Developing Gamified Learning Management Systems to Increase Student Engagement in Online Learning Environments

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***Abstract*—Online learning has become a trend in today's digital age. Accessibility, flexibility, a wide variety of learning resources, collaboration and communication, and the use of technology and innovation are reasons for the increasing popularity of online learning. However, student engagement is often low and requires innovative solutions to increase it. This study aims to develop and analyze the effectiveness of gamified Learning Management Systems (LMS) in increasing student engagement in online learning. The research method used is the ADDIE model, which consists of Analysis, Design, Development, Implementation, and Evaluation. The subjects of this study were students of one of the private universities in Indonesia who attended online lectures during the pandemic. Data collected using questionnaires, observation sheets, and interview guidelines were then analyzed using descriptive statistics. The results showed that gamified Learning Management Systems (LMS) was able to increase student engagement in online learning. However, technical limitations and inadequate institutional support were barriers to implementing gamified LMSs. In conclusion, developing gamified LMS can be an effective alternative strategy to increase student engagement in online learning and positively influence their academic performance. Overall, this research contributes to the development of gamified LMS in Indonesia and provides insight into the effectiveness of gamification strategies in increasing student engagement in the online learning environment.**

***Keywords*—gamification, learning management system, online learning, student engagement**

I. Introduction

Online and distance learning have become increasingly popular educational alternatives, especially since the COVID-19 pandemic began in 2020 [1–5]. This situation has encouraged the development and adoption of technology that supports virtual learning. Video conferencing, online discussions, and other interactive tools have enabled students and teachers to interact in real-time, share thoughts, and collaborate on shared assignments and projects [6]. It provides a more interactive learning experience, similar to the learning atmosphere in a physical classroom.

There are several benefits that students and lecturers get, such as flexibility in time and place, access to a broader range of resources, and savings in transportation and accommodation costs [6]. Although online learning has many advantages, online learning cannot completely replace face-to-face learning. Online learning is effective in certain situations, such as when access to schools or teachers is limited, or in an emergency, such as a pandemic [6].

The main problem that often arises in online learning is low student engagement [7–12]. It can be seen by the lack of participation, discussion, and interaction between students, lecturers, or classmates and the low motivation to be actively involved in online learning activities. Learning Management Systems (LMS) are not integrated with exciting game elements in evaluating the current state. The LMS used has not been able to encourage student engagement in online learning. In order to address this pressing issue, educational institutions and LMS providers must recognize the significance of student engagement in online learning environments. Efforts should be made to develop and implement LMS platforms that facilitate content delivery and foster a sense of community, interactivity, and enjoyment for students. By leveraging gamification strategies, the LMS can effectively motivate and encourage students to become active participants in their learning journey, thereby maximizing the potential of online education [13].

Implementing gamification strategies in an e-learning platform is still relatively new. Although the potential benefits of incorporating game elements into educational experiences are well recognized, many online learning platforms have yet to embrace this innovative approach fully. As a result, most e-learning experiences still follow traditional instructional models, lacking engagement and interaction. However, with the growing interest in gamified learning and its proven effectiveness in enhancing motivation, knowledge retention, and overall student engagement, it is only a matter of time before we witness a more widespread integration of gamification strategies within online education. The potential to create immersive and enjoyable learning experiences through gamification holds great promise for revolutionizing online education and transforming how students interact with course material [14]. By incorporating elements such as points, badges, leaderboards, and challenges, educators can tap into learners' intrinsic motivation and make learning more interactive and enjoyable, ultimately leading to improved outcomes [15]. As e-learning platforms continue to evolve and adapt to changing pedagogical trends, the integration of gamification strategies is expected to become increasingly prevalent, paving the way for a more engaging and effective online learning environment. Gamification has the potential to significantly enhance students' educational journey and

facilitate their acquisition of knowledge and skills [16].

The development of gamified LMS that suits the needs and characteristics of students is essential to help increase student motivation and engagement in online learning. gamified LMS development integrates game elements, such as rewards, challenges, leaderboards, and others [16–22]. Gamified LMS can be a solution to overcoming the problem of student engagement in online learning that has been emerging. Developing a gamified LMS that aligns with student's preferences and learning styles is essential. It allows for personalization and tailoring of the learning experience, giving students a sense of ownership and autonomy. Moreover, gamified LMS encourages active participation, as students are incentivized to progress and achieve higher levels within the learning environment.

This research aims to 1) develop gamified LMS that is feasible and appropriate for use in online learning environments and 2) test the effectiveness of gamified LMS in increasing student engagement. With these two objectives, this research is expected to make a meaningful contribution to developing and applying gamified LMS in online learning. The results of this study provide insight into the potential of gamified LMS as an effective tool in increasing student engagement in the online learning process. In addition, this research can also provide a deeper understanding of how gamification elements in LMS can affect student motivation, participation, and achievement in the online learning environment.

II. Literature Review

A. Gamification

Gamification has become an interesting topic for researchers and education practitioners. Gamification is a strategy that integrates game elements into non-game contexts to increase motivation, engagement, and performance [15, 18–25]. In recent years, many studies have been conducted to explore gamification's potential and effectiveness in improving online learning quality.

In a study conducted by Aguilos and Fuchs [26] involving students in higher education, gamification makes learning more engaging and increases the efficiency of independent learning. The results showed that students who engaged in gamified learning had higher motivation levels, more active participation, and better achievement in understanding learning concepts.

In addition, the results of Chans's research [23] illustrate the positive influence of gamification in increasing engagement and motivation in online learning. They found that game elements, such as points, levels, and rewards, can provide an intrinsic boost for learners to actively participate in the online learning process.

However, some studies have also shown that the effectiveness of gamification is influenced by proper design and implementation. According to Maher *et al.* [27], the development of gamification in online learning should consider personalization approaches and adaptation of additional gamification elements, such as feedback and evaluation of learning.

B. Learning Management Systems

The rapid development of Internet technology has changed how it facilitates formal learning in educational environments [28]. Learning Management Systems (LMS) have become essential to online learning. LMS is a technology platform that manages, delivers, and supports online learning [29]. LMS is one of the perfect approaches to grow students' awareness of education as sustainability [30].

In recent years, LMS research and development has become the focus of attention of academic and educational practitioners. A study by Mohammadi *et al.* [31] explained that implementing the Learning Management System (LMS) has brought critical challenges for many universities, especially during the COVID-19 pandemic. Although LMSs with many features have been developed, the success of such systems is closely related to users' understanding of the factors that affect the efficiency and effectiveness of learning, such as policies, organizational culture, technical constraints, governance models, skills, and quality of service. The results show that lack of policy is the most essential factor significantly impacting success. In contrast, technical constraints do not have a high impact on and success of online learning. The competence of human resources plays an essential role in the successful diffusion of LMS.

The primary source of success lies in how much the institution expects to utilize the LMS in the learning process, the interest of students in using the LMS, and the instructor's ability to make the most of the LMS [32]. When the institution strongly emphasizes incorporating the LMS into the learning ecosystem, setting clear expectations, and providing comprehensive training and support, it creates a culture that promotes active LMS utilization among educators and students. This institutional commitment sets the foundation for successful implementation and maximizes the LMS's impact on learning outcomes.

C. Online Learning Environment

The COVID-19 pandemic has created opportunities for schools and universities to conduct massive experiments with online classes [33]. The online learning environment gives students flexibility in accessing and participating in learning through online platforms. Much research has been conducted in the academic literature to explore the effectiveness of online learning environments.

Research by Firmansyah *et al.* [6] revealed that students welcome the implementation of learning. In their perception, online learning is considered more flexible, efficient, and effective in using time, cost, and energy. The study shows that students benefit from the flexibility of time and place, access to a broader range of learning materials, and the opportunity to participate in discussions with other students virtually.

A study by Mo *et al.* [2] explore the critical factors influencing students' e-learning use. Mo *et al.* concluded (1) the easier an online learning platform is to navigate, the better it is perceived by students, and students are more willing to use it; (2) Ease of use is associated with the choice of an e-learning platform, affecting students' attitudes towards its use; (3) Teachers' positive attitude towards learning increases students' perception of ease in using online learning platforms; (4) Family support increases teacher enthusiasm for online

learning. Family support can also affect students' habits and activeness in online learning.

D. Student Engagement

Student engagement in the learning process is critical to their academic success. Student engagement includes active participation, motivation, and attention to learning [7, 10, 11, 34, 35]. Schnitzler et al. [34] divide student engagement into behavioral, emotional, and cognitive dimensions. Behavioral engagement includes positive behavior, such as following rules, adhering to classroom norms, engaging in learning and assignments, and avoiding disruptive behavior. Emotional engagement refers to students' affective reactions in class, including interest, boredom, happiness, sadness, and anxiety. While cognitive engagement describes the mental effort of students and the use of learning strategies to manage their learning tasks [7].

In recent years, educational research and practice have increasingly noticed the importance of increasing student engagement. Many studies have been conducted to explore the factors that influence student engagement and practical strategies to improve them. Abou-Khalil *et al.* [9] identify effective strategies to increase student engagement in online learning. They concluded that the success of using LMS depends on three factors, namely student-student, student-teacher, and student-learning content interaction. Student-content interactions, such as screen sharing, summaries, and recordings, were considered the most effective, followed by student-teacher interactions, for example, Q&A sessions and reminders. Student-student interaction, for example, group chats and collaborative work, are considered the least effective.

A study by Ahshan [36] highlighted the importance of social interaction in increasing student engagement. The results showed that college students who engaged in social activities and interactions with their peers had higher levels of engagement. These interactions can occur both in physical contexts and in online learning environments. In addition, Ahshan also identified several factors that can influence student engagement, including engaging teaching methods, timely and constructive feedback, and an inclusive and supportive environment. Lecturers who actively guide and support students also play an essential role in increasing their engagement.

Five patterns of student engagement were identified by Schnitzler *et al.* [34] detached, obedient, silent, engaged, and busy. The study also revealed that students with high academic self-concept tend to show high engagement patterns and vice versa. These findings illustrate the need to understand each student's cognitive and psychological differences, to ensure online learning goes as expected. By recognizing the importance of student engagement patterns and the influence of academic self-concept, educators can adapt their instructional approaches, provide personalized support, and implement interventions that help each student maximize their potential and succeed in the online learning environment. Understanding students' cognitive and psychological differences is essential for creating compelling and inclusive online learning experiences.

III. Methodology

A. Research Design

Research and Development (R&D) uses the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model. Following product development procedures using the ADDIE model, researchers conduct a needs analysis and data collection, design, develop, implement, and evaluate the success and satisfaction of using gamified LMS in online learning.

In the Analysis phase, comprehensive needs analysis is used to identify the audience's requirements and challenges, including gathering data on student preferences, motivations, and learning styles and understanding the existing online learning environment. Based on the findings from the Analysis phase, the Design stage outlines the game mechanics, rewards, challenges, and other elements integrated into the LMS to enhance student engagement and motivation. Scores are assigned to each activity according to the guidelines: 1 for logging in, 5 for liking, 10 for reading, 15 for replaying, 20 for completing assignments, and 25 for students who share information. The Development phase focuses on creating and implementing the gamified LMS. This phase may involve collaboration with instructional designers, developers, stakeholders, and others. Once the gamified LMS is ready, it moves to the Implementation stage. It consists in deploying the system within the online learning environment and making it accessible to the intended users. Lastly, in the Evaluation phase, assess the success and satisfaction of using the gamified LMS in online learning is used. They collect data on student engagement, learning outcomes, and overall satisfaction with the gamified experience. This feedback is crucial in identifying areas for improvement and refining the gamified LMS for future iterations.

B. Population and Sample

The population in this study was undergraduate students at the Faculty of Teacher Training and Education, Universitas Veteran Bangun Nusantara - Indonesia, who used LMS in the learning process. The sample that was the focus of this study was selected purposively. The experimental class consisted of 60 college students, with 32 female students and 28 male students. The control class, for comparison, consisted of 52 students, with 28 female and 24 male students.

Purposive sample selection is carried out to ensure that the group of students involved in this study has characteristics relevant to the research objectives. By utilizing a representative sample from the intended population, this study can yield reliable results and facilitate more accurate generalizations regarding the impact of a gamified LMS on student engagement.

C. Instruments

This study used several instruments: questionnaires, observation sheets, and interview guidelines. The questionnaire collected data on student satisfaction with gamified LMS products. This questionnaire contains questions about gamified LMS's usefulness, practicality, and effectiveness. Observation sheets are used to observe student engagement in online learning before and after using a gamified LMS. Interview guidelines are used to collect data

on students' experiences using gamified LMS. The instrument is developed and adapted to students' research objectives and characteristics. In instrument development, researchers ensure that the tools used are valid and reliable to produce accurate and reliable data.

D. Data Analysis

The research data obtained were analyzed using descriptive analysis methods. The collected data will be analyzed at the evaluation stage using descriptive statistical techniques, including mean, median, modus, and standard deviation. The data contained two types. First, the gamified LMS feasibility test data will be analyzed to determine whether the gamified LMS has been developed and meets the established eligibility criteria. The descriptive analysis of the collected data, precisely the gamified LMS feasibility test results, will provide valuable insights into the development and eligibility of the gamified LMS. This analysis is a crucial component of the evaluation stage, informing future enhancements and optimizations to enhance student engagement in online learning.

This analysis will give an idea of the quality and adequacy of the features and content presented in a gamified LMS. Second, data on the effectiveness of gamified LMS in increasing student engagement also be analyzed. At this stage, the collected data is used to measure and compare student engagement between groups using gamified LMS and groups using conventional LMS. This analysis will provide insight into the extent to which gamified LMS can positively impact student engagement in online learning.

IV. Results

The validation results by media experts, material experts, and linguists on this research and development product show that gamified LMS is feasible and ready to be used in online learning. Tables 1 and 2 summarize the results of gamified LMS validation by media and content experts.

The results of product trials to users also show that gamified LMS is "good" and attractive. A recapitulation of product trial results to users is shown in Table 3. The difference in appearance and features between gamified and non-gamified LMS can be seen in Figs. 1 and 2.

Overall, the results of interviews with students and lecturers show that using gamified LMS significantly increases student engagement and motivation in learning. While challenges need to be overcome, using a gamified LMS can be an excellent option to increase the effectiveness and appeal of learning. The results of the interview are presented in Table 4.

Table 1. Gamified LMS validation results by media experts

Assessment Aspect	n	Average Score			Category
		1st Validator	2nd Validator	All Validator	
Content Appropriateness	5	3.40	3.60	3.50	Good
User Engagement	5	3.60	3.60	3.60	Good
Navigation and Interaction	5	3.60	3.40	3.50	Good
Multimedia and Visualization	5	3.40	3.60	3.50	Good
Evaluation and Feedback	4	3.00	2.75	2.88	Fair
Affordability and Compatibility	5	3.80	3.60	3.70	Very Good
Average	4.83	3.47	3.43	**(X) 3.45**	**Good**
Standard Deviation	0.41	0.27	0.34	**(s) 0.29**	
Median	5.00	3.50	3.60	3.50	

Notes: Average < X − ½ s = Fair, X − ½ s ≤ Average ≤ X + ½ s = Good, Average > X + ½ s = Very Good

Table 2. Gamified LMS validation results by content experts

Assessment Aspect	n	Average Score			Category
		1st Validator	2nd Validator	All Validator	
Language Accuracy	5	3.60	3.60	3.60	Very Good
Content Integration	5	3.40	3.80	3.60	Very Good
Accuracy of Presentation	5	3.60	3.40	3.50	Good
Content Wealth and Depth	5	2.80	3.20	3.00	Fair
Relevance and Novelty	5	3.60	3.60	3.60	Very Good
Average	5.00	3.40	3.52	**(X) 3.46**	**Good**
Standard Deviation	0.00	0.35	0.23	**(s) 0.26**	
Median	5.00	3.60	3.60	3.60	

Notes: Average < X − ½ s = Fair, X − ½ s ≤ Average ≤ X + ½ s = Good, Average > X + ½ s = Very Good

Table 3. Results of gamified LMS trials by users

Assessment Aspect	n	Average Score		Category
		Each User	Each Aspect	
Navigation and Interaction	5	17.50	3.50	Good
Multimedia and Visualization	5	18.00	3.60	Very Good
Evaluation and Feedback	5	17.50	3.50	Good
Affordability and Compatibility	5	18.00	3.60	Very Good
Accuracy of Presentation	5	17.50	3.50	Good
Content Wealth and Depth	5	14.00	2.80	Fair
Relevance and Novelty	4	14.00	3.50	Good
Average	4.86	16.64	**(X) 3.43**	**Good**
Standard Deviation	0.38	1.82	**(s) 0.28**	
Median	5.00	17.50	3.50	

Notes: Average < X − ½ s = Fair, X − ½ s ≤ Average ≤ X + ½ s = Good, Average > X + ½ s = Very Good

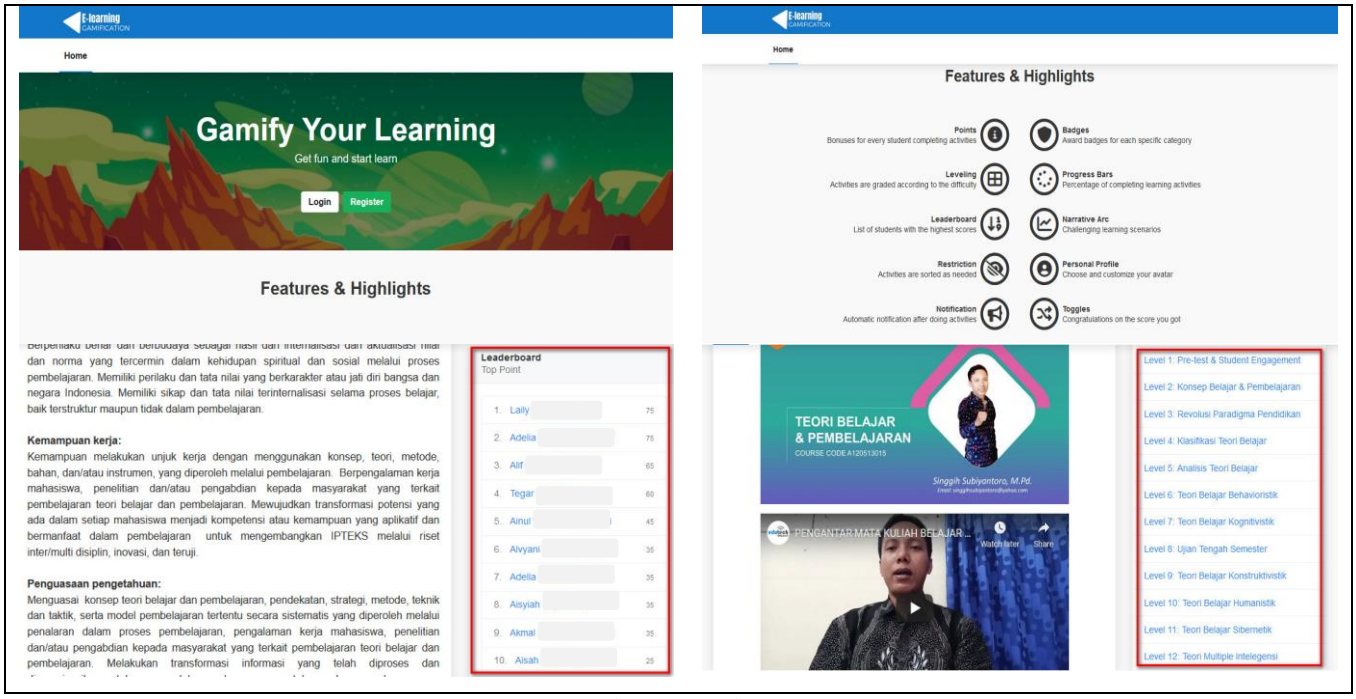

Fig. 1. Gamified LMS platform display.

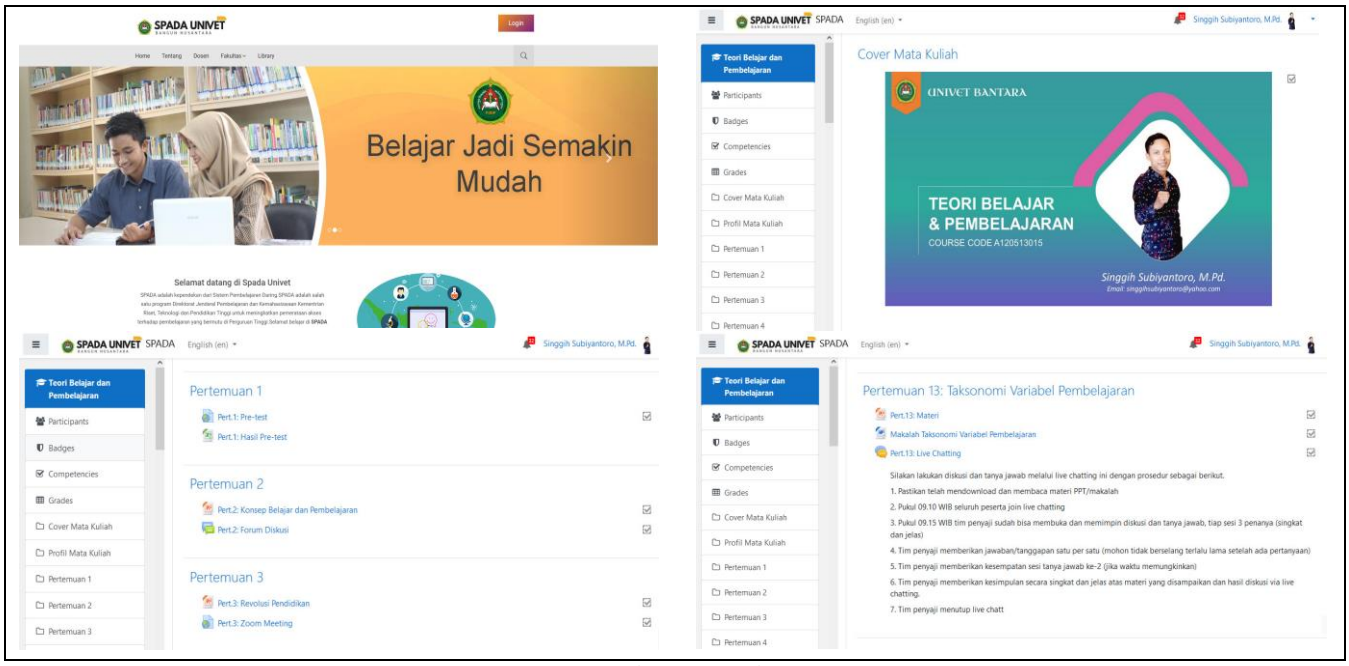

Fig. 2. Non-gamified LMS platform display

In testing the effectiveness of using gamified LMS in online classes, there was a significant increase in student engagement in the learning process. The results of measuring student engagement levels in the gamified LMS pre and post-treatment showed an increase. Student engagement in the experimental class prior to the treatment was 77.8% and increased to 91.43% after the treatment. Meanwhile, in the control class, student engagement before the treatment was 71.9% and increased to 75% after the treatment. These findings indicate that the treatment, in the form of a gamified LMS strategy, has a more significant impact on increasing student engagement than classes using a non-gamified LMS. Feedback from students shows that they feel more motivated and engaged in learning because of gamification elements, such as awarding points, grades, and rewards. User lecturers also positively responded to using gamified LMS in online learning. A summary of the results of interviews with students and lecturers is shown in Table 4.

Table 4. Results of interviews with students and lecturers using gamified LMS

No	Question	Respondent			
		1st Informant (Students with a high level of engagement)	**2nd Informant (Students with a low level of engagement)**	**3rd Informant (Lecturer with ICT background)**	**4th Informant (Lecturer without ICT background)**
1	How was your experience	I feel that my motivation has increased significantly. The	Previously, I often felt bored and less motivated when	I am delighted with the use of Gamified LMS in teaching. In	The implementation of Gamified LMS has brought

	learning/teaching online using a gamified LMS?	gamification element makes me compelled to complete tasks well and on time. The existence of points makes me more focused and enthusiastic in carrying out learning activities.	using a conventional LMS. However, with gamification elements such as point collection and ranking, I feel more involved and excited about learning.	addition, I can easily track individual progress and provide immediate feedback through the LMS system.	a new dynamic to teaching. Students engage in healthy competition, strive for high scores, and gain recognition on leaderboards.
2	Have you noticed increased student engagement after using Gamified LMS in online learning?	Yes, I feel an increase in student engagement in learning. Previously, I often felt bored and less motivated when using a conventional LMS. However, with the gamification element in the LMS, I feel more motivated and challenged to achieve targets and achieve achievements. I am also more active in participating in discussions and collaborations with classmates.	Of course. The LMS's gamification system provides incentives that motivate me to complete learning tasks. I want to get maximum points and achieve specific achievements. It makes me more focused, disciplined, and excited to complete tasks on time.	Yes, there is an evident change. After implementing Gamified LMS, students seem more motivated and active in learning. They are more enthusiastic about completing assignments, participating in discussions, and collaborating with fellow students.	Gamification elements provide incentives and healthy competition that encourage them to excel and increase their engagement in online learning.
3	When using a gamified LMS, do you feel any improvement in interactions with fellow students?	Sure, the gamification system in LMS has encouraged interaction between fellow students. We can communicate, discuss, and support each other through features such as discussion forums and shared challenges. We can also see the activities and achievements of our friends on the leaderboard, which makes the competition and collaboration even more enjoyable.	Yes, I felt more interaction with fellow students after using gamified LMS. Gamification elements, such as leaderboards and shared challenges, encourage us to interact and work together. Seeing the achievements of our friends on the leaderboard is also an additional motivation to interact and achieve better results together.	I see an increase in collaboration between students. They support each other and discuss in forums, to achieve better results. The gamification element in the LMS provides an engaging and interactive context for collaboration, which increases the sense of ownership and team spirit among students.	In my experience, Gamified LMS has helped build high engagement and increased student interaction. They feel more involved in learning and have more opportunities to interact with fellow students. It increases their motivation and creates a more dynamic and collaborative learning environment.
4	Do you have any suggestions or feedback regarding using Gamified LMS in online learning?	So far, I am delighted with the use of Gamified LMS. However, I wish there was more variety in the gamification elements offered. For example, maybe more types of achievements or challenges can be added that can trigger our motivation and engagement. In addition, there may be an option to interact more with lecturers or material experts through more active discussion or feedback features.	Apparent socialization and guidance are needed so students can use gamified LMS features well. In addition, it is essential to provide constructive feedback, to help students self-evaluate and improve the quality of their learning.	Sometimes, some students feel that it is unfair because of differences in accessibility. Therefore, ensuring that all students have an equal opportunity to earn points and achieve achievements is essential. Second, involving students in the gamified LMS development process is essential. Feedback on user experience can help improve the effectiveness of Gamified LMS.	Need to provide adequate training and support to lecturers and students in using Gamified LMS. Comprehensive training will help lecturers understand how to integrate gamification elements into their teaching best, while students will need guidance and support in using gamified LMS effectively.

V. Discussion

In this study, a gamified LMS has been developed to increase student engagement in the online learning environment. The design of the instructions drew from relevant theories of online learning and the use of game elements to boost student engagement. Game elements were incorporated to create a gamified learning experience that captivated students' interest and fostered a sense of achievement. The instructions were implemented through an online Learning Management System (LMS). The game elements were seamlessly integrated into the LMS platform, ensuring convenient access and navigation for students. Pilot studies were conducted to gather valuable student feedback regarding their experiences with the gamified instructions. This feedback formed the basis for continuous improvement and refinement of the instructions. Insights gained from these pilot studies prompted necessary modifications to address any identified challenges or limitations, ensuring the instructions aligned with students' needs and preferences. By emphasizing the design and performance of the instructions, the research illustrates the potential of gamified learning in enhancing student engagement within an online learning environment.

The results showed that using gamification elements, such as badges, challenges, and leaderboards, significantly positively impacted student engagement in the online learning process. Implementing badges, which students could earn upon achieving specific milestones or demonstrating proficiency in certain areas, provide a tangible representation of their progress and accomplishments. This visual recognition incentivized students to actively participate in learning activities as they strive to attain and showcase their badges, increasing their engagement and motivation.

Moreover, including challenges within the gamified LMS stimulated students' critical thinking and problem-solving abilities, it is following the results of Giráldez's research [22]. By presenting them with thought-provoking tasks and real-world scenarios, the challenges fostered active learning and encouraged students to apply their knowledge in practical contexts. This resulted in heightened levels of engagement, as students were motivated to overcome the challenges and attain a sense of accomplishment.

The integration of leaderboards further contributed to enhancing student engagement. By displaying the rankings

and achievements of learners, the leaderboards created a healthy competitive environment, spurring students to strive for excellence and outperform their peers [16]. This social element increased engagement and facilitated collaboration and peer interaction as students shared strategies, provided support, and celebrated each other's successes.

The study also revealed that students who use gamified LMS have higher participation rates in online discussions. They actively contribute to sharing ideas, exchanging opinions, and responding to classmates' questions or thoughts [37]. In addition, students who use gamified LMS also tend to collaborate more actively with classmates on group assignments. They use the collaborative features provided in gamified LMS to share information, solve problems, and achieve common goals [30].

The results also revealed that gamified LMS students further deepen their understanding of the learning material. Through the challenges presented in the gamified LMS, students are encouraged to explore the content more deeply, complete more challenging tasks, and achieve higher levels of achievement. It enables students' intrinsic motivation to learn and increases their understanding of the learning material. Additionally, the results indicated that using a gamified LMS increased student engagement and facilitated a deeper understanding of the learning material. The challenges presented within the gamified LMS encouraged students to delve more profoundly into the content, pushing them to tackle more intricate tasks and attain higher levels of achievement.

As additional information, the number of gamified LMS users per day, comments on discussion forums, and students sharing information on gamified LMS is more than Non-gamified LMS. This indicates the high student engagement in gamified LMS.

This study proves that gamified LMSs are worth developing and implementing in an online learning environment. Using gamification elements in an LMS can increase student engagement, encourage active participation, and deepen their understanding of the learning material. Thus, the development of gamified LMS can be an effective strategy to enhance online learning and create a more engaging and meaningful learning experience for students.

VI. Conclusion

The results of this study show that gamified LMS can increase student engagement in the online learning environment. It confirms that gamification elements such as rewards, challenges, and leaderboards can motivate students to participate more actively in learning. In addition, using gamified LMS can also increase student activeness in participating in discussions, collaborating with classmates, and deepening their understanding of learning materials.

Overall, this research contributes to the development of gamified LMS in Indonesia and provides insight into the effectiveness of gamification in increasing student engagement in online learning. Hopefully, this research can be a valuable resource for educators who want to incorporate gaming elements into online learning to increase student motivation and engagement. This research shows that there are obstacles to the use of gamified LMS. Among them are technical limitations in using gamified LMS, internet connection, and lack of policy support.

In developing a gamified LMS, it is necessary to pay attention to the characteristics and needs of students and features that can increase engagement and interaction in online learning. Further research is needed to explore the effectiveness of gamified LMS in different contexts and with diverse student populations and investigate the long-term effects of gamified learning on student learning outcomes. By addressing these research gaps, educators and instructional designers can make informed decisions about gamified LMS design, implementation, and optimization. Additionally, policymakers can use evidence-based findings to inform educational policies and practices related to the integration of gamification strategies in online learning environments.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

S. Subiyantoro conducted the research and wrote the paper; I.N.S. Degeng and D. Kuswandi analyzed the data; S. Ulfa proofread and finalized the article. All authors had agreed and approved the final version.

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