to at most three (3) times per week. This implies that these students managed well their digital gaming. In fact, indicators in the research instrument point out that students who usually engaged themselves in digital games only during their free time or when they get bored of staying at home or in their respective boarding houses. That is, when students do not have academic-related tasks, like course requirements to make, projects, reports, assignments, and other school-related tasks, that is usually their time of involving themselves with digital games.

3.2 Length of Time in Digital Gaming

Table 2 reveals the length of time that the students played digital games. As revealed, the majority of the students showed less time in computer gaming (n = 84, mean = 3.24); a number of them are fond of playing digital games from 1 – 3 hours per week; nineteen (n = 19, mean = 5.54) students played digital games from 4 – 6 hours per week while seven (n = 7, mean = 9.00) students played digital games

7-9 hours, and ten (n = 10, mean = 16.30) for more than 10 hours per week. Generally speaking, the respondents had high digital gaming as measured in the length of time.

Table 2. Length of Time in Digital Gaming

Average length of time in playing computer games (hours per week)	Frequency	Mean Hours	Interpretation
1 – 3	84	3.24	Low
4 – 6	19	5.45	Moderate
7 – 9	7	9.00	High
10 hours or more	10	16.30	Very High
Overall	120	8.49	High

The preceding results showed that the present sample of the respondents engaged in digital gaming is 7 to 9 times a week. It implies that the students had a high engagement in digital gaming with the 8.49 mean in hours considering that we are in a pandemic and most of them are staying at home so they have no other task to do aside from studying and doing household chores.

3.3 Level of Study Habits

Table 3 presents the respondents' level of study habits. As shown, 39 students showed good study habits with a mean of 3.43, 70 students indicated very good study habits with a mean of 4.20 and 11 students displayed excellent study habits with a mean of 4.59. In general, the respondents showed very good study habits with an overall mean of 4.07.

Table 3. Level of Study Habits

Study Habits	Frequency	Mean	Description
2.61 – 3.40	39	3.43	Good
3.41 – 4.20	70	4.20	Very Good
4.21 – 5.00	11	4.59	Excellent
Overall	120	4.07	Very Good

Table 3 reflects the results on the level of study habits, it shows that the respondents spent time in their studies despite several destructors which included but were not limited to the students' exposure to digital games, it is interesting to note that all of them indicated good to excellent study habits.

3.4 Level of Time Management

As shown in Table 4, the time management skills of the respondents range from good to excellent. Specifically, 25 students [mean = 3.38] indicated good time management, 78 students [mean = 4.35] showed very good time management while 17 students [mean = 4.50] displayed excellent time management having an overall average of 4.07.

Table 4. Level of Time Management

Time Management	Frequency	Mean	Description
2.61 – 3.40	25	3.38	Good
3.41 – 4.20	78	4.35	Very Good
4.21 – 5.00	17	4.50	Excellent
Overall	120	4.07	Very Good

Table 4 showed very good time management, it implies that the respondents were able to manage their time in doing their academic-related tasks such as school projects, assignments, reports, and examinations considering that they are always staying at home in this time of the pandemic.

3.5 Level of Academic Achievement

Table 5 shows the level of academic achievement of the respondents. As shown, 5 students [mean = 1.40] showed excellent academic achievement, 20 students [mean = 1.74] have very good academic achievement, 50 students [mean = 2.15] displayed good academic achievement, 28 students [mean = 2.50] have revealed satisfactory academic achievement while 17 students [mean = 3.0] have shown fair or passing academic achievement. The overall results showed good academic achievement among the respondents of the study.

Table 5. Level of Academic Achievement

Time Management	Frequency	Mean	Description
1.00 – 1.40	5	1.40	Excellent
1.41 – 1.80	20	1.74	Very Good
1.81 – 2.20	50	2.15	Good
2.21 – 2.60	28	2.50	Satisfactory
2.61 – 3.00	17	3.00	Fair
Overall	120	2.16	Good

Table 5 reveals that most of the respondents were in good academic achievement suggesting that the respondent's academic achievement was not totally affected by their engagement in digital gaming but rather they were able to manage their time in studying and gaming.

3.6 Correlation Analysis on the Extent of Digital Gaming, Study Habits, Academic Achievement and Time Management

Table 6 presents the correlation coefficients of the respondents' digital games usage, study habits, time management, and academic achievement. As shown in the table, there is no significant relationship between digital gaming (frequency and length of time) with academic achievement and study habits, with *r*-values ranging from –.04 to -.13. However, significant relationships were observed between time management and study habits [r (.54) = .54, $p < .05$]; time management and academic achievement [r (.26) = .54, $p < .05$] and finally, study habits, and academic achievement yielded a high significant relationship [r (.49) = .54, $p < .01$].

Table 6. Correlation Analysis

Variables	1	2	3	4	Academic Achievement
1. Frequency of Digital Gaming	-	.04	-.07	-.03	-.13
2. Length of time in digital gaming		-	-.06	-.06	-.04
3. Time Management skills			-	-.54**	.26*
4. Study Habits				-	.49*

** p–value < 0.05; ** p–value < 0.01*

Table 6 showed that there is no significant relationship between the extent of digital gaming with academic achievement and study habits, therefore hypothesis 1 is accepted. Furthermore, a highly significant relationship is observed with time management, study habits, and academic achievement, therefore, hypothesis 2 is rejected. It implies that based on the results, the extent of digital gaming has no effect on academic achievement because the respondents were able to manage their time well, they have good study habits, which resulted in good academic achievement. Clearly, the result of the present study does not conform with some of the literature gathered, like the study of Anderson and Dill [16] which revealed that video games and aggression further suggests that not only does gaming have an impact on students' performance directly, but it also triggers a higher level of aggression. This, according to them, is often linked to problems in school and decreased academic performance. Such a result conforms to the findings of Wakil *et al.* [33]. Although some studies revealed negative effects such as playing computer or video games are similar to addictions such as gambling which create negative social effects, however, other studies have noted positive aspects of the games such as the ability to experiment with aspects of individual identity which do not come out in public [34].

4. Conclusions

Digital gaming is often linked with low academic performance. A number of studies back up this theory; yet, some studies show that the impact of digital gaming isn't entirely detrimental. It influenced students' academic performance in both positive and negative ways. There was no definite evidence of a link between digital gaming and academic achievement in this study. However, it was clear that this link was mediated by students' time management skills. That is, in the current study, students effectively limited their digital gaming time, and as a result, their academic performance was not affected. This conclusion is consistent with Wakil *et al.* [33] findings. Although some studies have found negative effects of digital or video games, such as the ability to experiment with aspects of ones' identity that are not revealed in public, other studies have found positive aspects of the games, such as the ability to experiment with aspects of one's identity that are not revealed in public [34].

Furthermore, prior research suggests that the impact of digital gaming on academic attainment is ambiguous. Indeed, according to research "*there is no obvious causal association between video game/digital gaming and academic performance*" [34]. As a result, the research is described as "*sparse and contradictory*". These findings demonstrate that digital gaming has a variety of implications on students' academic performance. This could be positive or negative, depending on the other factors that influence academic progress and digital gaming. Therefore, the researchers concluded that the high extent of digital gaming could not at all times affect academic achievement. This holds true especially for students who manage their time well and possess good study habits. However, to validate the findings of the present study, it is recommended that a similar or parallel study in a wider scope be conducted.

References

[1] Wikipedia, "*Greg Costikyan*", https://en.wikipedia.org/wiki/Greg_Costikyan (accessed April 18, 2021).

[2] D. Oblinger, "*The next generation of educational engagement*", Journal of Interactive Media in Education, vol. 2004, no. 8, May 2004, pp. 1–18, doi: 10.5334/2004-8-oblinger.

[3] T. Downes, "*Playing with computing technologies in the home*", Education and Information Technologies, vol. 4, no. 1, March 1999, pp. 65–79, doi: 10.1023/A:1009607432286.

[4] S. Harris, "*Secondary school students' use of computers at home*", British Journal of Educational Technology, vol. 30, no. 4, December 2002, pp. 331–339, doi: 10.1111/1467-8535.00123.

[5] S. Mumtaz, "*Children's enjoyment and perception of computer use in the home and the school*", Computers and Education, vol. 36, no. 4, May 2001, pp. 347–362, doi: 10.1016/S0360-1315(01)00023-9.

[6] A. Macfarlane, A. Sparrowhawk, Y. Heald, "*Report on the Educational use of games*", www.questgarden.com/84/74/3/091102061307/files/teem_gamesined_full.pdf (May 27, 2021).

[7] M. Papastergiou, "*Digital game-based learning in high school computer science education: impact on educational effectiveness and student motivation*", Computers & Education, vol. 52, no. 1, January 2009, pp. 1-12, doi: 10.1016/j.compedu.2008.06.004.

[8] K. Facer, "*Computer games and learning*", www.futurelab.org.uk/resources/documents/.pdf (accessed May 22, 2021)

[9] Y. Kafai, "*The educational potential of electronic games: From games-to-teach to games-to-learn*", www.wayback.archive-it.org/11353/20181130073750/https://culturalpolicy.uchicago.edu/sites/culturalpolicy.uchicago.edu/files/kafai.pdf (accessed May 23, 2021)

[10] J. Kirriemuir and A. McFarlane, "*Literature review in games and learning*", Futurelab Series, Bristol, UK, vol. 8, July 2004.

[11] T. Malone, "*What makes things fun to learn? Heuristics for designing instructional computer games*", in Proceedings of the 3rd ACM SIGSMALL Symposium and the 1st SIGPC Symposium, 1980, pp. 162–169, doi: 10.1145/800088.802839.

[12] V. Anand, "*A study of time management: The correlation between video game usage and academic performance markers*", Cyber Psychology & Behavior, vol. 10, no. 4, August 2007, pp. 552-559, doi: 10.1089/cpb.2007.9991.

[13] J. Smyth, "*Beyond self-selection in video game play: An experimental examination of the consequences of massively multiplayer online role-playing game play*", Cyber Psychology and Behavior, vol. 12, no. 2, October 2007, pp. 241-244, doi: 10.1089/cpb.2007.9963.

[14] M. M. Skoric, L. L. C. Teo, L. Neo, "*Children and video games: Addiction, engagement, and scholastic achievement*", Cyber Psychology & Behavior, vol. 12, no. 5, October 2009, pp. 567-72, doi: 10.1089/cpb.2009.0079.

[15] S. I. Chiu, J. Z. Lee, D. H. Huang, "*Video game addiction in children and teenagers in Taiwan*", Cyberpsychology & behavior: the impact of the Internet, multimedia and virtual reality on behavior and society, vol. 7, no. 5, November 2004, pp. 571-81, doi:10.1089/cpb.2004.7.571.

[16] C. Anderson and K. Dill, "*Video games and aggressive thoughts, feelings, and behavior in the laboratory and in life*", Journal of Personality and Social Psychology, vol. 78, no. 4, 2000, pp. 772-790, doi: 10.1037//0022-3514.78.4.772.

[17] E. Wack and S. Tantleff-Dunn, "*Relationship between electronic game play, obesity, and psychosocial functioning in young men*", Cyber Psychology and Behavior, vol. 12, no. 2, April 2009, pp. 241-244, doi: 10.1089/cpb.2008.0151.

[18] L. Jackson, Y. Kolenic III, H. Fitzgerald, R. Harold, A. Von Eye, "*Race, gender, and information technology use: The new digital divide*", Cyber Psychology and Behavior, vol. 11, no. 4, August 2008, pp. 437-442, doi: 10.1089/cpb.2007.0157.

[19] F. Din and J. Calao, "*The Effects of playing educational video games on kindergarten achievement*", Child Study Journal, vol. 31, no. 2, June 2001, pp. 95-102.

[20] L. Annetta, M. Murray, S. Gull Laird, S. Bohr, J. Park, "*Investigating Student Attitudes Toward a Synchronous, Online Graduate Course in a Multi-User Virtual Learning Environment*", Journal of Technology and Teacher Education, vol. 16, no. 1, 2008, pp. 5-34.

[21] T. M. Connolly, E. A. Boyle, E. MacArthur, T. Hainey, J. M. Boyle, "*A systematic literature review of empirical evidence on computer games and seious games*", Computers and Education, vol. 59, no. 2, September 2012, pp. 661-686, doi: 10.1016/j.compedu.2012.03.004.

[22] M. C. Li, C. C. Tsai, "*Game-based lerning in science education: a review of relevant research*", Journal of Science Education and Technology, vol. 22, no. 6, 2013, pp. 877-898, doi: 10.1007/s10956-013-9436-x.

[23] M. F Young, S. Slota, A. B. Cutter, G. Jalette, G. Mullin, B. Lai, Z. Simeoni, M. Tran, M. Yukhymenko, "*Our princess is in another castle: a review of trends in serious gaming for education*", Review of Educational Research, vol. 82, no. 1, March 2012, pp. 61-89, doi: 10.3102/0034654312436980.

[24] M. Mahali, J. Jamaluddin, N. Mohd Din, M. A. Nias Ahmad, F. A. Jabar, N. S. M. Fadzillah, "*The Effects of Digital Games on Students's Learning Experience: A Review of Literature*", in Proc. Konferensi Akademik KONAKA 2016, 2016.

[25] K. Squire, "*Changing the game: what happens when video games enter the classroom?*", Innovate: Journal of Online Education, vol. 1, no. 6, August 2005.

[26] M. Binkley, O. Erstand, J. Herman, S. Raizen, M. Ripley, M. Runmble, "*Partnership for 21st century skills*", www.battelleforkids.org/networks/p21 (accessed June 23, 2021)

[27] J. A. Plucker and M. C. Makel, "*Assessment of creativity*", in The Cambridge Handbook of Creativity, Chapter 3, J. C. Kaufman, R. J. Sternberg (Eds), New York: Cambridge University Press, 2010, pp. 48-73, doi: 10.1017/CBO9780511763205.005.

[28] M. Quian and K. R. Clark, "*Game-based Learning and 21st century skills: A review of recent research*", Computers in Human Behavior, vol. 63, October 2016, pp. 50-58, doi: 10.1016/j.chb.2016.05.023.

[29] R. Tham and L. Tham, "*The effectiveness of game-based learning as an instructional strategy to engage students in higher education in Singapore*", International Journal on E-Learning, vol. 13, no. 4, 2014, pp. 483–496.

[30] S. Rondon-Melo, F. C.Sassi, C. R. Furquim de Andrande, "*Computer game-based and traditional learning method: A comparison regarding students' knowledge retention*", BMC Medical Education, vol. 13, no. 1, February 2013, doi: 10.1186/1472-6920-13-30.

[31] J. Holmes and R. Gee, "*A framework for understanding game-based teaching and learning*", On the Horizon, vol. 24, no. 1, 2016, pp. 1–16, doi: 10.1108/OTH-11-2015-0069.

[32] D. B. Clark, E. E. Tanner-Smith, S. S. Killingsworth, "*Digital Games, Design, and Learning: A Systematic Review and Meta-Analysis*", Review of Educational Research, vol. 86, no. 1, March 2016, pp. 79-122, doi: 10.3102/0034654315582065.

[33] K. Wakil, S. Omer, B. Omer, "*Impact of Computer Games on Students GPA*", European Journal of Education Studies, vol. 3, no. 8, 2017, doi: 10.46827/ejes.v0i0.892.

[34] J. Craton, "*The Effect of Videogames on Student Achievement Association for Christians in Student Development*", The Tutoring Center, www.hemet.tutoringcenter.com/blog/posts/tips/effect-of-videogames-on-students (accessed July 12, 2021).