THE ELEMENTS OF GAMIFICATION LEARNING IN HIGHER EDUCATION: A SYSTEMATIC LITERATURE REVIEW

Natalia Limantara
Computer Science Department, BINUS Graduate Program, Doctor of Computer Science.
Information Systems Department, School of Information Systems.
Bina Nusantara University,Jakarta, Indonesia 11480

Meyliana*
Information Systems Department, School of Information Systems
Bina Nusantara University,Jakarta, Indonesia 11480

Achmad Nizar Hidayanto
Faculty of Computer Science
Universitas Indonesia, Depok, Indonesia 16424

Harjanto Prabowo
Management Department, BINUS Business School Undergraduate Program
Bina Nusantara University,Jakarta, Indonesia 11480

*corressponding author

ABSTRACT

Gamification is a concept in which elements of the game in the environment are not games. This concept has been widely used in the educational world. Many universities are starting to change the way of learning by incorporating elements of the game and using different learning tools that have game elements in the learning process. Therefore, this article will further discuss which elements of the game have been used most in gamification learning and the impact of applying gamification learning to students. This study used systematic literature review approach using articles published in 2014-2018. Can be found if points, badges and leaderboard are the three main elements that are widely used in gamification learning.

Key words: gamification, learning, undergraduate, systematic literature review

1. INTRODUCTION

Gamification is a concept in which the elements of a game are applied in activities that are not games. All elements in a game are applied in many areas, including education. In the world of education, elements of the game are included to ensure that students are interested in the material being taught and actively involved in learning [1]. Gamification in Education is not asking students to play games like Scrable or other similar games whose purpose is to perfect certain skills, but to focus on how to apply the elements of the game to learning activities.

The learning model in universities is also affected by the concept of gamification. Educators have begun to apply gamification to learning to increase student engagement [2]. amification techniques are applied in many scientific fields such as computer science, such as software engineering, web design, programming [3]–[5], anatomy and physiology [6], and other field. Gamification encourages students to play an active role in the learning process by supporting the process of active learning, experimental learning and problem-based games. The role of the educator in the learning process also plays an important role, how the teacher can introduce the element of gamification in educational activities [7].

This paper will review previous studies to answer the following research questions: what are the elements of the game adopted in the concept of gamification for udergraduate study and what are the effects of the application of gamification on students? The results of this literature review are intended to allow educators to prepare the concept of gamification that applies the appropriate elements of the game so that learning objectives can be achieved.

2. LITERATURE REVIEW

2.1. Game

Game is part of people's experience who have become culture. According to [1] the game has several characteristics, namely rules, feedback systems and goals. Each game has rules that determine the scope of the game during the game. Interaction in the game depends on the feedback system, the steps taken by the player determine the actions that are given by the game. The goal of each game or the determination of the victory is clear, even if some games have modest goals, but the way players can win is clearly explained in the game. Games can also be defined as a system where players are bound by artificial conflicts, determined by rules and producing certain results[8].

2.2. Gamification

Gamification can be interpreted as a process of producing activities such as games [8]. In the educational world, the term gamification is often associated with the term Game Based Learning (GBL). GBL is the use of digital games related to education that allow students to play and feel impossible situations in terms of cost, time, logistics and security [9]. Gamification in the education system sees values from the perspective of reaching points and sequences as levels. Examples of application of game elements in learning are levels for displaying participant status, rankings, and progress; challenges and quests where there is something that participants must do to be motivated; a competition that allows the trainer to do the task faster or better; cooperation encourages participants to work together and collaborate for better results [4].

2.3. Gamification Learning

Gamification can be used in the learning process because it can increase students' learning motivation. Gamification learning is a series of processes and activities carried out to solve problems in the context of learning by using aspects that are in the game. The purpose of the

application of gamification learning is to obtain the learning experience and the purpose of education with conditions that are as close as possible to real conditions [10].

3. METHODOLOGY

This paper was carried out using the study literature review approach based on [11]. The process of drafting this document involves several processes, such as: determining the database used, determining the keywords to be used, determining the criteria for inclusion and exclusion, extracting data and analyzing the found literature to answer questions from the research.

3.1. Search Process

The first step is to determine the database of the items that will be used. In this study, there will be seven source databases, namely :

1. ACM Digital Library (https://dl.acm.org/)
2. AIS Electronic Library (https://aisel.aisnet.org/)
3. IEEE Xplore Digital Library (https://ieeexplore.ieee.org/Xplore/home.jsp)
4. ScienceDirect (https://www.sciencedirect.com/)
5. Springer Link (https://link.springer.com/)
6. Taylor & Francis Online (https://www.tandfonline.com/)
7. Wiley Online Library (https://onlinelibrary.wiley.com/)

The keywords used in this study combine Boolean operators to filter the data. The Boolean operators used are OR and AND, resulting in the following keywords:

((((("Gamification learning" OR "Simulation game Learning" OR "Gamification") AND ("Critical Design issue" OR "Factor" OR "Variable" OR "Evaluation")) AND ("Higher Education" OR "University") AND ("Learning")) AND NOT ("Flipped Learning")

The next step is to apply the inclusion criteria, using three (3) processes. The first process is "study results". All articles from all databases that are relevant to the research goals are included in "study results". The next step is Candidate Studies. Articles from Studies Found are re-evaluated in the abstract section to see if it matches the research goals. All suitable articles will be included in the candidate studies. In the final phase, all articles is read and checked to see if the results of the work can contribute to answering research questions. If necessary, they will be included in Selected Studies. All articles in the selected studies will be used to answer the research questions in this paper.

To further supplement the results of the literature review, the author also uses exclusion criteria that determine articles that are not used in this study. Articles meeting the following criteria will be deleted from the paper to be used:

1. Publication date before 2014
2. Duplicate paper
3. The information in the paper is incomplete
4. Paper not writing in English

3.2. Data Extractions

In the initial phase, 120 papers were found that were relevant to the research questions to be answered. After reviewing abstracts from the papers, there were 76 papers included in the candidate studies and 30 papers included as Selected Studies. 30 This paper is used to answer questions from this study. The search results of each database used are summarized in the following Table 1.

Table 1. Data Extraction in Inclusion Criteria

Source	Studies Found	Candidate Studies	Selected Studies
ACM Digital Library	20	12	4
AIS Electronic Journal	19	13	4
IEEE Xplore Digital Library	23	17	6
Science Direct	27	12	3
Springer Link	10	7	5
Taylor & Francis Online	11	9	6
Wiley Online Library	10	6	2
Total	120	76	30

4. RESULTS AND DISCUSSIONS

This study aims to identify the gamification components that are used in learning and also the impact of the application of gamification on students. Learning by applying the gamification model has been widely applied today. But this research will only focus on the application of gamification learning at undergraduate level. Based on the results of "Selected Studies", the fields involved are 39% in computing ([2], [3], [19]–[21], [4], [12]–[18]) , 9% in business ([22]–[24]), 9% in science ([23], [25], [26]), 9% in medical ([6], [27], [28]), 9% in Accounting ([26], [29], [30]), and other field like Art & Humanities ([23]), mathematics ([31], [32]), language ([33], [34]), and education [35]. Table 2 summarizes the demographic characteristics of the papers by title, year of publication and type of publication.

Table 2. Summary of Papers

Source Library	Title	Publication Year	Type*
ACM Digital Library	Designing game-like …..[3]	2016	C
ACM Digital Library	Empirical Support fo…..[6]	2018	C
ACM Digital Library	Increasing students'….. [36]	2018	C
ACM Digital Library	Uses and Gratification…..[21]	2018	C
AIS Electronic Journal	Gamifying the First ….. [15]	2017	C
AIS Electronic Journal	Leveling for Success….. [16]	2017	C
AIS Electronic Journal	Don't Make the Playe…..[14]	2017	C
AIS Electronic Journal	The Use of Gamificat…..[17]	2018	C
IEEE Xplore	Gamification of MOOC…..[33]	2014	C
IEEE Xplore	A Game-Based Learnin…..[37]	2015	C
IEEE Xplore	An Empirical Study I…..[18]	2015	C
IEEE Xplore	Personalization of G…..[34]	2016	C
IEEE Xplore	Influence of gamific…..[19]	2018	C
IEEE Xplore	Measurement of the e…..[20]	2018	C
Science direct	The effects of gamif…..[35]	2017	J
Science direct	Enhancing student le…..[24]	2018	J
Science direct	Individualising gami…..[30]	2018	J
Springer Link	The effects of stude…..[13]	2015	J
Springer Link	Using a gamified mob…..[26]	2017	J

Source Library	Title	Publication Year	Type*
Springer Link	Online learning read.....[25]	2018	J
Springer Link	Students' perception.....[12]	2018	J
Springer Link	The effectiveness of.....[2]	2018	J
Taylor & Francis Online	The use of GBL to te.....[32]	2015	J
Taylor & Francis Online	Gamification and stu.....[22]	2016	J
Taylor & Francis Online	Stimulating students.....[31]	2017	J
Taylor & Francis Online	Does educational gam.....[22]	2018	J
Taylor & Francis Online	Evaluating student p.....[28]	2018	J
Taylor & Francis Online	Fun and games in hig.....[23]	2018	J
Wiley Online Library	Using gamification t.....[27]	2016	J
Wiley Online Library	Implementing gamific.....[38]	2018	J
Notes: C= Conference; J = Journal			

Of the total of 30 articles used, there were a total of 80 authors involved. 41% of authors come from the computer science field, followed by business (14%) and information systems (11%). This demographics describes that gamification learning is a multidisciplinary field, looking at different disciplines such as computer science, economics, information systems, medicine and education. Table 3 summarizes the demographics of the authors involved.

Table 3. Author's Demography

Field of Study	#	%
Computer Science	33	41%
Business	11	14%
Information Systems	9	11%
Medical	7	9%
Information Technology	3	4%
Instructional Technology & Media	3	4%
Physiology	2	3%
Psychology	2	3%
Social Science	2	3%
Accounting	1	1%
Animation and Game Design	1	1%
Chemistry and Biotechnology	1	1%
Educational Sciences	1	1%
Engineering	1	1%
Information Science	1	1%
Law	1	1%
Social Sciences	1	1%
Total	**80**	

Gamification involves several elements of the game that are integrated into the learning process in order to gain experience by playing in the learning process. Some elements of the game used are points, levels, rewards, badges and ranking. Table 4 summarizes the elements of games used in the learning process. Apart from the game elements used in Table 4, some preliminary studies use role-playing games or game scenarios to make the game more interesting [13], [27]–

[29]. In this role play or scenario, students become certain roles and are asked to perform the tasks given in the group.

Table 4. Summary of Game Element

Source	Reward	Quest	Points	Badges	Narrative	Feedback	Competition	Publicity	Avatar	Card Games	Task	XP	Ranking	Level	Leaderboard	Achievement	Quiz	Puzzle	Virtual Goods
[3]	V	V																	
[6]			V	V															
[35]					V	V	V	V					V						
[13]			V	V					V										
[17]										V	V								
[18]		V		V								V	V	V	V				
[16]	V						V	V								V			
[19]											V								
[32]										V	V								
[36]										V							V	V	
[20]			V												V				
[33]				V		V								V	V				
[11]			V										V				V		
[12]			V	V		V		V			V			V	V		V		
[34]			V	V							V	V		V	V				
[23]				V		V					V			V	V		V		
[29]			V	V			V		V				V	V	V		V		V
[15]		V																	
[25]			V												V		V		
[24]			V											V					
[14]			V										V				V		
[2]			V										V				V		
[31]			V								V								
[21]	V		V			V							V						
[30]			V										V				V		
[21]			V								V			V	V	V			
[27]		V	V											V					
[22]																			
[26]			V	V		V								V					
[37]	V			V								V		V					

Another aspect that should be considered in the application of gamification learning is the model of student participation. Some of the methods applied are voluntary, compulsory or through a selection process and provide certain rewards for participating students. From the source documents used in this paper, 43% of the participation is mandatory and will contribute to the students' grades, 30% is voluntary based, 13% is randomly selected by researchers, 7% is offered and participants get some rewards, nd 7% is an unknown type of participation.

Table 5. Participation Type

Participation Type	Number of Paper	Percentage
Mandatory	13	43%
Voluntary	9	30%
Random	4	13%
Selected with Reward	2	7%
Unknown	2	7%

The effects of using gamification in several studies confirm that the use of gamification increases student learning motivation [2], [3], [34], [35], [38], [13], [15], [18], [19], [22], [29], [31], [33]. [18] stated that if one of the reasons for student motivation increased because, in the game environment, students wanted to be the best. But the drawback is that students become more individualistic and tend not to help their friends who are in trouble. Thus, some students think that unhealthy rivalries and pressures are occurring, which are not needed when students are in the state of the gamification course. [22] found that the four most motivating elements of

the game were the points for the assignments, due date bonuses dan penalty, due date flexibility, and current grade indicator.

[28], [31], [38] found that student scores increased after modification of the learning process using gamification. Research on medical students at Keele University, who initially were not sure about the pharmacological material that had been studied. Thus, a game is created in the group and students are invited to complete some of the proposed scenarios. After participating in the game, students were assessed using thematic analysis and questionnaires. As a result, students' level of confidence in the science of pharmacology has increased and so has the score of pharmacology's course [28]. However, in the increase of the score of this course, attention must also be paid to whether the technological investments made to realize the gamification experience and the time spent on preparing and implementing the gamification are comparable to the results obtained [20].

[16] found that the game designed must be related to the learning material or the chapter of the book that is used so that students feel more related to the game and the results are more effective. In previous studies, students were asked to use two types of games, namely, chapter-based group and scenario-based group. Students had better perspective of the chapter-based group because the game is connected to every chapter in the book and helps them understand the material better. While in the scenario-based group, students will become employees of a company and will be asked to complete the given quests. Students cannot connect this quest to the learning material.

5. CONCLUSION

This research can be used as a reference for further research in the field of gamification learning, especially at the university level. The results of the first research question, the gamification element used in the previous study, are presented in Table 4 in the discussion section. The most important elements in learning gamification, namely points, badges and leaderboard, can be the focus when applying gamification learning to get effective results. In several studies, researchers used different participation patterns to identify the implications of this gamification learning. Some types of participation are compulsory, voluntary, random, and rewarded. The results of the second research question, namely the implications of using learning gamification, is the majority of the impact of the application of gamification on the learning process: increasing student learning, increasing learning motivation, and increasing student engagement in the classroom.

LIMITATION AND FUTURE RESEARCH

For further research there are still many areas of learning gamification that can be investigated. This paper has not analyzed the gamification tools or software that can be used and how they affect student motivation and score. Moreover, the application of different types of courses can influence the effects of the application of gamification. The addition of database source can also improve the results of this work. For further research, researchers will apply the elements of gamification, especially in the field of information systems, and see if they have the same impact as previous research.

REFERENCES

[1]   Oxford Analytica, "Gamification and The Future of Education," 2016.

[2]   R. Ab. Rahman, S. Ahmad, and U. R. Hashim, "The effectiveness of gamification technique for higher education students engagement in polytechnic Muadzam Shah Pahang, Malaysia," Int. J. Educ. Technol. High. Educ., vol. 15, no. 1, p. 41, Dec. 2018.

[3]   A. Mora, E. Planas, and J. Arnedo-Moreno, "Designing game-like activities to engage adult learners in higher education," in Proceedings of the Fourth International Conference on Technological Ecosystems for Enhancing Multiculturality - TEEM '16, 2016, pp. 755–762.

[4]   O. Pastushenko, T. Hruška, and J. Zendulka, "Increasing students' motivation by using virtual learning environments based on gamification mechanics," in Proceedings of the Sixth International Conference on Technological Ecosystems for Enhancing Multiculturality - TEEM'18, 2018, pp. 755–760.

[5]   R. van Roy, S. Deterding, and B. Zaman, "Uses and Gratifications of Initiating Use of Gamified Learning Platforms," in Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18, 2018, pp. 1–6.

[6]   P. Denny, F. McDonald, R. Empson, P. Kelly, and A. Petersen, "Empirical Support for a Causal Relationship Between Gamification and Learning Outcomes," in Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18, 2018, pp. 1–13.

[7]   J. Martí-Parreño, D. Seguí-Mas, and E. Seguí-Mas, "Teachers' Attitude towards and Actual Use of Gamification," Procedia - Soc. Behav. Sci., vol. 228, no. June, pp. 682–688, Jul. 2016.

[8]   K. Huotari and J. Hamari, "A definition for gamification: anchoring gamification in the service marketing literature," Electron. Mark., vol. 27, no. 1, pp. 21–31, Feb. 2017.

[9]   L. Caporarello, M. Magni, and F. Pennarola, "One Game Does not Fit All. Gamification and Learning: Overview and Future Directions," in Organizing for Digital Innovation, vol. 27, A. Lazazzara, R. C. D. Nacamulli, C. Rossignoli, and S. Za, Eds. Springer, Cham, 2019, pp. 179–188.

[10]   S. Kim, K. Song, B. Lockee, and J. Burton, Gamification in Learning and Education. Cham: Springer International Publishing, 2018.

[11]   B. Kitchenham and P. Brereton, "A systematic review of systematic review process research in software engineering," Inf. Softw. Technol., vol. 55, no. 12, pp. 2049–2075, Dec. 2013.

[12]   S. A. Licorish, H. E. Owen, B. Daniel, and J. L. George, "Students' perception of Kahoot!'s influence on teaching and learning," Res. Pract. Technol. Enhanc. Learn., vol. 13, no. 1, p. 9, Dec. 2018.

[13]   C.-H. Su, "The effects of students' motivation, cognitive load and learning anxiety in gamification software engineering education: a structural equation modeling study," Multimed. Tools Appl., vol. 75, no. 16, pp. 10013–10036, Aug. 2016.

[14]   K. Grace, R. Lyons, and T. Lynn, "Don't Make the Player, Make the Game: Exploring the Potential of Gamification in IS Education," in Twenty-third Americas Conference on Information Systems, 2017, pp. 1–10.

[15]   M. Thongmak, "Gamifying the First Programming Class: Outcomes and Antecedents of Continued Engagement Intention," in SIGED: IAIM Conference, 2017.

[16]   C. S. Barber and K. Smutzer, "Leveling for Success : Gamification in IS Education," Proc. 23rd Am. Conf. Inf. Syst., pp. 1–10, 2017.

[17]   M. Thongmak, "The Use of Gamification in an Introductory MIS Course : the Views of Game Participants and Game Conductors," in Designing Digitalization (ISD2018 Proceedings), 2018.

[18]   W. Fracz, "An empirical study inspecting the benefits of gamification applied to university classes," 2015 7th Comput. Sci. Electron. Eng. Conf. CEEC 2015 - Conf. Proc., pp. 135–139, 2015.

[19]   K. Aleksic-Maslac, M. Rasic, and P. Vranesic, "Influence of gamification on student motivation in the educational process in courses of different fields," in 2018 41st International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), 2018, pp. 0783–0787.

[20]   A. Bernik, G. Bubas, and D. Radosevic, "Measurement of the effects of e-learning courses gamification on motivation and satisfaction of students," in 2018 41st International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), 2018, pp. 0806–0811.

[21]   R. van Roy, S. Deterding, and B. Zaman, "Uses and Gratifications of Initiating Use of Gamified Learning Platforms," in Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems, 2018, p. LBW565:1--LBW565:6.

[22]   J. R. Chapman and P. J. Rich, "Does educational gamification improve students' motivation? If so, which game elements work best?," J. Educ. Bus., vol. 93, no. 7, pp. 315–322, Oct. 2018.

[23] N. Whitton and M. Langan, "Fun and games in higher education: an analysis of UK student perspectives," Teach. High. Educ., vol. 0, no. 0, pp. 1–14, Nov. 2018.

[24] C. H.-H. Tsay, A. Kofinas, and J. Luo, "Enhancing student learning experience with technology-mediated gamification: An empirical study," Comput. Educ., vol. 121, pp. 1–17, Jun. 2018.

[25] K. Bovermann, J. Weidlich, and T. Bastiaens, "Online learning readiness and attitudes towards gaming in gamified online learning – a mixed methods case study," Int. J. Educ. Technol. High. Educ., vol. 15, no. 1, p. 27, Dec. 2018.

[26] E. Pechenkina, D. Laurence, G. Oates, D. Eldridge, and D. Hunter, "Using a gamified mobile app to increase student engagement, retention and academic achievement," Int. J. Educ. Technol. High. Educ., vol. 14, no. 1, p. 31, Dec. 2017.

[27] M. El Tantawi, S. Sadaf, and J. AlHumaid, "Using gamification to develop academic writing skills in dental undergraduate students," Eur. J. Dent. Educ., vol. 22, no. 1, pp. 15–22, Feb. 2018.

[28] S. A. Aynsley, K. Nathawat, and R. M. Crawford, "Evaluating student perceptions of using a game-based approach to aid learning: Braincept," High. Educ. Pedagog., vol. 3, no. 1, pp. 478–489, Jan. 2018.

[29] P. Buckley and E. Doyle, "Gamification and student motivation," Interact. Learn. Environ., vol. 24, no. 6, pp. 1162–1175, Aug. 2016.

[30] P. Buckley and E. Doyle, "Individualising gamification: An investigation of the impact of learning styles and personality traits on the efficacy of gamification using a prediction market," Comput. Educ., vol. 106, pp. 43–55, Mar. 2017.

[31] D. Gil-Doménech and J. Berbegal-Mirabent, "Stimulating students' engagement in mathematics courses in non-STEM academic programmes: A game-based learning," Innov. Educ. Teach. Int., vol. 3297, no. June, pp. 1–9, May 2017.

[32] N. Naik, "The use of GBL to teach mathematics in higher education," Innov. Educ. Teach. Int., vol. 54, no. 3, pp. 238–246, May 2017.

[33] A. Vaibhav and P. Gupta, "Maslac," in 2014 IEEE International Conference on MOOC, Innovation and Technology in Education (MITE), 2014, pp. 290–295.

[34] F. Roosta, F. Taghiyareh, and M. Mosharraf, "Personalization of gamification-elements in an e-learning environment based on learners' motivation," in 2016 8th International Symposium on Telecommunications (IST), 2016, pp. 637–642.

[35] I. Yildirim, "The effects of gamification-based teaching practices on student achievement and students' attitudes toward lessons," Internet High. Educ., vol. 33, no. 2016, pp. 86–92, 2017.

[36] O. Pastushenko, T. Hruška, and J. Zendulka, "Increasing Students' Motivation by Using Virtual Learning Environments Based on Gamification Mechanics: Implementation and Evaluation of Gamified Assignments for Students," in Proceedings of the Sixth International Conference on Technological Ecosystems for Enhancing Multiculturality, 2018, pp. 755–760.

[37] K. Kaneko, Y. Saito, Y. Nohara, E. Kudo, and M. Yamada, "A Game-Based Learning Environment Using the ARCS Model at a University Library," in 2015 IIAI 4th International Congress on Advanced Applied Informatics, 2015, pp. 403–408.

[38] M. Jurgelaitis, L. Čeponienė, J. Čeponis, and V. Drungilas, "Implementing gamification in a university-level UML modeling course: A case study," Comput. Appl. Eng. Educ., no. September, Oct. 2018.