

A Systematic Literature Review (SLR) Study on Gamification as A Teaching Tool in Fourth Industrial Revolution (4IR)

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Abstract. *The education revolution 4.0 has brought momentous changes in the global education landscape by emphasizing the use of technology and changes in teaching strategies that are more efficient and in line with the world's technological modernization. In this context, gamification appears as a valuable tool in creating a more interesting and effective learning experience. Therefore, this study aims to look at the theme of the study and discussion about the issue of using gamification as a teaching tool in the Industrial Revolution 4.0 (IR4.0). This systematic literature review (SLR) study was conducted by using articles from 2019 to 2023 from three databases namely ResearchGate, Scopus, and Science Direct. These articles have been collected and then researched to ensure that the selected articles meet the focus of the study. A total of 19 out of 82 articles were selected to be discussed in this study. Overall, the study shows that four themes can be classified regarding the themes of previous studies on the issue of gamification in education. The theme is 1) digital integration in education, 2) digital gamification as a teaching strategy, 3) digital gamification design in the teaching process, and 4) the need for digital gamification in the teaching process. Therefore, there is a need for a comprehensive study such as a study on the development of a gamification-based teaching model as a guide and in-depth reference for teachers, especially in the teaching and learning process. So, with that, the whole essence of this study will provide a comprehensive overview of the role of gamification in bringing education to a more relevant and viable direction, especially in the era of education 4.0.*

Keywords: *educational gamification, teaching strategies, industrial revolution 4.0*

1. Introduction

Gamification is one of the processes of determining and using elements of games, formal activities, and serious fields that are not originally games (Tan, 2018). The process of gamification produces serious games in four areas of formal activity, such as education, business, medical treatment, and military training. In fact, this gamification process can encourage user involvement in a product or service. The gamification process also turns an activity into a game by encouraging user participation or involvement (Abdullah & Razak, 2021; Deterding et al., 2011).

The gamification process in education is also able to contribute to the behavior, motivation, and awareness of students towards a learning process. As Smiderle et al. (2020) describe the integration of gamification elements in the learning process affects the engagement and behavior of students based on their original personality traits. The influence of gamification activities not only contributes to excellent performance in lessons but is also able to change perspectives and attitudes, as well as student involvement in the learning process. This means that students who have a low awareness of the gamification process have more passive actions, but with a good process and operation of the activity, the student's behavior can change according to the game design and finally earn points.

In addition, the implementation of gamification as a play tool needs to emphasize the learning outcomes to be achieved. Educators who implement the gamification process in learning need to emphasize the needs and characteristics of players well to be able to compare the diverse types of games required. The implementers need to identify and integrate appropriate gamification elements in the teaching process to create an effective gamification system. In fact, the emphasis on gamification elements can guide students to achieve effective learning goals. Therefore, among the appropriate elements are rewards, feedback, reward points, badges, game boards, levels, progress, avatars, and challenges (Syed Khuzzan et al., 2021).

Furthermore, in making the gamification process for game-based learning a success, instructors or learning designers should emphasize the basic steps in the gamification process, namely by setting goals and game rules that can be taught. The first step, setting goals and rules, must be aligned with the three main components, namely verbs, achievement conditions, and achievement levels. In addition, the second step is to design the way to play, which is to set the genre, challenge, and interaction of the game. Next is the third step: designing learning feedback for learning purposes, including instruction feedback, reinforcement feedback, and challenge feedback (Rahimah, 2019).

In addition, the rapid development of digitization innovation also opens space for the comprehensive education system, particularly in focusing on solving social and student performance problems. Through the modernization current of the industrial revolution and the speed of digitization, the policy of the Fourth Industrial Revolution (4IR) has been created to equip the future workforce with 4IR skill sets (Ali et al., 2021; Lubinga et al., 2023). In relation to that, the application of digital gamification in learning processes is considered one of the contributions to improving the skills and retraining of teaching staff to take advantage of 4IR technology and provide the future generation with technology. In relation to that, a study was conducted to analyze the theme of the discussion regarding the use of gamification in education, especially in the current industrial revolution (4IR) era.

2. Method

This study is a qualitative study that uses systematic literature review method [systematic literature review (SLR)]. This method will analyze Systematic previous studies to identify issues in implementations of gamification during the Industrial Revolution (4IR) era. Therefore, literature sources are limited between 2019 and until 2021. This is because the development of gamification in education is increasingly prioritized, especially in the teaching and learning process, which started in 2019 up to today. This study applies the literature review method. systematic (SLR) that includes background, problems, methods, and definitions of the study. Every literature selected will be arranged based on the implementation of gamification in education. Therefore, matters unrelated to the question and research objectives will not be included systematic literature review (SLR).

This method involves a systematic search by using keywords such as principles. systematic literature review (SLR) applied by modern researchers (Susan Michie & S. Williams, 2003; Abur Hamdi Usman et., 2020). This study said: The key to gamification, gamification in education, digital gamification, and the fourth industrial revolution (4IR) is used to obtain research data. Article search is using the database. Google Scholar, ResearchGate, and Science Direct. The issue of using gamification in education today is the main criteria in the analysis of this study. Studies have found that there are 82 articles

that found the search by using the keywords.

After checking the title and Abstract: There are 28 articles accepted. Although however, further evaluation and detail have been carried out on 28 articles and studies found that there are only 19 articles that will be used in this research like figure out in Figure 1.

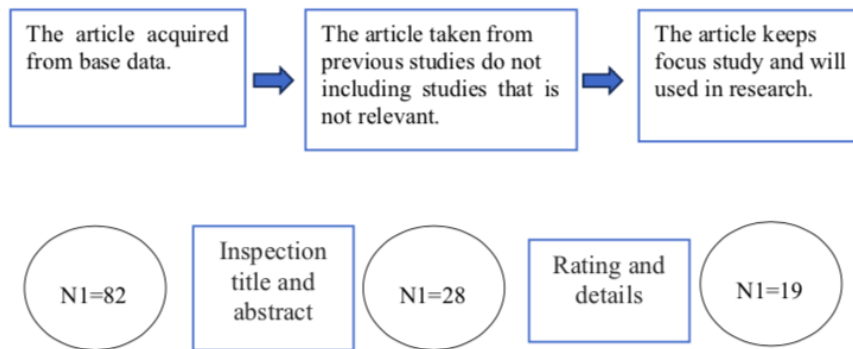


Figure 1. Primitive source (Michie & William, 2003)

3. Results and Discussions

A total of 19 articles have been identified as relevant to gamification implimentation in revolution industrial (4IR) era. The findings have been summarized systematically as in Table 1.

Table 1. Themes article discussion

No	Article	Digital Integration in Education	Digital Gamification as a Teaching Strategy	Digital Gamification Design in The Teaching Process	The Need for Digital Gamification in Teaching Process
1	Zainuddin et al., 2020.	x	x	x	
2	Torres et al., 2019.	x	x	x	
3	Sharma et al., 2019.	x	x	x	x
4	Chaka et al., 2022.	x			x
5	Elayyan et al., 2021.	x			x
6	Zimmerling et al., 2019	x	x		x
7	Zabala et al., 2021.	x	x		
8	Flores et al., 2021.	x	x		
9	Hosseini et al., 2021.	x	x		
10	Sadovets et al., 2022.	x	x	x	x
11	Mandragelia et al., 2023.	x	x		
12	Vargas et al., 2020.		x	x	
13	Pishchanska et al., 2022.		x	x	
14	Saxena & Mishra, 2021.		x	x	
15	González et al., 2022.		x	x	
16	Zakaria et al., 2020.		x	x	x
17	Iruela et., 2022.				x
18	Bitrián et la., 2022				x
19	Wardoyo et al., 2022				x

Based on 19 selected articles, the study has identified four important themes in the study of gamification in education in the era of the industrial revolution (4IR), namely:

1) digital integration in education; 2) digital gamification as a teaching strategy; 3) digital gamification design in the teaching process; and 4) the need for digital gamification in the teacher's teaching process. Below is the classification of articles according to the four themes.

Theme 1: Digital Integration in Education

The integration of gamification in educational settings has garnered significant attention due to its potential to enhance motivation, engagement, and active learning among students. Several studies have explored the impact of gamification on learning processes, student motivation, and educational outcomes. The impact of digital gamification as a teaching strategy in the Fourth Industrial Revolution (4IR) has been a subject of significant research. Zainuddin et al. (2020) conducted a systematic review of empirical evidence to assess the impact of gamification on learning and instruction. The study provided insights into the effectiveness of gamification in enhancing learning outcomes and instructional processes, shedding light on its potential as a pedagogical tool in the context of the 4IR (Zainuddin et al., 2020).

In the context of higher education, Padmanabhan (2024) discussed the digital transformation in higher education, highlighting the challenges and opportunities brought about by digitalization. The article emphasized the need for educational institutions to adapt to the digital transformation driven by the 4IR, underscoring the importance of leveraging digital technologies to enhance the learning experience and meet the evolving needs of students (Padmanabhan, 2024). Furthermore, Torres-Toukoumidis, (2019) focused on the implementation of gamification strategies for the enhancement of digital competences. The study utilized a questionnaire-based methodology to gather insights from experts in educational technologies, highlighting the convenience and effectiveness of implementing gamification for the development of digital competencies, aligning with the demands of the 4IR.

These studies collectively underscore the significance of digital gamification as a teaching strategy in the 4IR, emphasizing its potential to enhance learning outcomes, address the challenges of digital transformation in higher education, and develop essential digital competencies in students.

Theme 2: Digital Gamification as a Teaching Strategy

The integration of digital gamification as a teaching strategy in the context of the Fourth Industrial Revolution (4IR) has been explored in numerous studies. These studies have investigated the impact of gamification on motivation, active learning, and educational processes, particularly in higher education and secondary school settings. Zimmerling et al. (2019) examined the influence of common game elements on ideation output and motivation, providing insights into the potential of gamification to enhance student engagement and motivation.

In a similar, the use of gamification and game-based learning to strengthen motivation in mathematical engineering teaching processes, aiming to address the issue of dropout rates by leveraging gamification strategies to enhance motivation and engagement among students (Zabala-Vargas et al., 2021). Also, Rincón-Flores and Santos-Guevara (2021) investigated the use of gamification during the COVID-19 pandemic to promote active learning and motivation in higher education, highlighting the role of gamified undergraduate courses in enhancing student engagement and motivation, particularly in the challenging context of the pandemic.

Furthermore, Hossein-Mohand et al. (2021) analyzed the integration of the flipped learning model, project-based learning, and gamification methodologies by secondary school mathematics teachers, emphasizing the potential of gamification to enhance active learning and student participation. Additionally, Sadovets et al. (2022) explored gamification in the informal learning space of higher education within the context of digital transformation, shedding light on the potential of gamification to adapt to the digital transformation of education.

Finally, Zhukova et al. (2023) investigated digital technologies for introducing gamification into the education system in the context of the development of Industry 4.0, focusing on modeling the stages of using digital technologies for integrating gamification into the education system, aligning with the demands of the 4IR. These studies collectively demonstrate the growing interest in leveraging digital gamification as a pedagogical strategy to enhance motivation, active learning, and student engagement in the context of the 4IR.

Theme 3: Digital Gamification Design in The Teaching Process

The article "Digital Games (Gamification) in Learning and Training: An Approach to Adaptation and Integration in the Classroom" by Vargas-Macías (2020) provides an analysis of the adaptation and integration of digital games, specifically gamification, in the classroom. The study explores the technologies and methodologies of gamification and presents relevant results from its implementation in educational and business environments. The article aims to shed light on the potential of gamification in enhancing learning and training processes, particularly in educational settings within the context of the Fourth Industrial Revolution (4IR).

In a similar vein, "Gamification of Education: Innovative Forms of Teaching and Education in Culture and Art" by Pishchanska et al. (2022) delves into the phenomenon of gamification and its potential in organizing the educational process for future professionals in the field of culture and art. The study identifies three types of gamifications used in education (light, deep, and combined) and discusses the fundamental components of the method, including elements, mechanisms, dynamics, and game characters.

Furthermore, "Gamification and Gen Z in Higher Education" by Saxena & Mishra (2021) focuses on catering to the unique educational needs of Generation Z through the application of action design research principles. The study aims to engage the latest generation effectively by utilizing gamification to teach a postgraduate data warehouse/business intelligence module differently. Additionally, "Elaboration and Validation of the Scale to Measure the Experience on Gamification in Education (EGAMEDU)" by González (2022) discusses the use of gamification in education as an active methodology involving the use of mechanics, design, or game structures in the classroom. The study elaborates on the development and validation of a scale to measure the experience of gamification in education.

Lastly, "Assessing Ethos hunt as a Gamification-Based Mobile App in Ethics Education: Pilot Mixed-Methods Study" by Zakaria et al. (2020) involves a mixed-methods research design to assess the effectiveness of Ethos hunt, a gamification-based mobile app, in ethics education. The study aims to evaluate the usability and impact of the app in enhancing ethics education. These articles collectively contribute to the understanding of digital gamification design in the teaching process within the 4IR, highlighting its potential to enhance learning outcomes and engage students effectively.

Theme 4: The Need for Digital Gamification in Teaching Process

Iruela et al. (2022) conducted a study titled "Can Gamification Help in Increasing Motivation, Engagement, and Satisfaction? A gamified experience in teaching to students from other disciplines" in the context of the Fourth Industrial Revolution (4IR). The study aimed to explore the potential of gamification in increasing motivation, engagement, and satisfaction in teaching computer science (CS) to students from other disciplines. The introduction provides an overview of the increasing importance of digital gamification in education, especially in the 4IR, and the need to enhance motivation and engagement among students from diverse academic backgrounds. The methodology involves the design and implementation of a gamified experience in teaching CS to students from other disciplines, incorporating elements of gamification to assess its impact on motivation, engagement, and satisfaction. The results and discussion present the findings related to the effectiveness of gamification in increasing motivation, engagement, and satisfaction among students from diverse disciplines, contributing to the understanding of the role of digital gamification in the teaching process within the 4IR.

In a similar, Bitrián et al. (2021) explored the gamification of personal fiscal management apps in their study "Making Finance Fun: The Gamification of Personal Financial Management Apps." Although the focus is on personal finance, the study may provide insights into the potential of gamification in enhancing engagement and motivation in the context of the 4IR. The introduction discusses the increasing integration of gamification in various domains, including finance, to enhance user engagement and motivation. The methodology involves the analysis of gamified elements incorporated into personal economic management apps and their impact on user engagement and motivation. The results and discussion present the findings related to the effectiveness of gamification in making finance fun and engaging for users, shedding light on the potential of digital gamification in enhancing motivation and engagement in various domains, including education within the 4IR.

Finally, these studies collectively contribute to the understanding of the need for digital gamification in the teaching process within the 4IR, emphasizing its potential to enhance motivation, engagement, and satisfaction among diverse student populations.

4. Conclusions

The Fourth Industrial Revolution (4IR), characterized by the integration of digital, physical, and biological technologies, has drastically reshaped our world, touching every aspect of our lives, including education. A prominent feature of 4IR in education is the emergence of digital gamification, the use of game design elements in non-game contexts, as a powerful tool to enhance student engagement and learning outcomes. Gamification harnesses the motivational power of games and applies them to a classroom setting, aiming to make learning more interactive and enjoyable. In an era where digital natives are increasingly present in classrooms, leveraging such digital tools in education is not just an option but a necessity. This paper explores how digital gamification in the context of 4IR can enhance student learning, foster engagement, and prepare students for a future where digital literacy skills are paramount. The comprehensive approach taken will provide insights into academic theories of gamification and practical implications for its application in modern classrooms.

In an equivalent way, in the wake of the Fourth Industrial Revolution, the adoption and integration of digital gamification in education have become top priorities. As classrooms continue to evolve in tandem with technological advancements, so too, must

the teaching strategies have employed by educators. Digital gamification, when effectively designed and implemented, can enhance student engagement and learning outcomes. So that, based on the articles provided and related themes, digital gamification in education within the Fourth Industrial Revolution (4IR) can enhance students in many ways. The potential enhancements include:

1. Increased Motivation and Engagement: Gamification has been shown to increase student motivation, engagement, and satisfaction in the learning process (Rincon-Flores & Santos-Guevara, 2021; Zabala-Vargas et al., 2021; Zakaria et al., 2020).
2. Improved Learning Outcomes: The use of gamification has been associated with improved learning abilities, achievement, and academic performance among students (Rincon-Flores & Santos-Guevara, 2021).
3. Adaptation to the 4IR: Gamification can empower students to adapt to the demands of the 4IR, enabling them to take charge of their education and career strategies (Elayyan, 2021).
4. Development of Digital Competencies: Gamification strategies have been found to enhance digital competencies, such as collaborating through digital technologies, managing digital identity, programming, engaging in citizenship through digital technologies, sharing through digital technologies, and protecting health and well-being (Torres-Toukoumidis & Mäeots, 2019).
5. Fun and Enjoyable Learning: Gamification can make learning fun and enjoyable, thereby increasing student involvement and participation in the learning process (Rincon-Flores & Santos-Guevara, 2021; Zakaria et al., 2020).
6. Increased Usability and Value: Gamification-based approaches have been found to create value for students by encouraging learning through entertainment and increasing motivation and satisfaction (Zakaria et al., 2020; Vargas-Macas et al., 2020).

These findings collectively highlight the potential of digital gamification to enhance student motivation, engagement, learning outcomes, and adaptability to the demands of the 4IR, contributing to a more effective and enjoyable learning experience for students. Given these outcomes, gamification emerged as a powerful component of education in the Fourth Industrial Revolution. Increased engagement and motivation, improved learning outcomes, and the enhancement of necessary soft skills all underscore the meaningful impact gamification can bring to the educational landscape. The encouraging findings from different studies, highlighting students' adaptation to 4IR, suggest that gamification is not merely a tool for education, but a vital strategy for empowering future generations. These findings warrant further research and substantial consideration in the development of future curriculum.

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