Factors Influencing the Implementation of Gamification for Learning in Information Systems Education

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Abstract—Current technological advancements urge institutions to generate graduates capable of contributing to the industrial world. Information Systems is one of the scientific subjects whose graduates play a significant part in the advancement of modern technology. As a result, lecturers in Information Systems education, particularly at the undergraduate level, must be able to retain and even improve students' interest in studying this field. Gamification is one method that can be used to accomplish this purpose. The goal of this study is to identify factors that determine the successful implementation of gamification for learning, particularly in the context of Information Systems Education at the undergraduate level. This study's methodology is based on a systematic literature review technique from previous studies. Motivation, engagement, perceived utility, game design, and student perspective were identified as elements influencing the effective use of gamification for learning, particularly in the field of Information Systems education.

Keywords—gamification, higher education, information systems

1 Introduction

The field of information systems is quite active. Technology breakthroughs, opportunities, and trends are intrinsically related to the field of information systems. This is a challenge for educators in terms of preparing future information systems experts [1]. Whether we recognize it or not, information systems play an important part in the lives of all individuals, enterprises, and society. While information systems as a scientific discipline is not at the forefront of the development of technical component systems, its key skill is to combine all of these capabilities to assist individuals, corporations, and society in attaining their goals. It is vital for educators to equip students with a comprehensive educational experience that includes everything from technical skills to creative business models and values-based ethical impact assessments. The major job of Information Systems graduates is not to discover new technologies, but to contribute to the integration of business and computer-based solutions to help firms achieve their goals [2]. As a result, information systems play an important role in a company's performance, contributing to the increased demand for information systems specialists.

An examination of the gap between industry needs and present information systems curriculum has been conducted [3]. This study was carried out to determine the industry's demand for the abilities that new graduates of Information Systems must possess. As a result, various skill categories are established, including soft skills (interpersonal skills and intrapersonal skills) and hard skills (domain knowledge and technical abilities). They discovered that companies valued soft skills far more than hard skills for jobs in information systems, particularly those filled by recent graduates. The ability to think critically and the willingness to learn are two soft skills that are stressed. Microsoft office, security, and database are the most heavily emphasized hard skills.

To bridge the gap between industrial needs and university teaching activities, particularly in the Information Systems department, innovative learning methods that can boost students' motivation, engagement, and learning performance are required. Gamification is one of the latest learning strategies that may be used. Gamification is a notion in which game components are used in non-gaming contexts. [4]. Gamification in education refers to the use of game aspects in the learning environment. Gamification is used for psychological reasons related to games, such as enhancing motivation, attachment, and individual performance [5]. Furthermore, when combined with the use of technology, learning gamification will be more effective and efficient [6].

Gamification in the realm of education employs technology in its implementation. Kahoot!, Quizziz, Minecraft, and other applications are examples of gamification technologies that are frequently utilized in the learning process. Gamification is included into the Learning Management System utilized by students in various applications. Teachers must pay attention to the aspects that can affect the successful implementation of gamification for learning in order to ensure its success. The purpose of this research is to discover how gamification is used in the field of education, specifically in the Information Systems Education, as well as the factors that influence the use of this gamification. The researcher used a systematic literature review to evaluate papers published between 2016 and 2018.

2 Theoretical background

Gamification is a notion in which game components are used in non-gaming contexts [4]. Gamification in education refers to the use of game elements in the learning environment. Gamification is used for psychological reasons related to games, such as enhancing motivation, attachment, and individual performance [5]. Gamification is more about combining different aspects than it is about creating an entire computer game. Gamification adds an aesthetic and dynamic to a game that is not intended to be entertaining. Extrinsic gamification and intrinsic gamification are the two types of gamifications (the most widely used where game elements are added). The second form is intrinsic gamification, which engages users through increased motivation (RAMP) and behavioral design [7].

Extrinsic gamification is extensively used nowadays, with this gamification method focusing on awarding points, levels, leader boards, awards, or badges. However, the problem with this strategy is that once the incentive is removed, the behavior tends to

stop unless the person finds another motivation to continue the action. To address this, the concept of intrinsic gamification evolved. Completing tasks for intrinsic motives is more beneficial to one's mental health than performing chores for extrinsic incentives. Designers can generate intrinsic gamification by creating gamifications that assist users in discovering their own motives for engaging in specific activities. This gamification is based on the notions of competence, autonomy, and relatedness. Competent indicates that participants believe they have mastered it; when participants believe there is nothing more to pursue, they will look for other ways to gain new competences. Autonomy is defined as the degree to which a person makes his or her own decisions regarding conduct and when the actions and behaviors that a person does are in accordance with their own sense of who they are. The connection that one person feels to another by his or her behavior is the foundation of connectivity [8].

3 Research methodology

To answer research issues, this study used a systematic literature review strategy. Figure 1 depicts the steps of the author's systematic literature review. The first stage in answering the research topic is to identify the keywords that will be used. The keywords utilized are centered on the use of learning gamification for the discipline of information systems science at the undergraduate level. To locate relevant literature, the researcher use the following keywords:

("gamification learning" OR "gamification" OR "gamification of learning") AND ("higher education" OR "University")

The next step is to do a literature search. The author determines the database utilized as a search source as the initial step at this stage. For the search, the author consults four databases. The author's database of choice is:

a) ACM Digital Library
b) AIS eLibrary
c) IEEE xplore
d) SpringerLink

To ensure that the articles utilized are relevant to the scope of the research, the researcher only uses publications published between 2016 and 2021 with the scope of applicability in undergraduate Information Systems courses. In the last stage, called data extraction, the authors hunt for factors that influence the application of learning gamification together with its sub-factors.

Fig. 1. Systematic literature review process

4 Results

Following a review of the literature, 13 publications were discovered that discussed the use of gamification for learning in the subject of information systems, particularly at the undergraduate education level. Table 1 shows the demographics of the paper used.

Table 1. Article source demography

No.	Paper Title	Year	Publication Journal
1	Designing Game-like Activities to Engage Adult Learners in Higher Education [9]	2016	Proceedings of the Fourth International Conference on Technological Ecosystems for Enhancing Multiculturality
2	Leveling for Success: Gamification in IS Education [10]	2017	Proc. 23rd Am. Conf. Inf. Syst
3	Don't Make the Player, Make the Game : Exploring Potential of Gamification in IS Education [11]	2017	Twenty-third Americas Conference on Information Systems
4	Badges and Gamification in eLearning: Effects on Achievement and Engagement [12]	2017	Proceedings of the Southern Association for Information Systems Conference
5	Training Scrum with Gamification [13]	2017	2017 IEEE Global Engineering Education Conference (EDUCON)
6	The Use of Gamification in an Introductory MIS Course: the Views of Game Participants and Game Conductors [14]	2018	Designing Digitalization (ISD2018 Proceedings)
7	The impact of opt-in gamification on students' grades in a software design course [15]	2018	Proceedings of the 21st ACM/IEEE International Conference on Model Driven Engineering Languages and Systems Companion Proceedings
8	The effectiveness of gamification technique for higher education students engagement in polytechnic Muadzam Shah Pahang, Malaysia [16]	2018	Int. J. Educ. Technol. High. Educ
9	Raising Student's Cognitive Engagement Intention in a Preliminary IS Course Using Gamification [17]	2018	International Conference on Research and Practical Issues of Enterprise Information Systems
10	Is It Worth Using Gamification on Software Testing Education? An Experience Report [18]	2019	Proceedings of the XVIII Brazilian Symposium on Software Quality
11	Learning Scorecard Gamification: Application of the MDA Framework [19]	2019	Information Systems for Industry 4.0, Lecture Notes in Information Systems and Organization 31
12	Relax, It's a Game: Utilizing Gamification in Learning Agile Scrum Software Development [20]	2019	2019 IEEE Conference on Games (CoG)
13	Designing a gamified e-learning environment for teaching undergraduate ERP course based on big five personality traits [21]	2021	Educ. Inf. Technol

According to the collected research, various courses have used learning gamification in the learning process. Computer Information Systems [10], Management Information

Systems ([14], [17]), Software Testing [18], Advanced Software Design[15], Software Engineering ([9], [20], [13]), DICE module (Digital Innovation, Creativity, and Enterprise) [11], Information Technology course [12], database design [16], Enterprise Resource Planning [21], dan Decision Support System I dan II [19] are among the courses offered. Table 2 outlines how gamification was used in past research as well as the benefits received after using gamification.

Table 2. Implementation and benefit of gamification for learning in IS education

Source	How to Apply	Benefits
Leveling for Success: Gamification in IS education [10]	Gamification is used in the Computer Information Systems course in two ways: Chapter Based, which tries to develop understanding based on textbooks, and Scenario Based, which uses role play.	Points and grades influence student motivation in chapter-based learning, whereas points and grades influence motivation in scenario-based learning. Students appreciate the option that allows them to choose which segment of each chapter they want to study for Chapter Based Learning.
The Use of Gamification in an Introductory MIS Course: the Views of Game Participants and Game Conductors [14]	In this study, students were separated into groups, and each group would prepare a game based on a specific content, while another group would act as a player and provide feedback.	As a result, both game participants and game conductors have increased their understanding, problem-solving skills, creativity, and enthusiasm in themes. The motivation to participate in games, attend class, and participate in classroom activities all increased.
Is It Worth Using Gamification on Software Testing Education? An Experience Report [18]	The professor first goes through the notion of software testing, and then the first quiz is given. After that, it was resumed by outlining functional testing and its standards, followed by a second quiz. The final stage is to put it into practice.	Interest and Perceived choice are higher in the interest group than in the control group. The control group's value is lower both before and after the test. However, there was no difference in performance between the two experimental groups.
The impact of opt-in gamification on students' grades in a software design course [15]	Students are divided into teams, and each team is given a mini-competition at random; the team with the most points wins. .	Motivation and Enjoyment have a positive correlation. Motivation and grade have a significant relationship.
Designing game-like activities to engage adult learners in higher education [9]	Students are given a list of formative tasks (questions) to complete throughout the lecture process. Each assignment has a specific point. Points will be accumulated and transformed into academic prizes such as extra time to complete unfinished tasks and additional examples for passing tests.	The evaluation was conducted using the SPARC framework, and the results revealed that Sense and Autonomy had the highest positive values, followed by competency, purpose, and relatedness. The component that requires the most improvement is relatedness.
Badges and Gamification In eLearning: Effects on Achievement And Engagement [12]	Gamification and digital badges are used in two classes that have different distribution modalities, full online and hybrid, but the course outline is the same in both. Badges reflect project milestones connected to course curriculum. In addition, it is geared at the leaderboard.	Using badges increases student engagement

The effectiveness of gamification technique for higher education students engagement in polytechnic Muadzam Shah Pahang, Malaysia [16]	The instructor used online resources (Kahoot! and Quizziz) to conduct a formative evaluation at the start of the semester. Before moving on to the next subtopic, Kahoot! was utilized to assess student understanding at the end of each subtopic. While Quizziz is utilized to assess students, the outcomes will effect 5% of the entire topic score.	The usage of gamification technologies improves learning. Students often believe that the technology they are using is simple to utilize. Gamification in the classroom also creates a stimulating and unique learning environment. Assist students in increasing their engagement skills so that they are more likely to take notes in class; encourage them to listen more carefully during lectures so that they can answer gamified quizzes later in the day; and contribute to improving their interactions in class so that they are more eager to ask questions during lessons.
Designing a gamified e-learning environment for teaching undergraduate ERP course based on big five personality traits [21]	Students are required to use an online learning ERP that has been gamified. There will be a pretest at the start of the week, after which the lecturer will upload learning materials and a post test will be administered. The leaderboard, score, social standing, and profile will be visible to students.	In terms of information comprehension, the use of gamification cannot boost knowledge in all types of personalities because each feature of the game has both negative and good consequences. In terms of engagement, the utilization of game aspects can provide curiosity, thus the tips should always introduce new elements to retain curiosity.
Relax, It's a Game: Utilising Gamification in Learning Agile Scrum Software Development [22]	Students will study agile using Trello, and then they will be divided into groups to design a Trello Project board based on the case studies supplied, in which they will compete for prizes.	The average student score improved, and the consequences of this growth were consistent across a four-year period.
Training Scrum with Gamification [13]	the average value of students increased and the results of this increase were consistent for 4 years	The method of instruction engages pupils and encourages students from diverse backgrounds to collaborate in groups.

Several theories were identified during the early inquiry and used as a guideline while developing gamification for learning. The theories employed are the Intrinsic Motivation Inventory ([17], [20], [21], [25]), the Student Course Engagement Questionnaire [18], the Student Engagement Scale [18], [19], and [25], and SPARC [11] are the theories used. The Intrinsic Motivation Inventory is a questionnaire designed to assess participants' subjective perceptions while participating in laboratory activities. This assessment focuses on students' intrinsic motivation and self-regulation. Students will be graded on four criteria: interest/enjoyment, perceived competence, perceived choice, and reported pressure and tension.

The Student Course Engagement Questionnaire (SCEQ) is a method for measuring a student's level of involvement in a course. The examination is divided into four components: skill engagement, participation/interaction engagement, emotional engagement, and performance engagement [26]. [27] created the Student Engagement Scale (SES) to assess students' levels of engagement. There are three approaches to measure engagement: behavioral engagement, emotional engagement, and cognitive engagement. When compared to the four SCEQ dimensions, there is one area that SES does

not measure: participation/interaction engagement, which examines engagement through the lens of how students connect with one another and enjoy the information provided.

SPARC is the final framework, and it is used to construct the gamification experience. The abbreviation SPARC stands for sense, purpose, autonomy, relatedness, and competence. These five dimensions must be addressed when developing a gamification experience [11]. Based on various previously published theories or frameworks, Table 3 describes the variables that must be addressed while developing a gamification for learning, particularly in the field of information systems. Motivation, engagement, and student perspective are three characteristics that can be utilized to determine whether or not the implementation of gamification for learning was successful. The final aspect, game design, is a factor that may be utilized as a guide when creating learning gamification patterns that will be applied. Table 3 highlights and defines factors that determine the successful implementation of gamification for learning in the information systems education. Table 4 depicts the mapping between components and their sub-factors. Figure 2 depicts the mapping between components and sub-factors in gamification for information systems education.

Table 3. Factors influencing the implemenation of gamification for learning

Factors	Definition
Motivation	Taking action with the intention of achieving or getting something done, with a substantial impact on success and performance
Engagement	When learning or being taught, an individual's level of attention, curiosity, enthusiasm, optimism, and passion.
Student Perspective	Students' perspectives on gamification
Game Design	the process of developing game material and rules

Table 4. Factors and sub factors of gamification for learning

Factor	Subfactor	Definition of Subfactor	Source
Motivation	Perceived competence	The degree to which an individual feels effective when doing a task.	[15], [18], [19], [23]
	Perceived Choice	The degree to which a person feels effective when performing a task..	[15], [18], [19], [23]
	Pressure/Tension	The degree to which a person believes he or she is effective when executing a task.	[15], [18], [19], [23]
	Enjoyment/Interest	Interest and pleasure derived from participating in an activity.	[15], [18], [19]
Engagement	Participation / Interaction Engagement	Examine how students engage with one another.	[16]
	Cognitive engagement intention	Students' efforts in the learning process to grasp the issue under study and attain the best level of understanding of the field under study	[16], [17], [23]
	Behavioral Engagement	The extent to which pupils make an effort to obey the rules during the teaching and learning process.	[23]

	Emotional Engagement	The degree to which students connect with the learning material,	[23]
Student Perspective	Perceived Usefulness	Improved understanding, problem solving skills, creativity, and perceived interest in subject topics after playing games in class. The extent to which students believe using gamification can improve their performance in learning.	[11], [16], [17]
	Student satisfaction	The degree to which students are satisfied with their gamification experience.	[19]
	Gamification Perceived Ease Of Use	How much do students expect gamification to be effort-free?	[16]
Game Design	Game Elements	The extent to which the incorporation of game features influences the successful deployment of gamification.	[12], [17], [19], [21], [23]
	Sense	Students must understand the exercises and they must be consistent with the learning process..	[9]
	Purpose	Students must understand the exercises and they must be consistent with the learning process.	[9]
	Autonomy	Activities should be optional and should allow, if not encourage, students to make their own decisions.	[9]
	Relatedness	Every action should benefit other students or the course as a whole.	[9]
	Competency	Activities must ensure that pupils are able to master the rules and tools specified.	[9]

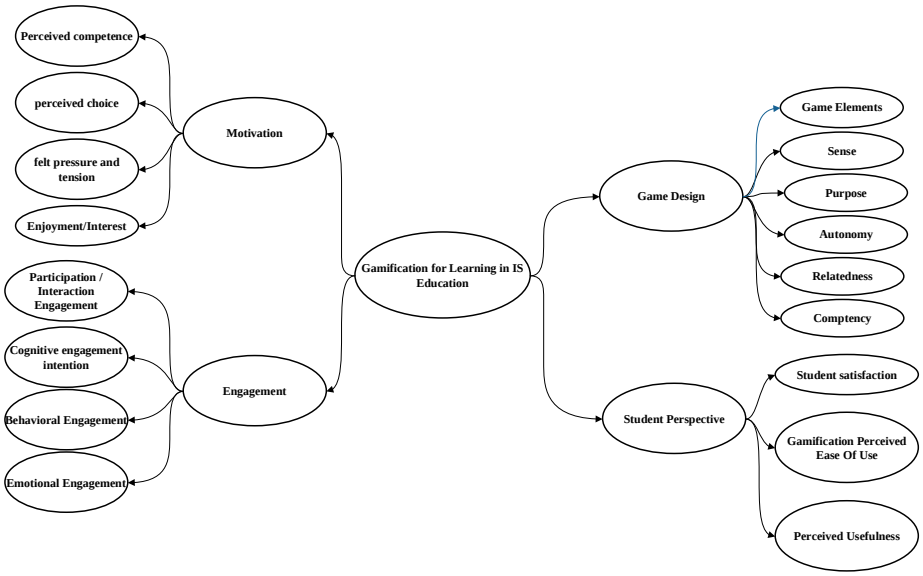

Fig. 2. Mapping of factors and sub factors of gamification for learning in IS education

5 References

[1] G.-J. de Vreede, E. Karsten, P. Leidig, and J. F. N. Jr., "IS2020 ACM/AIS Exploratory Task Force Reccomendation," 2020.

[2] H. Topi, "Reflections on the Current State and Future of Information Systems Education," *J. Inf. Syst. Educ.*, vol. 30, no. 1, pp. 1–9, 2019.

[3] L. Leonard, K. Jones, and G. Lang, "Information System Curriculum versus Employer Needs: A Gap Analysis," *Inf. Syst. Educ. J.*, vol. 17, no. 5, pp. 32–38, 2019.

[4] A. M. Toda, R. M. C. do Carmo, A. P. da Silva, I. I. Bittencourt, and S. Isotani, "An approach for planning and deploying gamification concepts with social networks within educational contexts," *Int. J. Inf. Manage.*, vol. 46, pp. 294–303, Jun. 2019. https://doi.org/10.1016/j.ijinfomgt.2018.10.001

[5] A. Sánchez-Mena and J. Martí-Parreño, "Gamification in Higher Education: Teachers' Drivers and Barriers," in *Proceedings of the International Conference of the Future of Education 6th Edition*, 2016, pp. 180–184.

[6] I. C. Panis, P. Setyosari, D. Kuswandi, and L. Yuliati, "Design Gamification Models in Higher Education: A Study in Indonesia," *Int. J. Emerg. Technol. Learn.*, vol. 15, no. 12, p. 244, Jun. 2020. https://doi.org/10.3991/ijet.v15i12.13965

[7] A. Marczewski, *Game Thinking. Even Ninja Monkeys Like to Play: Gamification, Game Thinking and Motivational Design*. CreateSpace Independent Publishing Platform, 2015.

[8] S. Nicholson, "A RECIPE for Meaningful Gamification," in *Gamification in Education and Business*, Cham: Springer International Publishing, 2015, pp. 1–20. https://doi.org/10.1007/978-3-319-10208-5_1

[9] 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. https://doi.org/10.1145/3012430.3012603

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

[11] 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.

[12] N. Rigole, L. Hollingsworth, and J. Ray, "Badges and Gamification In eLearning: Effects on Achievement And Engagement," in *Proceedings of the Southern Association for Information Systems Conference*, 2017, pp. 1–5.

[13] U. Schafer, "Training scrum with gamification: Lessons learned after two teaching periods," in *2017 IEEE Global Engineering Education Conference (EDUCON)*, 2017, pp. 754–761. https://doi.org/10.1109/EDUCON.2017.7942932

[14] 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.

[15] K. Fernandez-Reyes, D. Clarke, and J. Hornbach, "The impact of opt-in gamification on students' grades in a software design course," in *Proceedings of the 21st ACM/IEEE International Conference on Model Driven Engineering Languages and Systems Companion Proceedings - MODELS '18*, 2018, pp. 90–97. https://doi.org/10.1145/3270112.3270118

[16] 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. https://doi.org/10.1186/s41239-018-0123-0

[17] M. Thongmak, "Raising Students' Cognitive Engagement Intention in a Preliminary IS Course Using Gamification," in *International Conference on Research and Practical Issues of Enterprise Information Systems*, 2018, pp. 81–95. https://doi.org/10.1007/978-3-319-99040-8_7

[18] G. M. de Jesus, L. N. Paschoal, F. C. Ferrari, and S. R. S. Souza, "Is It Worth Using Gamification on Software Testing Education?," in *Proceedings of the XVIII Brazilian Symposium on Software Quality - SBQS'19*, 2019, pp. 178–187. https://doi.org/10.1145/3364641.3364661

[19] T. Pedroso, E. Cardoso, F. Rações, A. Baptista, and J. Barateiro, "Learning Scorecard Gamification: Application of the MDA Framework," 2019, pp. 29–46. https://doi.org/10.1007/978-3-030-14850-8_3

[20] N. Naik and P. Jenkins, "Relax, It's a Game: Utilising Gamification in Learning Agile Scrum Software Development," in *2019 IEEE Conference on Games (CoG)*, 2019, pp. 1–4. https://doi.org/10.1109/CIG.2019.8848104

[21] A. Pakinee and K. Puritat, "Designing a gamified e-learning environment for teaching undergraduate ERP course based on big five personality traits," *Educ. Inf. Technol.*, vol. 26, no. 4, pp. 4049–4067, Jul. 2021. https://doi.org/10.1007/s10639-021-10456-9

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

[23] Ş. Ç. Özhan and S. A. Kocadere, "The Effects of Flow, Emotional Engagement, and Motivation on Success in a Gamified Online Learning Environment," *J. Educ. Comput. Res.*, vol. 57, no. 8, pp. 2006–2031, Jan. 2020. https://doi.org/10.1177/0735633118823159

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