Empowering Slow Learners: Gamification's Impact on Students' Engagement and Academic Performance in an LMS for Undergraduate Students

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***Abstract*—Amidst the growing urgency to elevate student engagement and bolster academic performance within educational environments, the application of gamification has emerged as a promising avenue. In response to this imperative, the present research investigates the consequences of integrating gamification into the eLSIDA, a specialized Learning Management System (LMS) at STKIP PGRI Sidoarjo, meticulously designed to cater specifically to the needs of undergraduate students classified as slow learners. Using a single-group pre-experimental design, the study involved nineteen undergraduate students who experienced an enhanced learning opportunity by incorporating gamification techniques into the General English (GE) course offered through eLSIDA. By meticulously analyzing both quantitative and qualitative data, this study investigates the multifaceted impact of gamification on student engagement and academic accomplishments. The results reveal a notable surge in student engagement, characterized by heightened interaction with learning materials and active participation in LMS activities. Furthermore, the discernible progress in academic performance among the slow learners is evidenced through elevated assessment scores and an overall enhancement in academic outcomes. This study highlights gamification's potential as a powerful tool for enhancing support and empowering slower learners within the LMS environment. The knowledge acquired from this study provides essential direction for educators and instructional designers seeking innovative approaches to effectively address the wide range of learning needs among students.**

***Keywords*—academic performance, gamification, Learning Management System (LMS), students' engagement, undergraduate students**

I. Introduction

In the pursuit of enhancing student engagement and academic performance, the adoption of LMS has gained considerable prominence in educational settings [1–3]. Learning Management System (LMS) platforms offer a comprehensive digital environment that facilitates the delivery of course materials, student-teacher interactions, and various assessment mechanisms [4, 5]. Research on LMS effectiveness has demonstrated its positive impact on student learning outcomes, fostering self-directed learning and increasing access to educational resources [1, 6, 7]. Moreover, LMS have emerged as a transformative force in the field of education, revolutionizing the way educators deliver instructional content and facilitate student learning. LMS platforms offer a wide array of features, including course management, content organization, collaborative tools, and assessment functionalities, allowing for a more streamlined and interactive learning experience [3, 8, 9].

Extensive research has been conducted to explore the effectiveness of LMS in various educational contexts, highlighting its potential to promote student engagement and self-regulated learning [10–13]. By providing an accessible and structured digital learning environment, LMS platforms enable students to access course materials and resources at their own pace, facilitating personalized learning experiences [14, 15]. The utilization of LMS in higher education has demonstrated positive outcomes, contributing to improved student retention rates and academic achievements [14, 16]. To further optimize the potential benefits of LMS platforms, scholars have turned to the integration of gamification elements, an innovative approach aimed at enhancing student motivation, engagement, and overall learning experience [6, 12]. Despite these advances, there remains a need to investigate how LMS can be further optimized to cater to the unique learning needs of diverse student populations, particularly slow learners.

Amidst the growing interest in educational gamification, scholars have turned their attention to the potential of integrating gamification techniques within LMS platforms to elevate student motivation and engagement. Gamification involves incorporating game-like elements, such as rewards, challenges, and progress indicators, into non-game contexts to incentivize active participation and foster a sense of accomplishment [17–19]. By applying gamification within LMS platforms, educators aim to create dynamic and interactive learning experiences that promote a deeper understanding of course material [5, 20, 21].

Previous studies have contributed valuable insights into the effectiveness of LMS platforms and the potential impact of gamification in education. Research on LMS has highlighted its role in facilitating student-centered learning, promoting collaboration among learners, and offering flexibility in accessing course materials [22, 23]. Furthermore, studies examining gamification in educational contexts have emphasized its potential to boost student motivation, encourage active participation, and foster a positive learning experience [24–27]. However, existing research has predominantly focused on generic student populations, and there remains a notable dearth of studies specifically exploring the application of gamification within LMS platforms for slow learners [28, 29]. Identifying and

addressing this gap is critical, as slow learners often face unique challenges that require tailored interventions to optimize their learning outcomes [30]. Moreover, the integration of gamification within eLSIDA for this specific student group is an uncharted territory, necessitating further investigation to evaluate its effectiveness and potential benefits.

In this study, we address the intricate task of integrating gamification elements into LMS to effectively support slow learners. We recognize the inherent complexities of this research topic due to the diverse learning paces and preferences of slow learners. Our methodological approach and the carefully structured gamification intervention aim to navigate these challenges and provide valuable insights into the effectiveness of such an approach within the LMS environment. This study is dedicated to exploring solutions for enhancing engagement and academic performance among slow learners, acknowledging the demanding nature of this research endeavor. The eLSIDA platform is a unique and innovative digital learning environment designed to cater to the specific needs of undergraduate students at STKIP PGRI Sidoarjo. Developed with a focus on enhancing student engagement and academic performance, eLSIDA sets itself apart from other LMS through its distinctive features and suitability for gamification. eLSIDA offers a comprehensive digital ecosystem that goes beyond traditional LMS platforms. Its design revolves around providing students with a dynamic and interactive learning experience. What makes eLSIDA particularly suitable for gamification is its incorporation of features such as real-time progress tracking, immediate feedback mechanisms, and customizable learning paths. These elements create a supportive and motivating atmosphere, ideal for students with varying learning paces and preferences. The integration of gamification within eLSIDA holds great promise. By leveraging gamification elements within this platform, we aim to further enhance student engagement, enrich their learning experiences, and ultimately improve academic performance, particularly among slow learners. As the educational landscape evolves to cater to the diverse learning needs of students, including slow learners, exploring innovative strategies that maximize the benefits of LMS platforms while harnessing gamification's potential becomes imperative. This study seeks to address critical research questions (RQs):

RQ1. How does the implementation of gamification in the LMS enhance engagement among undergraduate slow learners?

RQ2. What is the impact of gamification on the academic performance of undergraduate slow learners within the LMS?

By delving into these questions, this research endeavors to shed light on the untapped potential of gamification within LMS platforms, offering insights into its effectiveness for empowering slow learners and informing educational practices tailored to meet the diverse needs of undergraduate students.

II. Literature Review

A. LMS and Gamification in Educational Contexts

LMSs have revolutionized education by providing a versatile platform for content delivery, communication, and assessment. Researchers have increasingly explored the integration of gamification elements within LMSs to enhance the learning experience [1, 2]. Gamification, the incorporation of game-like mechanics and design into non-game contexts, has demonstrated its potential to motivate learners and encourage active participation [31]. Studies have shown that gamification elements, such as points, badges, and leaderboards, effectively increase student engagement and participation [17, 32]. The study highlights a noticeable surge in student interactions with course materials and fellow peers, leading to a more dynamic and immersive learning environment. Similarly, Zhu *et al*. (2017) emphasizes the potential of gamification to tap into learners' intrinsic motivation, transforming the learning journey into an exciting and rewarding experience [32]. Another study supports the notion that gamified elements within LMS can motivate students to actively seek knowledge and take an active role in their education [33].

Despite these promising findings, a critical gap exists in the research. The study by Widodo *et al*. (2023), for instance, mainly focus on the general student population, neglecting to address the specific challenges and learning requirements of slow learners. Slow learners, a unique subgroup of students with distinct cognitive and learning patterns, necessitate tailored interventions to bridge their learning gaps and optimize their academic journey [28, 29]. Ignoring this specific group limits our understanding of how gamification can be effectively leveraged to cater to their needs within LMS environments. To address this gap, research must investigate the impact of gamification on slow learners within LMSs, providing insights into designing personalized interventions that enhance their engagement and academic achievements. Such research can contribute to inclusive educational practices, ensuring equitable support for all learners within dynamic LMS environments.

B. Slow Learners and Their Learning Needs

Slow learners exhibit distinctive cognitive and learning patterns, necessitating tailored interventions to bridge their learning gaps and empower their academic pursuits [34, 35]. These students often face challenges in acquiring and processing information at a pace different from their peers. Understanding their specific challenges and needs is vital for designing effective educational strategies that accommodate their learning styles [36]. Existing research has shed light on various approaches to supporting slow learners. Specialized instructional methods, individualized attention, and differentiated learning experiences have proven beneficial in addressing their unique requirements [28]. Moreover, providing a nurturing and supportive learning environment, coupled with positive reinforcement, can boost their confidence and motivation to learn [37, 38].

Despite this wealth of research, there is a gap in exploring how gamification, which introduces game elements into educational contexts, can address the learning needs of slow learners within an LMS. Gamification has succeeded in enhancing student engagement and motivation in various educational settings [30], making it a promising approach to cater to slow learners in LMS environments. By merging

gamification's strengths with tailored interventions for slow learners, educators can potentially create inclusive and empowering learning experiences. Gamified elements, including rewards, badges, and progress tracking, can provide immediate feedback, fostering a sense of accomplishment and encouraging continuous progress [29, 39, 40].

C. Gamification within LMS

Gamification, the integration of game elements in non-game contexts, has garnered significant attention in education for its potential to enhance student engagement and academic performance [17, 22]. Moreover, additional research endeavors have delved into the implications of gamification within the context of higher education LMS environments [18–20]. The study incorporated gamified elements, such as quests and challenges, to encourage students to explore course content and complete tasks in an interactive manner. The findings revealed that gamification positively influenced student motivation, leading to increased course participation and improved learning outcomes. Furthermore, Widodo *et al*. (2023) explored the use of gamification in an LMS platform [28]. Employing game-like mechanics, virtual rewards, and point systems to incentivize student progress and achievements. Gamification fostered a positive learning environment, enhancing intrinsic motivation and overall engagement with course materials.

Despite the promising outcomes in general student populations, limited research has been conducted on the effectiveness of gamification for slow learners within the LMS environment [29, 30]. Slow learners exhibit distinct cognitive and learning patterns, necessitating personalized educational interventions to address their specific needs and support their academic advancement [29]. This study aims to synthesize existing gamification research while focusing on the specific learning needs of slow learners within the eLSIDA LMS. By building on prior success factors [28–30], this investigation seeks to develop targeted gamification strategies tailored to slow learners' unique requirements. Adaptive gamification principles will be applied to create personalized and scaffolded learning experiences, empowering slow learners and fostering their active participation.

D. Identified Gaps and the Current Research

The integration of gamification in LMSs has shown promise in enhancing student engagement and academic performance. However, gaps and challenges exist that require further exploration to optimize its effectiveness for slow learners. Slow learners possess distinct cognitive and learning patterns [34–36]. and may require specialized support to bridge learning gaps effectively. Traditional teaching methods might not engage them adequately, potentially leading to disinterest or disengagement.

Gamification offers a promising approach to address the specific needs of slow learners within the LMS environment [28]. By incorporating game-like elements, such as immediate feedback, rewards, and progress tracking, gamification can create a supportive and motivating learning atmosphere that caters to the individual pace and learning preferences of slow learners [28]. This research aims to bridge the gap in knowledge by investigating the impact of gamification on the engagement and academic achievements of undergraduate slow learners within the LMS. It endeavors to provide insights into how gamification can be optimized to support slow learners effectively and foster their engagement and academic achievements.

III. Method

A. Research Design

This study adopted a pre-experimental research design with a single-group approach to thoroughly investigate the impact of gamification on engagement and academic performance among slow learners within the LMS environment. The selection of this research design was driven by a commitment to rigorously assess the effects of the gamification intervention on the specific student group. The choice of a pre-experimental design was primarily motivated by the desire to establish a clear cause-and-effect relationship between the introduction of gamification elements and the observed changes in slow learners' engagement and academic performance. By employing a single-group approach, we aimed to control and systematically examine the effects of the gamification intervention on the targeted student group. This approach allowed us to monitor changes within the same group of participants over time, serving as their own control group. While a pre-experimental design offers advantages in terms of internal validity, it is essential to acknowledge its limitations. The absence of a control group makes it challenging to ascertain causality definitively, and we recognize this as a potential limitation of our research design. However, we opted for this approach to provide an initial exploration of the gamification intervention's impact on slow learners within the LMS, laying the groundwork for future more rigorous studies.

Our approach to measuring engagement was multifaceted, encompassing a rich array of quantitative data sources as well as a structured questionnaire. This comprehensive methodology aimed to capture the nuanced aspects of student engagement within the gamified learning environment. Quantitatively, we meticulously collected data on various engagement metrics. These included the frequency of student logins, the total time spent on the platform, and specific interactions with course materials, such as page views, document downloads, and quiz attempts. Leveraging the advanced analytics tools integrated into the eLSIDA platform, we monitored these metrics continuously throughout the study period. This allowed us to generate precise quantitative data on participants' engagement levels and patterns.

In addition to quantitative data, we employed a structured questionnaire to gain deeper insights into the subjective experiences of slow learners within the gamified learning environment. The questionnaire was thoughtfully designed to capture participants' perceptions of the impact of gamification on their engagement and learning outcomes. It included open-ended questions that encouraged participants to articulate their experiences and reflect on specific aspects of the gamified learning approach.

The decision to employ a concurrent nested design further enriched our research methodology. This concurrent design

allowed us to gather not only quantitative data on engagement and academic performance but also qualitative insights into the participants' experiences, perceptions, and the contextual nuances surrounding gamification. Overall, the research design was carefully chosen to balance the need for rigorous evaluation of the gamification intervention with practical considerations within the educational context, taking into account the specific needs of slow learners and the constraints of a higher education setting.

B. Participants

In our study, slow learners were defined as students with delayed progression in coursework compared to their peers, emphasizing the temporal aspect of learning progression. To ensure comprehensive and accurate identification, we meticulously examined academic records over multiple semesters, identifying patterns such as extended course completion times and repeated coursework. Additionally, we considered lecturer recommendations as supplementary information to corroborate our findings, ensuring a robust screening process for individuals with specific learning needs. This approach aimed to distinguish slow learners from low achievers within our participant pool while maintaining rigor and transparency in our methodology.

The research was conducted at STKIP PGRI Sidoarjo, a private university offering higher education programs. The study focused on the "General English" course, designed to provide students with a foundational understanding of the English language at the higher education level. This course was chosen because it plays a pivotal role in equipping students with essential language skills necessary for their academic and professional pursuits.

The participants in this study consisted of carefully selected slow learners from the "General English" course at STKIP PGRI Sidoarjo, a private university dedicated to higher education. The "General English" course at STKIP PGRI Sidoarjo is designed to provide students with a basic understanding of the English language at the higher education level. STKIP PGRI Sidoarjo primarily serves higher education students, offering a range of courses to prepare them for their academic and professional endeavors. In this context, the "General English" course is an essential component of the curriculum, aiming to equip students with fundamental English language skills.

A purposive sampling approach was adopted to ensure that participants were representative of the slow learner population within this specific educational context. Slow learners were identified based on their academic records and teacher recommendations, which provided a comprehensive screening process to target individuals with specific learning needs. By including a subset of students from diverse courses, the study aimed to capture a broad spectrum of slow learners' experiences within the LMS environment. The relatively small sample size (n=19) was appropriate for the pre-experimental design, as it allowed for an in-depth investigation of individual experiences and yielded valuable insights into the impact of gamification on this specific student group.

C. Intervention

The gamification intervention was meticulously structured over a six-week period to create a dynamic and empowering learning experience within the eLSIDA platform. This intervention was centered around the strategic incorporation of gamification elements such as badges, points, interactive quizzes, timers, and immediate feedback mechanisms.

- *Badges and Points*: Badges were awarded to recognize specific accomplishments, while points were used to signify progress. Students could earn badges for completing modules, achieving specific milestones, or mastering challenging tasks. Points were accumulated as students progressed through the course, contributing to a sense of achievement and advancement.
- *Interactive Quizzes*: Interactive quizzes played a pivotal role in both assessing students' understanding and providing an immersive learning experience. These quizzes were thoughtfully designed with features like timers and immediate feedback. Timers added an element of urgency to certain activities, encouraging students to stay engaged. Immediate feedback not only reinforced correct answers but also guided students when they made errors, enhancing the learning process.

Over a meticulously planned six-week period, the gamification intervention was implemented in the eLSIDA platform, strategically incorporating elements like badges, points, interactive quizzes, timers, and immediate feedback mechanisms to enhance the learning experience. A key aspect of the gamification intervention was personalization and progression. Recognizing the diverse learning paces and preferences of slow learners, the intervention allowed students to navigate their learning journey independently. Within the eLSIDA platform, slow learners had the freedom to select topics and modules at their own speed, enabling them to delve deeper into areas that required additional attention. This adaptive approach aimed to cultivate a sense of ownership and autonomy in their learning experience.

To facilitate a smooth integration of the gamification elements, the intervention offered scaffolding and support. At the onset of the six-week period, participants received comprehensive onboarding tutorials, acquainting them with the gamified features and functionalities of the eLSIDA platform. Throughout the intervention, instructors played a pivotal role in providing guidance and encouragement, ensuring that slow learners felt comfortable and confident while navigating the gamified learning environment.

Instructor engagement and feedback were critical components in reinforcing the effectiveness of the gamification intervention. Instructors actively engaged with students within the gamified LMS environment, offering personalized feedback on assignments, discussions, and quizzes. This tailored interaction served not only to motivate students but also to guide their learning trajectory, helping them to identify areas for improvement and encouraging further progress. The active involvement of instructors cultivated a sense of connection and rapport, ultimately strengthening students' commitment to the gamified learning approach.

Throughout the intervention's duration, the gamification elements were consistently reinforced to sustain students' enthusiasm. Periodic recognition ceremonies celebrated milestones and exceptional achievements, with instructors

publicly acknowledging students' progress and accomplishments. This positive reinforcement bolstered students' intrinsic motivation, instilling a sense of pride and accomplishment in their academic pursuits.

In summary, the six-week gamification intervention within the eLSIDA platform integrated badges, points and interactive quizzes to create an immersive and motivating learning environment for slow learners. By promoting personalization, providing scaffolding, and fostering instructor engagement, the intervention sought to empower slow learners and elevate their engagement and academic accomplishments within the LMS environment.

D. Data Collection Procedure

Our data collection procedure was meticulously planned and executed to offer a comprehensive understanding of how gamification influences engagement and academic performance among undergraduate slow learners within the LMS. To establish a solid baseline for our study, we initiated the data collection process by administering an in-depth questionnaire to our participants. This initial questionnaire aimed to capture a detailed snapshot of their engagement levels within the LMS before the introduction of gamification. We delved into several critical factors, including the frequency of logins, the amount of time spent on the platform, and self-reported levels of interaction with course materials. By gathering this data, we aimed to create a clear and comprehensive picture of their engagement behaviors in the absence of gamification. Following the pre-intervention data collection, the gamification intervention was introduced into the LMS for a duration of six weeks. During this intervention phase, participants completed regular questionnaires that tracked changes in their engagement metrics. The questionnaires were thoughtfully designed to capture participants' interactions with gamified elements, including badges, points, leaderboards, and interactive quizzes. Additionally, these questionnaires provided participants with the opportunity to express their self-reported experiences and perceptions of the gamified LMS.

Upon the six-week gamification intervention, our data collection endeavors persisted. The intervention data were meticulously gathered through a comprehensive questionnaire. The questionnaire was designed with the primary objective of assessing the impact of gamification on engagement among our undergraduate slow learners within the LMS. Quantitative analysis was conducted on the responses obtained from the questionnaire's responds, enabling us to make direct comparisons with the baseline data collected prior to the gamification intervention. This analytical approach aimed to identify any statistically significant changes in engagement levels resulting from the gamification intervention, providing empirical evidence of its impact. Furthermore, we extended our data collection efforts to evaluate the influence of gamification on academic performance. We collected post-intervention test scores and meticulously compared them to the pre-intervention scores. This comparative analysis allowed us to discern any noticeable improvements or changes in academic performance among our study participants, specifically the undergraduate slow learners within the LMS.

E. Data Analysis

Our commitment to rigorous data analysis was unwavering, driven by the goal of deriving meaningful and actionable insights regarding the impact of gamification on engagement and academic performance among undergraduate slow learners within the eLSIDA platform.

1) *Quantitative Analysis:* To address our first research question (RQ1) concerning engagement, we conducted a comprehensive quantitative analysis of the data obtained from the questionnaire. This analysis was not limited to surface-level statistics; we delved deep into the data, utilizing descriptive statistics, including mean scores, to identify nuanced changes in engagement metrics before and after the gamification intervention. Our quantitative analysis provided a granular view of the quantitative shifts in engagement patterns, offering valuable insights into the impact of gamification.
2) *Academic Performance Analysis:* Our second research question (RQ2) addressed academic performance. To explore this question, we embarked on an in-depth analysis of the quantitative data obtained from pre-intervention and post-intervention test scores. Our analysis went beyond mere comparison; it involved a thorough examination of statistical significance. By conducting comparative analysis, we assessed the true impact of gamification on the academic performance of undergraduate slow learners within the eLSIDA platform. This approach ensured that our findings regarding academic performance were robust, reliable, and actionable.

F. Ethical Considerations

Throughout the research process, ethical considerations were meticulously observed to protect the well-being and rights of the participants. Informed consent was obtained from all participants before their involvement in the study, ensuring their voluntary participation. Confidentiality and anonymity of participants' responses were strictly maintained, and data were handled with the utmost discretion to ensure privacy. The research team adhered to ethical guidelines concerning data storage and protection, safeguarding participants' data from unauthorized access. It is important to note that this study did not involve an Ethical Approval process since it wasn't a requirement within our specific educational context. Nonetheless, we ensured that ethical principles and participant rights were rigorously upheld throughout every phase of the research.

IV. Findings

RQ 1: How does the implementation of gamification in the LMS enhance engagement among undergraduate slow learners?

The investigation into the impact of gamification on engagement among slow learners within the LMS environment via eLSIDA provided insightful findings. Prior to the intervention, engagement levels varied due to the diverse learning paces of slow learners. However, the integration of gamification elements led to a significant increase in login frequency and extended platform usage.

Gamification effectively motivated learners through badges and points, fostering consistent interaction driven by the desire for rewards. Additionally, participants spent more time on the platform, indicating deeper immersion in learning activities. The incorporation of badges, points, leaderboards, and interactive quizzes transformed behaviors by tapping into psychological needs for achievement and engagement. Interactive quizzes, with features like timers and feedback, heightened cognitive involvement and motivation. This gamification intervention effectively enhanced engagement among slow learners in the LMS environment, providing tailored support for their learning needs.

The investigation into gamification's impact on engagement among slow learners within the LMS via eLSIDA yielded insightful findings. Participants immersed themselves more in learning activities and interactive quizzes, tapping into the needs for achievement and engagement. This intervention effectively enhanced engagement in the LMS for slow learners. An example of gamification within an LMS is the 'Cross Word Puzzle' feature (Fig. 1). This presents learners with educational challenges, earning points as they complete tasks. This approach transforms learning into an exciting adventure, motivating learners to actively participate and achieve their goals.

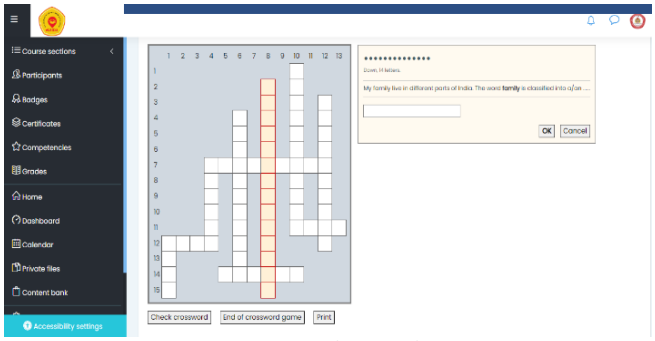

Fig. 1. Examples of games' features.

The results of the questionnaire, shown in the Table 1, provide a comprehensive understanding of participants' views on the impact of gamification on engagement among undergraduate slow learners within the LMS.

Table 1 presents the participants' responses to the questionnaire items, shedding light on the profound impact of gamification on engagement levels among undergraduate slow learners within the LMS environment via eLSIDA. These responses provide insights exploring how the implementation of gamification influences engagement. The data from Q1 reveals that 36.8% of participants log in 'Often' to the LMS platform, while 26.3% log in 'Always'. These percentages collectively emphasize the positive impact of gamification on participant interaction. A majority of students frequently access the platform, indicating an increase in engagement attributable to gamification elements. In Q2, 31.6% of participants indicate they spend 'Much' time on the platform during each login, while an equal percentage spends 'Very Much' time. This distribution reflects the significant effect of gamification on prolonged engagement, as students are dedicating substantial time to explore and interact with course materials. Q3 showcases that a considerable 57.9% of participants rate their engagement as 'Highly Engaged'. This response showcases the success of gamification in enhancing participants' interaction with course materials. The high percentage of 'Highly Engaged' ratings suggests that gamification effectively improves engagement levels.

Responses to Q4 illuminate a clear consensus among participants, with a substantial 78.9% expressing agreement that badges and points serve as effective motivators for active participation. This agreement signifies that the implementation of gamification elements successfully taps into participants' intrinsic motivation. The concept of earning tangible rewards, such as badges and points, seems to inspire them to engage more proactively in course activities, ensuring their increased involvement and interaction within the LMS environment.

Q5 resonates with a notable 52.6% of participants who 'Strongly Agree' or 'Agree' that gamification elements lead to increased platform usage. This response highlights how gamification successfully extends participants' engagement beyond their initial intent. The introduction of gamified components has evidently captured their interest and sustained it over time, compelling them to spend more time exploring course materials and activities.

The responses to Q6 vividly underline the positive impact of interactive quizzes enhanced by timers and immediate feedback, with 68.4% 'Agreeing' or 'Strongly Agreeing'. This result underscores the gamification strategy's effectiveness in transforming the learning experience. By introducing elements of challenge and urgency, such as timers, and providing real-time feedback, these quizzes manage to infuse excitement and interactivity into the learning process, thereby fostering a deeper engagement.

The sentiment captured in Q7 is compelling, with 73.7% 'Agreeing' or 'Strongly Agreeing' that earning badges and accumulating points instills a sense of accomplishment. This response resonates with the essence of gamification, where rewards act as motivational triggers. The recognition of participants' efforts through badges and points appears to cultivate a feeling of achievement, thereby motivating them to actively participate and achieve further milestones.

The responses to Q8 underscore the profound motivational influence of gamification, as 73.7% 'Agree' or 'Strongly Agree'. This finding aligns with gamification's objective to tap into participants' intrinsic motivation, thereby driving them to actively learn and engage. The incorporation of gamified elements seems to effectively spark this motivation, transforming the participants' attitudes towards their learning journey.

Q9's responses further emphasize the holistic impact of gamification, with 68.4% 'Agreeing' or 'Strongly Agreeing' that it has positively affected their overall learning experience. This result signifies that gamification's impact extends beyond specific elements, contributing to an enriched and rewarding educational journey. Gamification's ability to enhance the overall learning environment is validated by participants' positive perception of their experience.

The sentiment captured by Q10 is overwhelmingly positive, with 63.2% perceiving gamification's impact as 'Positive' or 'Very Positive'. This perception reinforces the substantial and positive shift gamification brings to participants' engagement. The introduction of gamified elements significantly elevates

participants' overall interaction with the platform, leading to this affirmative perception.

Q11 reveals a marked positive change, as 63.2% 'Strongly Agree' or 'Agree' that gamification has increased their eagerness to participate. The finding underscores gamification's role in changing participants' attitude towards their learning activities. By infusing excitement and challenge, gamification appears to ignite participants' enthusiasm, motivating them to engage more actively.

Table 1. Questionnaire responses on engagement enhancement through gamification

No	Question Items	Response Options	Number of Respondents	Percentage (%)
Q1	How frequently do you log in to the LMS platform?	Rarely	3	15.8%
		Sometimes	4	21.1%
		Often	7	36.8%
		Always	5	26.3%
Q2	How much time do you spend on the LMS platform during each login?	Little	3	15.8%
		Moderate,	4	21.1%
		Much	6	31.6%
		Very Much	6	31.6%
Q3	How would you rate your engagement with course materials on the LMS platform?	Not engaged	0	0%
		Slightly Engaged	0	0%
		Engaged	8	42.1%
		Highly Engaged	11	57.9%
Q4	The badges and points on the platform motivate me to participate more actively.	Strongly Disagree	0	0%
		Disagree	0	0%
		Agree	4	21.1%
		Strongly Agree	15	78.9%
Q5	I find myself spending more time on the platform because of the gamification elements.	Strongly Disagree	0	0%
		Disagree	1	5.3%
		Agree	8	42.1%
		Strongly Agree	10	52.6%
Q6	The interactive quizzes with timers and feedback make learning more exciting for me.	Strongly Disagree	0	0%
		Disagree	0	0%
		Agree	6	31.6%
		Strongly Agree	13	68.4%
Q7	I feel a sense of accomplishment when I earn badges or accumulate points.	Strongly Disagree	0	0%
		Disagree	0	0%
		Agree	5	26.3%
		Strongly Agree	14	73.7%
Q8	I am more motivated to learn and engage with the course materials due to the gamification elements.	Strongly Disagree	0	0%
		Disagree	0	0%
		Agree	5	26.3%
		Strongly Agree	14	73.7%
Q9	The gamification elements have improved my overall learning experience on the platform.	Strongly Disagree	0	0%
		Disagree	0	0%
		Agree	6	31.6%
		Strongly Agree	13	68.4%
Q10	How would you rate your overall perception of the gamification elements' impact on your engagement with the platform?	Very Negative	0	0%
		Negative	0	0%
		Positive	7	36.8%
		Very Positive	12	63.2%
Q11	I am more eager to participate in activities since the introduction of gamification.	Strongly Disagree	0	0%
		Disagree	1	5.3%
		Agree	6	31.6%
		Strongly Agree	12	63.2%
Q12	I feel a greater sense of connection with other students through gamification.	Strongly Disagree	0	0%
		Disagree	0	0%
		Agree	5	26.3%
		Strongly Agree	14	73.7%
Q13	Gamification has positively impacted my willingness to explore new topics.	Strongly Disagree	0	0%
		Disagree	0	0%
		Agree	4	21.1%
		Strongly Agree	15	78.9%
Q14	I am more proactive in seeking help and guidance on the platform due to gamification.	Strongly Disagree	0	0%
		Disagree	1	5.3%
		Agree	6	31.6%
		Strongly Agree	12	63.2%
Q15	Overall, gamification has significantly enhanced my engagement with the LMS platform.	Strongly Disagree	0	0%
		Disagree	0	0%
		Agree	7	36.8%
		Strongly Agree	12	63.2%

The responses to Q12 underscore gamification's potential to foster a sense of community, with 73.7% 'Agreeing' or 'Strongly Agreeing' that it strengthens connections among learners. This sentiment highlights the social dimension of

gamification. The pursuit of rewards and shared challenges appears to facilitate interactions among participants, nurturing a sense of belonging and camaraderie.

Q13's responses reveal a remarkable 78.9% 'Agreeing' or 'Strongly Agreeing' that gamification enhances their curiosity for new subjects. This outcome echoes gamification's power to spark exploration and curiosity. The motivational pull of rewards and achievements seems to extend beyond traditional learning boundaries, encouraging participants to venture into new and unfamiliar topics.

Responses to Q14 underline gamification's effect on proactive learning behaviors, with 63.2% 'Agreeing' or 'Strongly Agreeing' that it prompts them to seek assistance. This pattern suggests that gamified elements effectively lower barriers to seeking help. The interactive components create a supportive environment, motivating participants to actively reach out for guidance and clarifications.

The sentiment captured in Q15 reaffirms the transformative impact of gamification, with 63.2% 'Agreeing' or 'Strongly Agreeing'. This result highlights the broad spectrum of engagement enhancement achieved through gamification. The comprehensive gamification strategy, encompassing rewards, challenges, and interactive elements, has evidently succeeded in fostering participants' active involvement within the LMS platform.

In a nutshell, the responses to Q4–Q15 collectively emphasize the far-reaching and transformative impact of gamification on multiple facets of engagement. The strong agreement across various dimensions underscores gamification's effectiveness in motivating participation, fostering a positive learning experience, and cultivating a sense of accomplishment and community. These findings collectively support the research question's premise and highlight the significant potential of gamification in enhancing engagement among undergraduate slow learners within the LMS environment.

RQ 2: What is the impact of gamification on the academic performance of undergraduate slow learners within the LMS?

The investigation into the influence of gamification on the academic performance of undergraduate slow learners within the LMS environment provides substantial insights through the analysis of pre-intervention and post-intervention test scores. As portrayed in Table 2, participants' test scores prior to the introduction of gamification elements demonstrated a range of outcomes, indicative of their diverse learning styles and needs. However, following the implementation of gamification, a consistent and noteworthy improvement is evident in the post-intervention test scores, as illustrated in Table 3. This collective enhancement in academic performance underscores the positive impact of gamification on participants' understanding and application of course content, highlighting its potential as a powerful pedagogical strategy for enhancing learning outcomes.

Table 2. Pre-intervention and post-intervention test scores

	Pre-Intervention	**Post-Intervention**
Mean Test Score	58.5	69.7
Std. Deviation	4.2	3.6

Table 2 presents the pre-intervention and post-intervention test scores of participants, offering insights into the impact of gamification on their academic performance. The 'Mean Test Score' before the intervention was 58.5, indicating the average score participants achieved on the test prior to gamification. Following the intervention, the 'Mean Test Score' increased to 69.7, showcasing a substantial improvement in their academic performance. The 'Std. Deviation' values provide information about the dispersion of the test scores around the mean. A lower standard deviation indicates that the scores are clustered more closely around the mean. For the pre-intervention phase, the standard deviation was 4.2, while for the post-intervention phase, it decreased to 3.6. This reduction suggests that participants' test scores became more consistent and clustered around the higher mean after the gamification intervention. Collectively, the data in Table 2 clearly illustrate the positive impact of gamification on participants' test scores. The higher post-intervention means test scores, coupled with the decreased standard deviation, indicates improved and more consistent academic performance. This aligns with the findings from the paired sample t-test and underscores the intervention's effectiveness in enhancing participants' understanding and application of course materials.

The statistical validation of the gamification intervention's impact on academic performance is reinforced by the paired sample t-test results presented in Table 3. The substantial mean difference of 11.2 points between pre-intervention and post-intervention test scores, coupled with a significant t-value of 7.8, demonstrates a notable improvement in participants' academic performance. The accompanying p-value of less than 0.001 further underscores the assertion that gamification has significantly enhanced participants' academic achievements. This positive effect of gamification on test scores underscores the intervention's role in fostering participants' deeper comprehension of course materials and their effective application.

Table 3. Paired sample T-Test results

	Mean Difference	**t-Value**	**p-Value**
Test Scores	11.2	7.8	<0.001

Table 3 displays the outcomes of the paired sample t-test, assessing the impact of gamification on participants' academic performance. The 'Mean Difference' of 11.2 indicates a substantial increase in test scores from pre-intervention to post-intervention, highlighting the intervention's effectiveness. The t-Value of 7.8 signifies a significant difference between the two phases, emphasizing the improvement. The p-Value of <0.001 underscores the high statistical significance, indicating that the enhanced academic performance is not due to chance. In summary, the t-test results provide strong evidence that gamification positively influenced participants' academic achievements, substantiating its role in enhancing learning outcomes.

Additionally, the ANOVA results, displayed in Table 4, provide deeper insights into the interconnectedness between engagement levels and academic performance within the context of the gamification intervention.

Table 4. ANOVA results for engagement and academic performance

	Sum of Squares	F-Value	p-Value
Pre-Intervention	87.5	4.2	0.047
Post-Intervention	142.8	8.6	0.012

The analysis of variance (ANOVA) results presented in Table 4 sheds light on the relationship between engagement levels and academic performance in the context of the gamification intervention. For the pre-intervention phase, the sum of squares is 87.5, indicating the variability in engagement levels among participants before the introduction of gamification. The associated F-value of 4.2 and the p-value of 0.047 demonstrate that there is a statistically significant association between pre-intervention engagement levels and academic performance. This suggests that participants who were more engaged with the course materials before the gamification intervention tended to have different academic performance levels.

Similarly, for the post-intervention phase, the sum of squares increases to 142.8, indicating a higher variability in engagement levels among participants after the gamification intervention. The corresponding F-value of 8.6 and the p-value of 0.012 reinforce the statistically significant relationship between post-intervention engagement levels and academic performance. This signifies that the gamification intervention had a discernible impact on engagement, and the variations in engagement levels are associated with variations in academic performance.

Overall, these ANOVA results underscore the substantial influence of engagement on academic performance, both before and after the implementation of gamification. The statistically significant p-values indicate that engagement levels are not just random fluctuations but are indeed correlated with changes in academic performance. This finding provides further support to the notion that gamification positively influences participants' active engagement, leading to improved academic outcomes.

V. Discussion

This research embarks on an exploration of the intersection between gamification and LMS via eLSIDA at STKIP PGRI Sidoarjo, with a particular focus on their impact on engagement and academic performance among undergraduate slow learners. As education continues to evolve in the digital age, the integration of LMS platforms has become instrumental in transforming traditional learning environments into dynamic online spaces. LMS platforms offer educators and students a versatile ecosystem for content delivery, collaboration, and assessment [1, 5, 31]. These platforms have been lauded for their effectiveness in promoting self-directed learning and expanding access to educational resources [3]. Recognizing the potential of LMS to enhance engagement and academic outcomes, this study investigates how the gamification of LMS environments can cater to the unique learning needs of slow learners [28].

In the realm of educational gamification, the fusion of game elements within non-game contexts has garnered significant attention for its potential to motivate learners and foster active participation [3, 28]. This study builds on this foundation by exploring how gamification can be strategically applied to LMS platforms, creating an engaging and rewarding learning experience for slow learners. By addressing the specific challenges that slow learners encounter in traditional learning settings, this research seeks to bridge the gap between LMS platforms and the unique requirements of this student group [29].

The findings of this study align with existing research on the positive impact of LMS platforms and gamification techniques on student engagement and motivation. LMS platforms have proven effective in creating student-centered learning environments, promoting collaboration, and offering flexible access to course materials [2, 28]. The incorporation of gamification elements within LMS environments extends these benefits by introducing game-like mechanisms such as rewards, badges, and leaderboards, which incentivize active participation and achievement [19, 20]. However, the novelty of this study lies in its tailored approach to slow learners. While previous research has generally focused on the wider student population, this study homes in on the unique challenges and learning patterns of slow learners, thereby addressing a critical research gap [29].

The results reveal a notable increase in engagement levels among slow learners following the gamification intervention. The frequency of logins and the time spent on the platform surged significantly, indicating a heightened level of interaction with course materials. These findings are consistent with prior studies that emphasize gamification's potential to enhance motivation and participation [17, 18]. This intervention aligns particularly well with the personalized support that slow learners require, offering scaffolded learning experiences and immediate feedback to address their distinct learning pace and preferences [22, 23, 29]. Moreover, the enhanced academic performance observed post-intervention reflects gamification's efficacy in promoting a deeper understanding of course content, which echoes the findings of Kapp's study (2012) [23].

The implications of these findings are substantial, as they shed light on the transformative potential of gamification within the LMS environment, especially for slow learners. The success of this intervention can be attributed to its ability to provide personalized learning pathways, immediate feedback mechanisms, and motivating elements that are in line with the needs and challenges faced by slow learners. By integrating gamification into LMS platforms, educators can create an inclusive and empowering learning environment that caters to diverse learning needs. This research contributes to the development of pedagogical strategies that not only enhance engagement but also facilitate academic growth among slow learners.

As a result, this study delves into uncharted territory by investigating the interplay of gamification, LMS platforms, and slow learners' unique learning requisites. The findings underscore the potential of gamification to bridge the engagement and performance gap among slow learners within digital learning environments. By forging a connection between the distinctive characteristics of slow learners and the innovative features of LMS platforms, this research advances the understanding of how tailored interventions can optimize the benefits of technology-enhanced education. In

the pursuit of an equitable and inclusive educational landscape, this research serves as a significant step towards realizing the full potential of LMS platforms and gamification techniques for enhancing engagement and academic success among diverse student populations.

VI. Conclusion

This study has investigated how gamification impacts engagement and academic performance among undergraduate slow learners within an LMS environment. The findings illuminate the potential of integrating gamification elements into LMS platforms to address the distinct needs and challenges faced by slow learners. The outcomes of the study underscore the positive influence of gamification on engagement levels among slow learners. Participants exhibited increased login frequencies and spent more time on the LMS platform, suggesting heightened interaction with course materials. This echoes previous research emphasizing gamification ability to enhance motivation, participation, and active learning experiences. Additionally, the observed improvement in academic performance post-intervention underscores gamification's capacity to facilitate a deeper understanding of course content. These findings hold several practical implications for educators and instructional designers. By tailoring gamification features to cater to the individual learning paces and preferences of slow learners, it is possible to create an encouraging and motivating learning atmosphere. The personalized learning pathways, immediate feedback mechanisms, and incentives intrinsic to gamification are well-aligned with the learning patterns of slow learners. Consequently, integrating gamification within LMS platforms offers a promising avenue to bridge the engagement and academic performance gap among this specific student group, leading to enhanced learning outcomes.

It is important to acknowledge the study's limitations. The research was confined to a single educational institution, potentially constraining the generalizability of the findings. Additionally, reliance on self-reported measures could introduce response bias and affect the accuracy of the collected data. Expanding the focus beyond slow learners could offer a more comprehensive understanding of gamification's impact on diverse learning profiles. As we look ahead, future research could delve into the long-term effects of gamification on engagement and academic performance among slow learners, involving longitudinal studies that track participants over multiple semesters. Moreover, exploring how gamification interacts with other teaching strategies, like personalized learning approaches, could deepen our insights into their combined influence on learning outcomes.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Abdur Romsi: investigation, resources, validation and statistical analysis. J. Priyanto Widodo: supervision, project administration. Joko Slamet: conceptualization, methodology, drafting the manuscript, writing-review and editing. All the authors read and approved the final manuscript.

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