

Mobile Seamless Learning to Mitigate Negative Effects in Gamification of Learning

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ABSTRAK

Rendahnya keterlibatan siswa dalam pembelajaran serta potensi dampak negatif dari gamifikasi dalam pendidikan menjadi tantangan utama dalam pengembangan media pembelajaran yang inovatif. Penelitian ini bertujuan untuk mengembangkan Mobile Seamless Learning yang secara efektif mengintegrasikan elemen gamifikasi untuk meningkatkan keterlibatan siswa sekaligus meminimalkan potensi dampak negatifnya. Penelitian ini menggunakan desain penelitian pengembangan dengan model Alessi & Trollip, yang mencakup tiga fase utama: perencanaan, desain, dan pengembangan. Subjek penelitian adalah 121 mahasiswa dari program studi teknologi pendidikan yang dipilih untuk mengevaluasi efektivitas aplikasi ini. Data dikumpulkan menggunakan lembar kuesioner, dan analisis data dilakukan dengan pendekatan deskriptif kualitatif dan kuantitatif untuk mengevaluasi persepsi dan umpan balik pengguna. Hasil penelitian menunjukkan bahwa aplikasi ini mendapatkan persepsi positif dari mahasiswa, terutama dalam hal kegunaan, kemudahan penggunaan, dan pengalaman belajar. Umpan balik dari pengguna menyoroti manfaat aplikasi dalam meningkatkan aksesibilitas, memantau kinerja belajar, memotivasi siswa, dan mendukung pembelajaran lintas perangkat secara seamless. Selain itu, aplikasi ini terbukti dapat menciptakan pengalaman belajar yang menarik dan efektif dengan fokus pada pengurangan risiko yang mungkin timbul dari penerapan elemen gamifikasi yang berlebihan. Simpulan penelitian ini menegaskan bahwa Mobile Seamless Learning yang dikembangkan tidak hanya mampu meningkatkan keterlibatan siswa, tetapi juga memberikan nilai tambah dalam mendukung proses pembelajaran berkelanjutan, sehingga layak digunakan sebagai media pembelajaran berbasis teknologi yang inovatif dan relevan di era digital.

ABSTRACT

Low student engagement in learning and the potential negative impacts of gamification in education are significant challenges in developing innovative learning media. This study aims to develop Mobile Seamless Learning that effectively integrates gamification elements to enhance student engagement while minimizing potential drawbacks. The research employed a development research design using the Alessi & Trollip model, which includes three main phases: planning, design, and development. The study participants consisted of 121 students from an educational technology program, selected to evaluate the application's effectiveness. Data were collected using questionnaires, and analyses were conducted using both qualitative and quantitative descriptive approaches to assess user perceptions and feedback. The findings indicate that the application received positive perceptions from students, particularly in terms of usability, ease of use, and learning experience. User feedback highlighted the application's benefits in improving accessibility, tracking learning performance, motivating students, and supporting seamless cross-device learning. Furthermore, the application successfully created engaging and effective learning experiences, focusing on mitigating risks associated with excessive gamification elements. The study concludes that the developed Mobile Seamless Learning not only enhances student engagement but also adds value by supporting continuous learning processes, making it a suitable and innovative technology-based learning medium in the digital era.

1. INTRODUCTION

The trend of learning technology, especially in the context of gamification, has gained significant momentum in recent years, significantly accelerated by the challenges posed by the COVID-19 pandemic. Learning technology has various benefits, such as increasing the accessibility of learning materials (Fauziah et al., 2021; Melda et al., 2021). The use of technology allows students to access learning resources. This makes it possible to learn anytime and anywhere, with the support of various digital platforms (Fauziah et al., 2021; Kimianti & Prasetyo, 2019; Melda et al., 2021; Wulandari et al., 2020). Technology also supports learning differentiation. Students with different needs can use devices that suit their learning style and pace. Technology also facilitates collaboration between students through online platforms, group discussions, or joint projects, which hone their social and communication skills. In addition, technology also enables more interactive and engaging learning (Alfadda & Mahdi, 2021; Dombrowski et al., 2018; Zaccoletti et al., 2020). For example, simulations and educational games are used. Gamification utilizes technological elements to increase student motivation and engagement in the learning process.

Gamification, which involves applying game design elements in non-game contexts, has emerged to increase student engagement and motivation in educational settings (Dewi et al., 2020; Redy & Ariningsih, 2020). This approach is not only about incorporating games into learning but rather leveraging game mechanics such as points, badges, and leaderboards to create a more interactive and enjoyable learning experience (Dewi et al., 2020; Febriansah et al., 2024; Lutfi, A. et al., 2021; Redy & Ariningsih, 2020). With the growing interest in innovative learning methods, gamification has emerged as an attractive solution to improve the effectiveness of education at various levels. Research suggests that integrating gamification into educational practices can lead to better learning outcomes and higher student motivation (Dewi et al., 2020; Redy & Ariningsih, 2020). Furthermore, studies have shown that gamification can transform traditional educational methods, making learning more dynamic and engaging and fostering a more conducive environment for knowledge acquisition (Febriansah et al., 2024; Lutfi, A. et al., 2021). This transformation is particularly relevant in distance and hybrid learning environments that have become prevalent due to the pandemic (Febriansah et al., 2024; Khuluq et al., 2023; Lutfi, A. et al., 2021).

However, the current problem is that accelerated learning in some fields is often considered difficult, especially for those without experience. Although many studies have shown that gamification can positively impact educational contexts, attention to the potential negative impacts of game design elements is still limited. Previous studies have identified that elements such as leaderboards, badges, and competitions are often associated with undesirable impacts, including decreased motivation, confusion in understanding the material, and even cheating among students (Ananda & Aliwijaya, 2023; Toda et al., 2018). For example, leaderboards can create excessive pressure on students, leading to feelings of insecurity and demotivation, especially for those in lower positions. In addition, poorly designed gamification elements can cause students to feel irrelevant to the subject matter, reducing their engagement in the learning process. Therefore, it is important to explore the challenges faced in implementing gamification and understand how these elements can affect the overall learning experience (Redy & Ariningsih, 2020; Wijaya et al., 2021). With a better understanding of potential adverse impacts, developers and educators can make more informed decisions in designing effective and enjoyable learning experiences.

Therefore, it is important to design effective and enjoyable learning activities. The right approach can motivate students and increase engagement in the learning process (Cigdem et al., 2024; Wardana & Sagoro, 2019). Given these challenges, alternative learning approaches such as Mobile Seamless Learning offer promising solutions that prioritize learner flexibility and autonomy. In the 21st century, the learning process that occurs naturally is further strengthened by technological developments such as smartphones that allow learning to take place anytime and anywhere without being bound by time and space (Chen et al., 2021; Efriyanti & Annas, 2020; Mirza et al., 2019). Mobile Seamless Learning (MSL) is a learning concept that utilizes mobile devices such as smartphones or tablets to create continuous and integrated learning experiences without being hindered by time or space constraints. Mobile Seamless Learning emerged as a learning model emphasizing continuity and continuity in the learning process, so it is important to design an effective learning environment to accommodate students' learning preferences and atmosphere (Moon et al., 2024; Ulfa et al., 2020). MSL combines formal and informal learning by allowing students to learn anytime and anywhere, inside and outside the classroom. Through mobile technology, students can access learning materials, interact with content, collaborate with classmates, and receive real-time feedback (Barrett et al., 2022; Moon et al., 2024; Ulfa et al., 2020).

Previous research findings state that mobile learning can facilitate students' learning (Lestari et al., 2019; Liando et al., 2022; Wangid et al., 2020). Other studies also state that well-designed mobile

learning can increase learning motivation and improve student learning outcomes (Astuti et al., 2017; Mabururi et al., 2019; Sambung et al., 2017). With this approach, students not only get easy access to learning resources but can also integrate knowledge gained from various contexts of everyday life into the learning process. There has been no study on smooth mobile learning to reduce the negative impacts of gamification on learning. Therefore, this study aims to develop an application that supports the Mobile Seamless learning approach and overcome impacts that may arise from gamification elements in education. This study contributes to the learning technology field by offering solutions that increase student motivation and engagement while reducing the negative impacts of gamification. In the increasingly common context of distance and hybrid learning, this research provides valuable insights for educators and app developers to create more inclusive and adaptive learning environments.

2. METHOD

This study uses a development research design. This study uses a development research design that aims to create and test a Mobile Seamless Learning application with a gamification approach. This approach was chosen to ensure that the application developed is innovative and effective in improving students' learning experiences. With a focus on sustainable development, this study seeks to produce relevant and applicable products in various educational contexts. The development model used in this study follows the stages initiated by Alessi and Trollip, which consist of three main phases: planning, design, and development. Each phase is accompanied by ongoing evaluation to assess the application's effectiveness and ease of use, as well as project management to ensure that the development process runs according to plan (Alessi & Trollip, 2001). With this approach, the resulting application will be able to meet user needs and provide a more enjoyable and interactive learning experience.

This study involved 121 students from the educational technology study program who had attended lectures for two semesters using the gamification method. The demographic characteristics of the participants included various educational backgrounds and experiences in using technology in learning contexts. The selection criteria for participants were based on their experiences in courses related to gamification-based learning activities so that they could better understand gamification. The method used to collect data was a questionnaire. The questionnaire method was used to collect research data on the Mobile Seamless Learning (MSL) application with a gamification approach because it can provide systematic and structured information regarding the application's experience, perception, and effectiveness from the user's perspective, in this case, students or learners. In the context of MSL research with gamification, the questionnaire was designed to identify how gamification elements (such as points, levels, challenges, or badges) affect the engagement, motivation, and learning outcomes of students who use mobile-based learning applications. The instrument used in collecting data was a questionnaire sheet. The questionnaire grid used is presented in Table 1.

Table 1. Grid of Questionnaires Used in the Research

No	Aspect	Indicator
1	Perceived Usefulness (PU)	PU1. Using Mumed App in your work will enable you to complete your product tasks faster? PU2. Using Mumed App will improve your product task completion performance? PU3. Using Mumed App in your work will increase your productivity? PU4. Using Mumed App will increase your effectiveness in doing your product tasks? PU5. Using Mumed App will make your work easier? PU6. Do you find the Mumed App useful in completing your product assignments?
2	Perceived Ease of Use (PEU)	PEU1. When you learned to operate the Mumed App, was it easy for you? PEU2. Will you find it easy to do what you want in the application? PEU3. After you feel, your interaction with the Mumed App is clear and understandable? PEU4. In your opinion, are you sure? Mumed App is clear and understandable? PEU5. Will it be easy for you to master using this Mumed App? PEU6. Do you think the Mumed App is easy to use?

The techniques used to analyze the data are qualitative and quantitative descriptive analysis. Qualitative descriptive analysis is used to manage data as input given regarding the Mobile Seamless Learning application with a gamification approach. Quantitative descriptive analysis is used to manage data in the form of scores given regarding the Mobile Seamless Learning application with a gamification approach.

3. RESULT AND DISCUSSION

Result

This study aims to develop an application that supports the mobile learning approach to seamless learning and addresses the possible impacts of gamification elements in education. This study contributes to the field of learning technology by increasing student motivation and engagement while reducing the negative impacts of gamification. The Mobile Seamless Learning Design Flow x Gamification Context is presented in Figure 1.

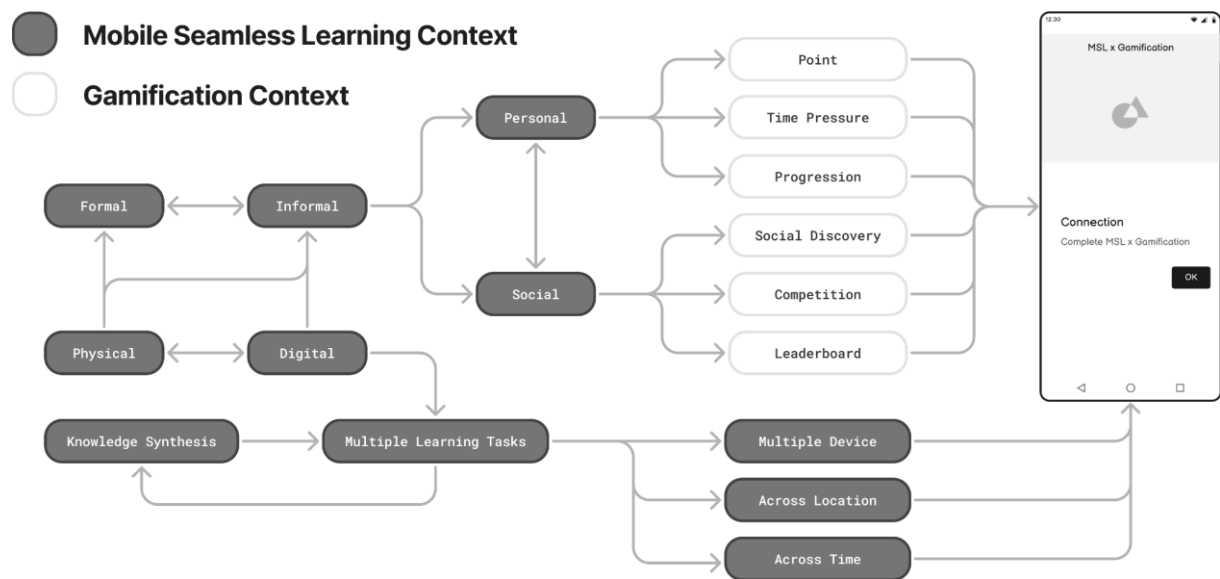


Figure 1. Design Flow of Mobile Seamless Learning x Gamification Context

The evaluation of the Mobile Seamless Learning application developed in this study was conducted after an 8-week implementation period. Data were collected using a questionnaire based on the Technology Acceptance Model (TAM) to assess user acceptance, focusing on perceived usefulness (PU) and perceived ease of use (PEU). Descriptive Statistics Of Perceived Usefulness (PU) showed in Table 2.

Table 2. Descriptive Statistics of Perceived Usefulness (PU)

Item	Mean	Standard Deviation	Response (Frequency)							Dominant response
			Strongly Disagree	Disagree	Somewh at disagree	Neutral	Somewh at agree	Agree	Strongly agree	
PU1	5.57	1.189	0	1	3	22	28	34	33	Agree
PU2	5.72	1.043	0	0	3	14	27	47	30	Agree
PU3	5.68	1.127	0	1	7	8	26	51	28	Agree
PU4	5.78	1.004	0	0	5	7	26	55	28	Agree
PU5	5.70	1.130	0	0	5	15	25	42	34	Agree
PU6	5.83	1.101	0	0	2	16	25	36	42	Strongly agree

The analysis of perceived usefulness (PU) revealed that participants generally rated the Mobile Seamless Learning application positively. The mean scores for the six items ranged from 5.57 to 5.83 on a 7-point Likert scale, indicating that most users found the application beneficial for enhancing their learning experience. Specifically, PU6 had the highest mean score of 5.83, with a significant number of participants indicating "Strongly Agree," suggesting that they found the application particularly useful in their studies. The majority of responses across all items leaned towards "Agree," indicating a strong consensus among participants regarding the application's effectiveness in supporting their learning. Descriptive statistics of perceived ease of use (PEU) showed in Table 3.

Tabel 3. Descriptive Statistics of Perceived Ease of Use (PEU)

Item	Mean	Standard Deviation	Response							Dominant Response
			Strongly Disagree	Disagree	Somewhat disagree	Neutral	Somewhat Agree	Agree	Strongly Agree	
PEU1	6.09	1.033	0	0	3	8	17	40	53	Strongly agree
PEU2	5.83	0.978	0	0	0	14	27	45	35	Agree
PEU3	5.97	0.991	0	0	2	9	22	46	42	Agree
PEU4	6.07	0.896	0	0	0	9	17	51	44	Agree
PEU5	6.09	0.876	0	0	0	7	20	49	45	Agree
PEU6	6.27	0.922	0	0	1	6	15	36	63	Strongly agree

Regarding perceived ease of use (PEU), scores were similarly high, ranging from 5.83 to 6.27. This suggests that users generally found the application to be user-friendly and easy to navigate. Notably, PE6 received the highest mean score of 6.27, with predominant responses of "Strongly Agree." This finding highlights that participants felt confident in using the application without significant challenges. Overall, the results demonstrate a strong perception of ease of use, which is crucial for technology acceptance in educational contexts. Developed application user interface showed in Figure 2.

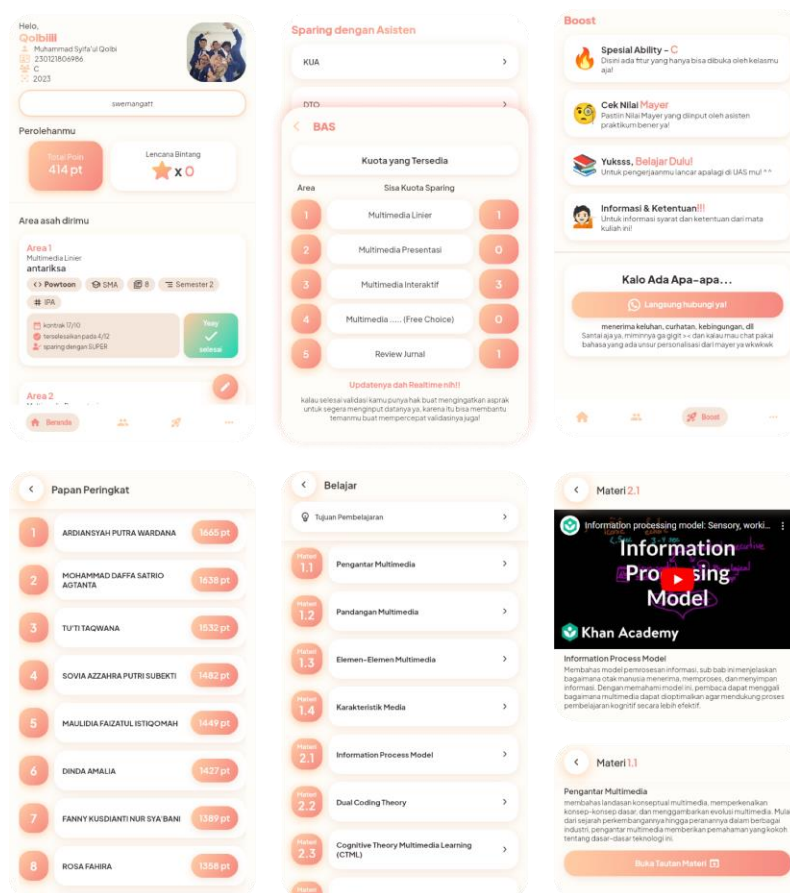


Figure 2. User Interface of the Developed Application

The qualitative feedback from users regarding the Mumed application reveals several key themes that significantly enhance their learning experiences. These themes include accessibility, performance tracking, user experience, motivation, and suggestions for enhancing seamless learning. First, accessibility of information. Users emphasized that Mumed greatly simplifies the process of managing assignments and tracking assistant availability. Many participants shared their previous frustrations with finding available assistants, describing it as a challenging task. One user stated, "Before Mumed, it was really difficult to find available assistants, but now I can easily see who has open slots." This newfound accessibility allows students to avoid the frustration of overlapping project titles, as noted by another respondent: "Mumed helps prevent my title from being taken by others." The clear visibility of assistant availability is crucial for effective task planning, making the app an essential tool for students.

Second, performance tracking. Many users reported that Mumed enhances their ability to monitor their grades and overall progress. Prior to using the app, students often struggled to understand their performance metrics. One participant remarked, "With Mumed, I can see my points and understand how I'm performing, which motivates me to put in more effort." The app allows for easy tracking of deadlines and grades, transforming what was once a tedious process into a simple task. Another user highlighted, "I used to waste time searching through spreadsheets for my project details, but now I can just check Mumed." This capability empowers students to make informed decisions about their study habits and encourages a proactive approach to learning. Third, user experience and user interface. The aesthetic appeal and user-friendly design of Mumed received widespread praise. Many users described the interface as "cute and organized," contributing to a positive and enjoyable experience. One user noted, "The colors are lovely, and it's easy to navigate, which keeps me engaged." This thoughtful design enhances usability, allowing students to focus on their tasks rather than struggling with the app itself. The layout facilitates quick access to information, reducing frustration and enhancing productivity. Overall, the design fosters a sense of enjoyment while using the app, which is particularly beneficial in a demanding academic environment.

Fourth, motivation and engagement. Mumed has significantly boosted user motivation. Many respondents shared that the app turns the often tedious process of managing assignments into a more engaging experience. One participant stated, "Mumed feels like a game; it makes the learning process more enjoyable." The gamified aspects, such as the leaderboard feature, encourage friendly competition and camaraderie among peers. Another user remarked, "It's like a leaderboard for education, which motivates me to achieve higher points." This competitive element not only inspires students to excel but also fosters a sense of community as they share their achievements and progress. Fifth, enhancing seamless learning. Users also provided insights on how Mumed could further enhance seamless learning experiences. Many participants expressed a desire for features that would support learning across different contexts and devices. For instance, one user suggested, "It would be beneficial if Mumed could integrate with other educational tools or platforms I use, making it easier to access all my learning resources in one place." Additionally, some users highlighted the importance of real-time notifications for deadlines and updates, which would allow them to stay informed regardless of their location. One participant mentioned, "Having alerts on my phone would help me manage my tasks more effectively while I'm on the go." These suggestions reflect users' enthusiasm for making Mumed an even more integral part of their learning journey, further promoting the principles of seamless learning. The feedback indicates that Mumed plays a crucial role in enhancing the efficiency and enjoyment of the learning process. Users value its ability to streamline tasks, provide real-time updates, and create a more engaging and motivating educational environment. The application effectively addresses several challenges faced by students in managing their academic responsibilities, making it an invaluable tool in their educational journey.

Discussion

The results of this study highlight the substantial impact of the Mobile Seamless Learning application on learner experience in bridging contextual diversity to overcome the adverse effects of gamification. The overwhelmingly positive feedback, reflected in quantitative descriptive statistics and qualitative insights, highlights the effectiveness of this application in improving learning outcomes and driving greater user engagement. By simplifying the learning process and providing easily accessible resources, this application empowers students to navigate their learning journey more efficiently, ultimately improving their overall learning experience. Some of the findings obtained are as follows.

First, gamification of learning has emerged as an attractive strategy to enhance the educational experience, particularly in overcoming the adverse effects often associated with traditional learning methods. By integrating game-like elements, such as points, badges, and leaderboards, these apps can

increase motivation and engagement among users (Dewi et al., 2020; Redy & Ariningsih, 2020). Research has shown that gamified learning environments can significantly increase students' intrinsic motivation, which is critical for effective learning (Khuluq et al., 2023; Permata & Kristanto, 2020). Participants noted that these gamification features transformed the learning process into a more enjoyable experience, fostering a sense of accomplishment and community. The apps' ability to facilitate performance tracking also emerged as an important theme in user feedback (Febriansah et al., 2024; Permata & Kristanto, 2020). Participants reported that they could easily monitor their grades and overall progress, encouraging a proactive learning approach. This capability is essential to foster self-regulated learning, a key component of successful educational outcomes (Dewi et al., 2020; Redy & Ariningsih, 2020; Sudana et al., 2021; Yaniaja et al., 2021). Clear presentation of performance data empowers users to take charge of their academic journey, ultimately contributing to better academic achievement. High mean scores for perceived usefulness (PU) and perceived ease of use (PEU) further reinforce the effectiveness of this application. Users view it as a helpful tool that simplifies academic tasks. High scores indicate that when an application is perceived as valuable and easy to navigate, students are more likely to engage with its content actively. This acceptance is important in an educational context, as user engagement directly impacts learning outcomes.

Second, the Mobile Seamless Learning (MSL) Principle enriches the educational experience by emphasizing accessibility and integration of formal and informal learning. This pedagogical model allows learners to engage with content across multiple contexts, whether in the classroom, at home, or in the community (Fahyuni et al., 2020; Ulfa et al., 2020). The ability to seamlessly transition between these contexts enhances the learning experience and promotes a more profound understanding of the material, which aligns with the seamless learning dimension. Participants stated that having access to educational resources anytime and anywhere kept them engaged and invested in their studies, reinforcing the idea that flexibility supports better learning outcomes (Hanifah et al., 2020; Irawati et al., 2022; Shofi & Jannah, 2022; Wang et al., 2017). The design and user interface of the application were widely praised, with many users describing it as aesthetically pleasing and user-friendly. This positive user experience is essential to maintaining engagement, especially in a digital learning environment. The interactive nature of gamified learning experiences encourages active participation, which is important for effective learning (Khuluq et al., 2023; Permata & Kristanto, 2020; Redy & Ariningsih, 2020). Research has shown that gamification can produce higher levels of engagement, as students are more likely to immerse themselves in activities framed as games rather than traditional lessons (Ariessanti et al., 2020; Hendriyati Haryani et al., 2023; Sudana et al., 2021).

Participants also provided valuable feedback on potential improvements to support seamless learning further. Suggestions included integrating the app with other educational tools and providing real-time deadline notifications. These insights reflect users' desire for a more connected learning experience transcending traditional boundaries. The ability to access multiple learning resources in one place would significantly enhance the user experience, making it easier for students to manage their academic responsibilities across multiple contexts (Fahyuni et al., 2020; Hanifah et al., 2020; Irawati et al., 2022; Nisa et al., 2020; Shofi & Jannah, 2022; Ulfa et al., 2020; Wang et al., 2017). The findings suggest that the Mobile Seamless Learning app is a valuable tool that enhances the efficiency and enjoyment of the learning process. By addressing key factors such as perceived usefulness, ease of use, accessibility, and user engagement, the app effectively supports students in managing their academic responsibilities. Positive feedback from users indicates strong acceptance of these tools, and suggestions for further enhancements reflect a commitment to continuous improvement. As educational technology continues to evolve, these applications stand out as exemplary models of how gamification and fluid learning principles can effectively enrich student experiences and outcomes (Khuluq et al., 2023; Permata & Kristanto, 2020).

The researchers acknowledge that there are still many limitations. Suggestions for future research are to explore user experiences in more depth through qualitative studies that identify challenges faced when using Mobile Seamless Learning applications and features that users most value. Comparative analysis of different applications can determine which features are most effective in improving learning outcomes and engagement. Longitudinal studies will help assess the long-term effects of these applications on learning. Additionally, investigating how demographic and psychographic characteristics such as age and learning style influence acceptance and use can lead to more tailored designs.

4. CONCLUSION

The results of the data analysis show that the development of a Mobile Seamless Learning application with a gamification approach has shown promising results in reducing the negative impacts of

gamification in learning. This study's findings highlight the application's effectiveness in enhancing the learner experience, improving learning outcomes, and encouraging greater user engagement. Positive feedback from users regarding the application's accessibility, performance tracking, user experience, motivation, and suggestions for improvement further strengthen its potential as a valuable tool in supporting students' academic responsibility. As educational technology evolves, this study provides valuable insights into designing and implementing a Mobile Seamless Learning application that integrates gamification principles to create a more enjoyable, interactive, and practical learning experience. By addressing the challenges associated with gamification and leveraging the benefits of seamless learning, educators and developers can create innovative solutions that drive better learning outcomes and improve the overall educational experience.

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