Management of Gamified Lesson: Understanding Aesthetics and Acceptance among Learners

Nor Azairiah Fatimah Othman[1], Amir Imran Zainoddin[1*], Azila Jaini[1], Mazida Ismail[1], Siti Fatimah Mohamad Radzi[1] & dan Norashikin Hussein[2]
[1]Universiti Teknologi MARA Cawangan Johor, Kampus Segamat, Malaysia
[2]Universiti Teknologi MARA Cawangan Selangor, Kampus Puncak Alam, Malaysia
norazairiah@uitm.edu.my, *amirimran@uitm.edu.my, azilajaini@uitm.edu.my, mazid933@uitm.edu.my,
sitifatimahradzi@uitm.edu.my, shikin6320@uitm.edu.my

Abstract: Joyful learning evokes happy feelings and subsequently induces positive academic achievement. With the rise of mental health issues due to intense study among students, gamification has recently grown in popularity among academic institutions to make learners happier, more engaged and ultimately improve learning outcomes. However, the management of gamified lessons has been a problem for years for all education levels on a varying basis. Nowadays, it is increasingly recognized that not all learners are acceptive of gamified lessons for learning. Drawing on a survey of 283 students of higher learning institutions, this study found that aesthetics, perceived ease of use, perceived usefulness and perceived enjoyment have a favorable impact on the intention to accept gamification in learning among learners. This study is contributing to under-investigated scholarly works of suitable conditions under which gamified lesson best takes place with regards to aesthetic and learners' acceptance that would be beneficial for effective management of gamification.

Keywords: *Gamification Acceptance, Aesthetics, Perceived Ease of Use, Perceived Usefulness, Perceived Enjoyment.*

1. Introduction

Previously academic lessons in learning institutions were held in and outside the classroom only. During the last couple of years, gamification has been the talk of the town as a means to support learning experiences for higher education institutions (Alhammad & Moreno, 2018). Gamification in education involves incorporating game elements into learning (Swacha, 2021). Kahoot, Duolingo, Brainscape and Virtual Reality are some of the gamification tools used in academic courses from elementary, primary school and secondary schools up to higher learning institutions. According to Khaldi et al. (2023), gamification promotes "desired behaviors of less distraction and better involvement in the course". A study conducted by Murillo-Zamorano et al. (2021) has shown that gamification encourages learners to be more active in learning. Students learning using game-based learning attain a new learning experience that improves their motivation and learning process (Alshammari, 2020) by putting forward "similar experiences as games" do (Huotari & Hamari, 2017). However, students have been found to discard game-based learning when it requires more time, effort and prefer minimal effort (Squire, & Barab, 2004). Gamification does not bring a similar effect to everyone (Gokuüna & Gursoy, 2019). Due to the fact that gamification largely depends on users and context (Hamari, 2013) and has been problematic in raising learners' attention to all fields of education, an understanding of game design aesthetics and learners' acceptance are the key factors towards successful gamification operationalization.

2. Management of Gamification in Teaching and Learning

Generation-based research acknowledges that "Generation Z, may require a new approach to learning than past generations" (Jones et al., 2007). Today's generation enjoys playing activities for learning and grows up playing more games compared with previous generations, it is apparent that the teaching and learning needs to be changed toward game-based delivery to better suit Gen-Z and the succeeding generation's way of life. Nowadays, gamification has an important position in the education setting to make learners engage and perform more profoundly in learning. Effective management of gamification is necessary, or otherwise, it could ultimately bring opposite learning outcomes to what was originally intended. However, there is still little focus given to the matter of whether all learners are acceptive of gamification in regard to game design (aesthetic). In common, pedagogy in many learning environments presumes that all learners have alike characteristics (Kamunya & Mirirti, 2020). Noticeably, there is no one-size-fits-all gamified lesson that

possibly works for all learners in real life. Some educational games developed are either too easy or too difficult (Verdugo & Belmonte, 2007) and students have been identified to reject gamified lessons when they require more time, effort and is preferring for minimal effort (Squire & Barab, 2004). According to Hamari (2013), gamification is largely depending on users and context. Yet most gamification projects are not working because user's personal needs are being given thought (Schöbel & Söllner, 2016). Conflicting needs among learners may cause some are accept gamification in learning and others to reject it, putting the success of gamification operationalization at risk. Further, the success of educational game applications is subject to their continued use (Bhattacherjee, 2001). However, Andrea et al. (2021) argue that there has been a problem in raising learners' attention to all fields of education. Therefore, understanding the aesthetic and learner's intention to accept gamified lessons in teaching and learning is deemed appropriate.

Underpinning Theoretical Framework: The acceptance of technology can be predicted by the Technology Acceptance Model (TAM) proposed by Davis in 1989. Perceived ease of use and perceived usefulness are the two most studied factors in understanding technology acceptance. Perceived Enjoyment is one of the additional recognized factors that also influence technology usage behavior. This study examining aesthetics as an additional variable is believed to contribute to gamification acceptance that has not been much explained by existing scholarly works. Previous research acknowledges that perceived ease of use is the key to acceptance. Perceived ease of use is the degree to which a person thinks using a specific system would be effortless (Davis, 1989). When people think that the technology is difficult, tiresome, or time-consuming, it is quite likely that they will reject the technology (Thong et al., 2002). People much likely prefer technology that is simple to use and requires little effort. Apart from perceived ease of use, perceived usefulness also is found impactful on people's acceptance behavior. According to Davis (1989), "perceived usefulness is the degree to which a person believes that employing a system would improve his or her ability to accomplish a job".

When people think that technology is benefiting them to carry out their tasks effectively and efficiently, most likely they will be more acceptive towards accepting of the technology. According to Lee and Lehto (2013), "intention to use and actual use of the technology of an individual is directly impacted by the perceived usefulness. Prior scholarly works had acknowledged factors other than perceived ease of use and perceived usefulness to explain people's behavior towards technology among others perceived enjoyment and aesthetics. Perceived enjoyment is the degree to which the activity of using the computer is seen as enjoyable independent of any predicted performance results (Park et al., 2012). The joyful feeling while learning using gamified lessons also impacts the decision to gamify. According to Wei et al. (2011), joyful learning makes students feel happy in the learning process. Meanwhile, the aesthetic is related to the individual's impression regarding the visual appearance of an interface (Rosmansyah et al., 2020). With previous scholarly work evidencing aesthetics able to affect learners' motivation (Farhan et al., 2019), a study on the relationship between aesthetics, perceived ease of use, perceived usefulness, perceived enjoyment, and acceptance towards gamification is deemed appropriate.

Research Framework: The Technology Acceptance Model (TAM) (Davis, 1989) has been used to predict the user's acceptance of new technology. Figure 1 illustrates the research framework developed to understand the intention to accept gamification among learners. In this study, Perceived Ease of Use (PEU) refers to a person's perception that using the game for learning will require minimal effort. Perceived Usefulness (PU) refers to the user's perception that the use of the technology could enhance their performance. Gamification Acceptance (GA) is the intention to accept gamification for learning. Aesthetic (AE) and Perceived Enjoyment (PE) are added to the framework to explain aesthetics and enjoyment associated with intention to accept gamification in learning.

Figure 1: Research Framework
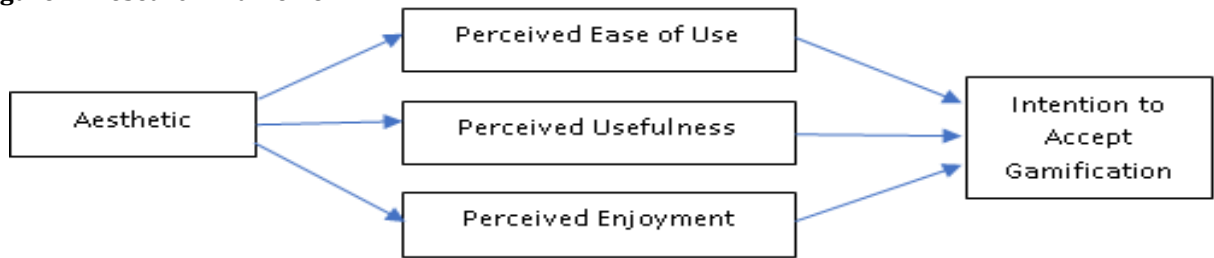
Hypotheses: This study made attempts to examine the mediating factors of perceived ease of use, perceived usefulness, and perceived enjoyment in the relationship between aesthetics and intention to accept gamification in learning. Therefore, the following hypotheses were postulated; (i). **H1:** Aesthetic positively affects perceived ease of use, (ii). **H2:** Aesthetic positively affects perceived usefulness, (iii). **H3:** Aesthetic positively affects perceived enjoyment, (iv). **H4:** Perceived ease of use positively affects intention to accept gamification, (v). **H5:** Perceived usefulness positively affects intention to accept gamification, (vi). **H6:** Perceived enjoyment positively affects intention to accept gamification, (vii). **H7:** Perceived ease of use mediates the relationship between aesthetics and intention to accept gamification, (viii). **H8:** Perceived usefulness mediates the relationship between aesthetic and intention to accept gamification and (ix). **H9:** Perceived enjoyment mediates the relationship between aesthetics and intention to accept gamification.

3. Methodology

In this study, undergraduate students enrolled in a Bachelor of Business Administration program at a higher learning institution in Malaysia make up the study's population. Responses are obtained through judgmental sampling. Only student with prior experience in gamified lesson is eligible to be the respondent of the survey. The choice of judgmental sampling is appropriate as this study only obtained information from specific responses (Cavana et al., 2001). The questionnaire was divided into two sections. The first section comprised questions about the demographic details of the respondents. The second section was instruments that examined aesthetics, perceived ease of use, perceived usefulness, perceived enjoyment, and gamification acceptance in learning. Informed consent was obtained from all students after ethical approval from the university ethics committee.

4. Data Analysis

Demographic: A total of 283 questionnaires were collected through an online survey. Table 1 represents the respondents' demographic profile in terms of gender, age and academic year. The respondents of this study comprised 73.1 % female and 26.9% male. The majority of the respondents were aged between the age of 21 to 24 years old and were studying in Year 1.

Table 1: Respondent Demographic

Demographics	Respondents (n=283)	Percentage (%)
Gender		
Male	76	26.9
Female	207	73.1
Age		
20 years old and below	96	33.9
21-24 years old	184	65
25 years old and above	3	1.1
Year		
Year 1 (Part 1 and 2)	136	48
Year 2 (Part 3 and 4)	75	26.5
Year 3 (Part 5 and 6)	72	25.5

Partial Least Squares Structural Equation Modelling: Structural Equation Modelling Partial Least Square (SEMPLS) was used to predict the relationship between variables and test the study hypotheses (Hair et al.,

2019).

Measurement Model: The assessments of the measurement model involving internal consistency (reliability), convergent validity (loading ≥ 0.7 and average variance extracted ≥ 0.5), composite reliability (≥ 0.7) and discriminant validity for the indicators (Hair et al., 2017).
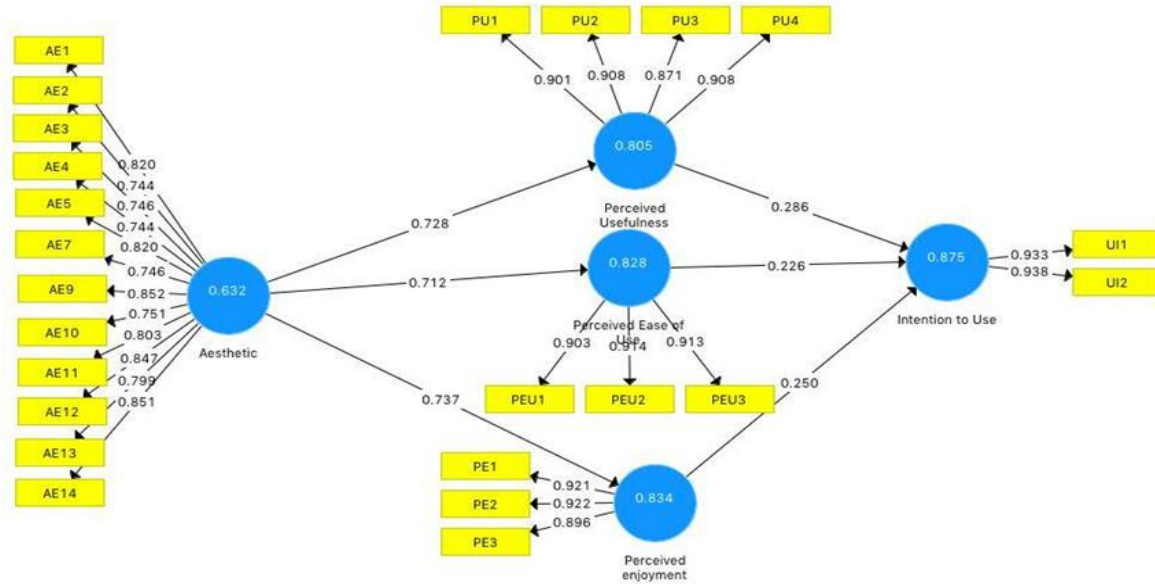
Figure 2: Measurement Model

Table 2: Measurement Model

Construct	Items	Loadings	CR (>0.7)	AVE (>0.5)
Aesthetic	AE1	0.82	0.954	0.632
	AE2	0.744		
	AE3	0.746		
	AE4	0.744		
	AE5	0.82		
	AE7	0.746		
	AE9	0.852		
	AE10	0.751		
	AE11	0.803		
	AE12	0.847		
	AE13	0.799		
	AE14	0.851		
Perceived Enjoyment	PE1	0.921	0.938	0.834
	PE2	0.922		
	PE3	0.896		
Perceived Ease of Use	PEU1	0.903	0.935	0.828
	PEU2	0.914		
	PEU3	0.913		
Perceived Usefulness	PU1	0.901	0.943	0.805
	PU2	0.908		
	PU3	0.871		
	PU4	0.908		
Intention to Accept Gamification	GA1	0.933	0.933	0.875
	GA2	0.938		

Discriminant validity was assessed based on the HTMT criterion suggested by Henseler et al. (2015) and Franke and Sarstedt (2019). A stricter criterion is denoted by an HTMT value of ≤ 0.85, whereas a lenient criterion is denoted by ≤ 0.90. Table 3 shows that all the HTMT values were lower than ≤ 0.85; hence, signaling these five constructs are easy to understand by the respondents and the measurement items for all constructs are valid and reliable.

Table 3: Discriminant Validity

Construct	Aesthetic	Intention to Accept Gamification	Perceived ease of use	Perceived usefulness	Perceived enjoyment
Aesthetic					
Intention to Accept Gamification	0.695				
Perceived ease of use	0.768	0.71			
Perceived usefulness	0.78	0.712	0.846		
Perceived enjoyment	0.793	0.69	0.781	0.755	

Structural Model: Next, the structural model was assessed to determine the accuracy of the model's estimations and the significance of the hypothesized variables' relationships. According to Hair et al., (2019) suggestion, the path coefficients, standard errors, t-values, and effect size (f^2) of the structural model were tested through a bootstrapping procedure of 5,000 samples. R^2 values of 0.26, 0.13 and 0.02 indicate substantial, moderate, and weak explanatory power of the model (Cohen, 1992). The results in Table 4 revealed R^2 values of 0.506, 0.529 and 0.542 representing 50.6 percent of the variance in perceived ease of use (PEU), 52.9 percent of the variance in perceived usefulness (PU) and 54.2 percent of the variance in perceived enjoyment (PE) is explained by aesthetic (AE). With regards to gamification acceptance (GA), the result of R^2 showed that 46.8 percent of the variance is explained by all three mediators (PEU, PU and PE) and thus presented substantial explanatory power of the model for all constructs.

With regards to the effect size (f^2), the values of 0.02, 0.15 and 0.35 represent small, medium, and large (Cohen, 1992). Thus, the results show that aesthetics exerts a large effect on all three variables of perceived ease of use (PEU) (f^2 = 1.029), perceived usefulness (f^2 = 1.129) and perceived enjoyment (f^2 = 1.192). In contrast, those three variables (PEU, PU and PE) exert a weak effect on the intention to use with f^2 = 0.034, 0.057 and 0.054. For assessing the study hypotheses, the cut-off t-value of the one-tailed test for 5% (a = 0.05) significant level is 1.645 (Ramayah et al., 2018). Table 4 shows a summary of the hypothesized relationships among the constructs. Aesthetic positively affects perceived ease of use (β= 0. 712, t = 21.428, p < 0.01), perceived usefulness (β= 0. 728, t = 23.799, p < 0.01) and perceived enjoyment (β= 0.737, t = 21.747, p < 0.01). Thus, H1, H2 and H3 were supported. Additionally, perceived ease of use (β= 0.226, t = 2.896, p < 0.01), perceived usefulness (β= 0.286, t = 3.607, p < 0.01), and perceived enjoyment (β= 0.25, t = 3.364, p < 0.01), also significantly affect gamification acceptance and thus, H4, H5 and H6 were accepted.

Table 4: Direct Relationship

	Relationship	β	SE	*t*-value	LL	UP	f^2	Decision	R^2
H1	AE -> PEU	0.712	0.033	21.428	0.658	0.765	1.029	Supported	0.506
H2	AE -> PU	0.728	0.031	23.799	0.669	0.773	1.129	Supported	0.529
H3	AE -> PE	0.737	0.034	21.747	0.676	0.788	1.192	Supported	0.542
H4	PEU -> GA	0.226	0.078	2.896	0.094	0.352	0.034	Supported	0.468
H5	PU -> GA	0.286	0.079	3.607	0.162	0.422	0.057	Supported	
H6	PE -> GA	0.25	0.074	3.364	0.123	0.363	0.054	Supported	

Mediating hypotheses were examined by bootstrapping the indirect effect with 5000 resamples as suggested by Preacher and Hayes (2008). Table 5 presents a summary of all three mediating relationships. Overall, perceived ease of use (β= 0. 161, t = 2.865, p < 0.01), perceived usefulness (β= 0.208, t= 3.656, p < 0.01) and perceived enjoyment (β= 0. 185, t = 3.352, p < 0.01) mediate the relationship between aesthetic and

gamification acceptance. In addition, the 95% confidence intervals bias-corrected shows intervals extending over 0, which confirmed these results, and thus H7, H8 and H9 were supported.

Table 5: Mediating Relationship

Hypothesis	Relationship	β	SE	*t*-value	LL	UP	Decision
H7	AE->PEU-> GA	0.161	0.056	2.865	0.059	0.281	Supported
H8	AE->PU-> GA	0.208	0.057	3.656	0.121	0.357	Supported
H9	AE->PE-> GA	0.185	0.055	3.352	0.068	0.288	Supported

5. Discussion and Conclusion

Discussion: Gamification is all about fun. As the inclusion of game-based learning in higher learning institution settings is in its infancy phase, it is deemed appropriate to research what affects leaner's acceptance. In this study, the researchers investigate the effects of gamification design (aesthetic) on learner's perceived ease of use, perceived usefulness, perceived enjoyment, and subsequent intention to accept game-based learning. Via an online survey among 283 students of higher learning institutions, the result indicates that aesthetics is a motivator for accepting gamification in the context of learning. In the academic setting, gamification is aimed at assisting learners towards better learning experiences, greater learning satisfaction, and higher engagement. In this study, AE is found to have positive effects on PEU (β= 0. 712, t = 21.428, p < 0.01), implying that the design of the game influences the degree to which learners believe that using the game for learning would be free from effort. AE is found to have positive effects on PU (β= 0. 728, t = 23.799, p < 0.01), denoting that the design of the game influences the degree to which learners believe that using the game for learning would enhance learners' performance. AE too is found to have a positive effect on PE (β= 0.737, t = 21.747, p < 0.01), implying that the design of the game influences the degree of fun experienced by learners. Further, PEU has a positive effect on GA (β= 0.226, t = 2.896, p < 0.01), which implies that the degree to which learners believe that learning using gamification is effortless and important in influencing them to accept game-based learning.

Other than PEU, PU also exerts a positive effect on GA (β= 0.286, t = 3.607, p < 0.01), denoting that the degree to which learner believes that using gamification for learning would enhance his/her academic performance, influences the degree to acceptance among learners. This result is consistent with the positive effect of PE on GA (β= 0.25, t = 3.364, p < 0.01), denoting that the degree of fun and pleasure experienced by users influenced the degree of acceptance among learners. To sum up, this study shows that AE, PEU, PU and PE significantly and positively affected GA among the learners, confirming acceptance towards gamification (GA) among learners in higher learning institutions largely depending on the studied variables above. All findings are aligned with past studies that indicate gamification improves student enjoyment (Forndran & Zacharias, 2019) and that a good aesthetic design can enhance the users' acceptance of online learning (Farhan et al., 2019; Korableva et al., 2019). The study provided evidence that learners are acceptive of gamified lessons when the game designs are simple, purposeful and amusing. As such learning institutions should critically take into consideration the circumstances of game elements when designing teaching and learning activity. This study was limited to understand the management of gamified lessons from a student perspective whereas effective teaching and learning through gamification is only possible when the right pedagogy, skillful educator, conducive learning environment and many more factors take place.

Conclusion: Although gamification is publicly recognized for delivering better learning experience**s**, engagement, and academic performance, the notion can only be real, if the learners are acceptive to the game-based learning. To sum up, learning institutions must place more focus on aspects of the gamification design as to attract learner acceptance towards gamified lesson**s** and ultimately attain the expected academic result.

References

Alhammad M. M. & Moreno, A. M. (2018). Gamification in software engineering education: A systematic mapping. *Journal of Systems and Software,* 141, 131–150.

Alshammari, M. T. (2020). Evaluation of gamification in E-Learning systems for elementary school students. *TEM Journal,* 9, 806-813. https://doi.org/10.18421/TEM92-51.

Bencsik, A., Mezeiova, A. & Oszene Samu, B. (2021). Gamification in Higher Education (Case Study on a Management Subject). *International Journal of Learning, Teaching and Educational Research*, 20(5), 211-231, May 2021

Bhattacherjee, A. (2001). Understanding information systems continuance: An expectation–confirmation model. *MIS Quarterly*, 25(3), 351-370.

Cavana, R. Y., Delahaye, B. L. & Sekaran, U. (2001). Applied business research. Qualitative and quantitative methods. Australia: John Wiley & Sons Australia Ltd.

Cohen, J. (1992). Quantitative methods in psychology: A power primer. *Psychological Bulletin*, 112(1), 155-159.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use and user acceptance of information technology. *MIS Quarterly,* 13, 319-340.

Farhan, W., Razmak, J., Demers, S. & Laflamme, S. (2019). E-learning systems versus instructional communication tools: developing and testing a new e-learning user interface from the perspectives of teachers and students. Technology in Society, 59.

Forndran, F. & Zacharias, C. R. (2019). Gamified experimental physics classes: A promising active learning methodology for higher education. *European Journal of Physics,* 40(4), 045702.

Franke, G. & Sarstedt, M. (2019). Heuristics versus statistics in discriminant validity testing: A comparison of four procedures. *Internet Research,* 29(3), 430-447

Goksuna, D. O. & Gursoy, G. (2019). Comparing success and engagement in gamified learning experiences via Kahoot and Quizizz, *Computers & Education*, 135*, 15-29. https://doi.org/10.1016/j.compedu.2019.02.015

Hair, J. F., Risher, J. J., Sarstedt, M. & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2-24.

Hair, J. F., Thomas, G., Hult, M., Ringle, C. M. & Sarstedt, M. (2017). A Primer on Partial Least Squares Structural Equation Modeling (2nd ed.). Thousand Oakes, CA: Sage.

Hamari, J. (2013). Transforming homo economics into homo ludens: A field experiment on gamification in a utilitarian peer-to-peer trading service. *Electronic commerce research and applications*, 12(4), 236-245. https://doi.org/10.1016/j.elerap.2013.01.004

Henseler, J., Ringle, C. & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science,* 43(1), 115-135.

Huotari, K. & Hamari, J. (2017). A definition for gamification: anchoring gamification in the service marketing literature. *Electron. Markets*, 27(1), 21-3.

Jones, V., Jo, J. & Martin, P. (2007). Future schools and how technology can be used to support Millennial and Generation-Z students. ICUT 2007 (Proceedings B, pp. 886-891), 1st International Conference of Ubiquitous Information Technology, Dubai, Feb 12- 14, 2007.

Kamunya, S. & Mirirti, E. et al. (2020). An adaptive gamification model for e-learning. In *2020 IST-Africa conference (IST-Africa)*.

Khaldi, A., Bouzidi, R. & Nader F. (2023). Gamification of e-learning in higher education: a systematic literature review. *Smart Learn. Environ,* 10(1), 10. doi: 10.1186/s40561-023-00227-z. Epub 2023 Jan 31. PMCID: PMC9887250.

Korableva, O., Durand, T., Kalimullina, O. & Stepanova, I. (2019). Usability testing of MOOC: Identifying user interface problems. In A. Brodsky, S., Hammoudi, M., Smialek & J. Filipe (Eds), *Proceedings of the 21st International Conference on Enterprise Information Systems (ICEIS 2019)*, 2, 468-475), SciTePress. https://10.5220/ 0007800004680475.

Landers, R. N. & Callan, R. C. (2011). Casual Social Games as Serious Games: The Psychology of Gamification in Undergraduate Education and Employee Training.

Lee, D. Y. & Lehto, M. R. (2013). User acceptance of YouTube for procedural learning: An extension of the Technology Acceptance Model. *Computers & Education*, 61, 193-208.

Lester, D., Skulmoski, G. J., Fisher, D. P., Mehrotra, V., Lim, I., Lang, A. & Keogh, J. W. L. (2023). Drivers and barriers to the utilization of gamification and game-based learning in universities: A systematic review of educators' perspectives. *British Journal of Educational Technology*, 00, 1–23. https://doi.org/10.1111/bjet.13311

McGonigal, J. (2011). Reality Is Broken: Why Games Make Us Better and How They Can Change the World. Penguin Press. New York, NY.

Murillo-Zamorano, L. R., López Sánchez, J. Á., Godoy-Caballero, A. L. & Bueno Munoz, C. (2021). Gamification and active learning in higher education: Is it possible to match digital society, academia, and students' interests? *International Journal of Educational Technology in Higher Education,* 18(1), 1–27.

Park, Y., Son, H. & Kim, C. (2012). Investigating the determinants of construction professionals' acceptance of web-based training: an extension of the technology acceptance model. *Automation in Construction,* 22, 377-386. https://doi.org/10.1016/j.autcon.2011.09.016

Preacher, K. J. & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40(3), 879- 891.

Ramayah, T., Cheah, J., Chuah, F., Ting H. & Memon M. A. (2018). Partial Least Squares Structural Equation Modeling (PLS-SEM) Using Smartpls 3.0: An Updated and Practical Guide to Statistical Analysis. 2nd ed. Malaysia: Pearson Malaysia Sdn Bhd.

Rosmansyah, Y., Isdiyanto, I., Hardi, A. B. & Putri, A. (2020). Using gamification for engaging surveyors: A case study in Statistics Indonesia. *Interactive Technology and Smart Education,* 17(4), 377-391.

Salen, K. & Zimmerman, E. (2004). Rules of play: Game Design Fundamentals. Cambridge, MA: MIT Press.

Schöbel, S. & Söllner, M. (2016). How to gamify information systems—Adapting gamification to individual user preferences.

Squire, K. (2006). From Content to Context: Videogames as designed experience. *Educational Researcher*, 35(8), 19- 29.

Squire, K. & Barab, S. (2004). Replaying History: Engaging Urban Underserved Students in Learning World History through Computer Simulation Games. In 6th International Conference on Learning Sciences. Santa Monica, United States: International Society of the Learning Sciences, 505-512.

Swacha, J. (2021). State of research on gamification in education: A bibliometric survey. *Education Sciences,* 11(2), 1–15.

Thong, J. Y. L., Hong, W. & Tam, K. Y. (2002). Understanding user acceptance of digital libraries: what are the roles of interface characteristics, organizational context, and individual differences*? International Journal of Human-Computer Studies*, 57(3), 215-242.

Wei, C. W., Hug, I. C., Lee, L. & Chen, N. S. (2011). A Joyful Classroom Learning System with Robot Learning Companion for Children to Learn Mathematics Multiplication, *The Turkish Online Journal of Educational Technology*, 10(2), 12, 2011.

Verdugo, D. R. & Belmonte, I. A. (2007). Using Digital Stories to Improve Listening Comprehension with Spanish Young Learners of English, *Language Learning & Technology*, 11, 87-101, 2007.