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Incorporating Gamified Elements into Mobile Learning to Enhance Critical Thinking Skills

Dwi Sulisworo[1], Ika Maryani[2*], Al-Rashiff Hamjilani Mastul[3] & Dian Artha Kusumaningtyas[4]

[1]Department of Education, Universitas Ahmad Dahlan, Indonesia

[2*]Department of Primary School Teacher Education, Universitas Ahmad Dahlan, Indonesia

[3]Department of Education, Western Mindanao State University, Zamboanga City, Philippines

[4]Department of Physic Education, Universitas Ahmad Dahlan, Indonesia

*Corresponding email: ika.maryani@pgsd.uad.ac.id

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Abstract: Incorporating Gamified Elements into Mobile Learning to Enhance Critical Thinking Skills. Objective: This study explores the potential of gamified mobile learning in fostering critical thinking skills among learners. The objective is to investigate how gamified learning environments can provide engaging challenges, opportunities for decision-making, constructive feedback, collaborative experiences, adaptive pathways, and immersive narratives to promote the development of critical thinking skills. **Methods**: The research employed a descriptive qualitative approach to explore how gamified learning environments influence the development of critical thinking skills. This method aimed to express experiences, perceptions, and behaviors within their natural context. It was informed by a review of existing literature on gamified learning and critical thinking, establishing a theoretical framework and grounding the research in established theories and findings. Thematic analysis was used to identify patterns and themes in the data, which were then integrated with relevant literature to gain comprehensive insights into the relationship between gamified learning and critical thinking. **Findings:** The findings suggest that gamified mobile learning can indeed be a powerful tool for fostering critical thinking skills. By harnessing the motivational power of games, educators can create dynamic learning environments that inspire learners to think critically, solve problems, and achieve deeper understanding. Gamified challenges, decision-making scenarios, collaborative experiences, adaptive pathways, and immersive narratives provide learners with meaningful learning experiences that promote active engagement and reflection. **Conclusion**: Overall, gamified mobile learning has the potential to revolutionize education by cultivating the skills and dispositions necessary for success in the 21st century.

Keywords: critical thinking skills, education, gamified learning, thematic analysis.

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INTRODUCTION

Gamification, the integration of game design elements into non-game contexts, has gained significant traction in education and training (Elshorbagy et al., 2022). By incorporating personalized experiences tailored to individual learners' preferences, interests, and skill levels, gamified learning platforms enhance engagement and motivation (Elshorbagy et al., 2022). Leveraging data analytics to track learners' progress and performance allows for real-time adaptation of the learning experience, providing personalized recommendations and feedback to optimize outcomes (Elshorbagy et al., 2022).

With the increasing use of smartphones and tablets, gamified learning is becoming more mobile-friendly and accessible (Elshorbagy et al., 2022). Additionally, the incorporation of social features like leaderboards and multiplayer challenges promotes collaboration, competition, and peer-to-peer learning, enhancing motivation and engagement (Elshorbagy et al., 2022).

Educators are increasingly integrating gamified learning into formal education settings, including K-12 schools, colleges, and universities, to make learning more engaging and interactive across various subjects and disciplines (Elshorbagy et al., 2022). The effectiveness of gamification in engaging learners and enhancing learning outcomes has been recognized (Afirando et al., 2023). Gamification has been shown to encourage student participation and motivation by adding game elements to classroom activities (Barber et al., 2020). Furthermore, the use of gamification in learning environments has been linked to increased student engagement and knowledge development (Sanzana et al., 2023).

The transferability of critical thinking skills from gamified environments to real-world scenarios can be constrained when tasks lack relevance to learners' lives or are too disconnected from authentic problems. While gamified learning environments are designed to boost engagement and enjoyment, there is a concern that prioritizing entertainment could compromise the depth and complexity of the content, potentially impeding the development of higher-order critical thinking skills. Additionally, although competition can serve as a motivator in gamified settings, it might also deter collaboration and certain facets of critical thinking, such as open-mindedness and perspective-taking. Research by Levac et al. (2019) highlights the importance of transfer in learning, emphasizing the application of skills in real-world contexts. Michalski et al. (2019) define transfer as the process of applying skills developed through training in real-world tasks. Harris et al. (2020) stress the significance of effectively applying learning in varied environments, a concept fundamental to many human activities. Moreover, Michalski et al. (2021) demonstrate that individuals with neurodevelopmental disorders can transfer vocational skills from virtual environments to real-world settings. Parsons & Mitchell (2002) discuss incorporating real-world social interaction in virtual reality training for individuals with autistic spectrum disorders.

Incorporating real-world contexts into learning activities can aid in the development of critical thinking skills, as noted by Stark (2012) and Ye & Xu (2023). Furthermore, the study by Ross et al. (2004) underscores the limitations of simulator training in replicating the emotional and physiological states induced by real-world conditions, affecting transferability. Lastly, Zikas et al. (2022) highlight the effectiveness of gamified learning environments in facilitating skill transfer from virtual to real-world settings, surpassing traditional methods. By considering these insights, educators, and designers can enhance the effectiveness of gamified learning environments in fostering critical thinking skills that are transferable to real-world situations.

The objective of this discussion is to explore the relationship between gamified learning environments and the development of critical thinking skills. By identifying the potential benefits and challenges associated with gamified learning in fostering critical thinking, we aim to gain a deeper understanding of how educators and developers can leverage gamification effectively to promote critical thinking skills among learners. Through this exploration, we seek to inform best practices for designing and implementing gamified learning environments that support the cultivation of critical thinking abilities in diverse educational contexts.

METHOD

Participants

This study did not involve any participants other than the researcher himself. This is because literature review research does not rely on participants. Literature review research does not involve human participants, as its focus is on synthesizing and analyzing existing scholarly works. This research can effectively contribute to the advancement of knowledge within their respective fields by adhering to rigorous methodological approaches through a comprehensive examination of relevant literature.

Research Design and Procedures

The research utilized a descriptive qualitative approach to investigate the relationship between gamified learning environments and the development of critical thinking skills. This approach focused on describing and interpreting phenomena within their natural context, allowing for a rich exploration of participants' experiences, perceptions, and behaviors.

Instrument

The research was guided by a review of existing literature on gamified learning, critical thinking, and their intersection. Scholarly articles, academic journals, conference papers, and relevant books will be consulted to establish a theoretical framework and identify key concepts, theories, and empirical findings related to gamified learning and critical thinking. The literature encourages informed interpretation, ensuring that research is based on existing theory and research findings. Because the data is in the form of literary documents, the researcher acts as the key instrument in this research. The researcher acts as a key instrument because of his capacity to interpret and provide meaning to the data collected. The success of research depends greatly on the researcher's sensitivity, expertise, and reflective ability to understand and present the social reality being studied.

Data analysis

Qualitative data analysis techniques used thematic analysis employed to identify patterns, themes, and categories within the data. Typically, the process starts with familiarizing oneself with the data, then generating initial codes to label features of interest, organizing these codes into potential themes, and refining these themes to accurately represent the data. We then used the final themes to develop a detailed report, backed by evidence from the data, which provided a comprehensive understanding of the patterns and meaning underlying the qualitative data in this study. Source triangulation is used in this research, where the researcher uses various sources of information to strengthen the brightness of the research results. This process involves collecting data from various documentary and literary sources, which are then combined to build a more comprehensive understanding of the phenomenon under study. Through source triangulation, researchers can identify consistencies in the data obtained, reduce bias, and deepen it so that the analysis of research results becomes more valid and trustworthy. This not only strengthens the validity of the research by showing that the same results emerge from multiple sources, but also increases the depth and complexity of understanding the research subject. The findings from the qualitative analysis were integrated with relevant literature to generate comprehensive insights into the relationship between gamified learning and critical thinking.

RESULT AND DISCUSSION

The data collected on the teachers' experiences from Harzings' Publish or Perish was organized using the PRISMA flow 2020 diagram, as shown in Figure 1. The descriptive data of the included articles are indicated in Table 1.

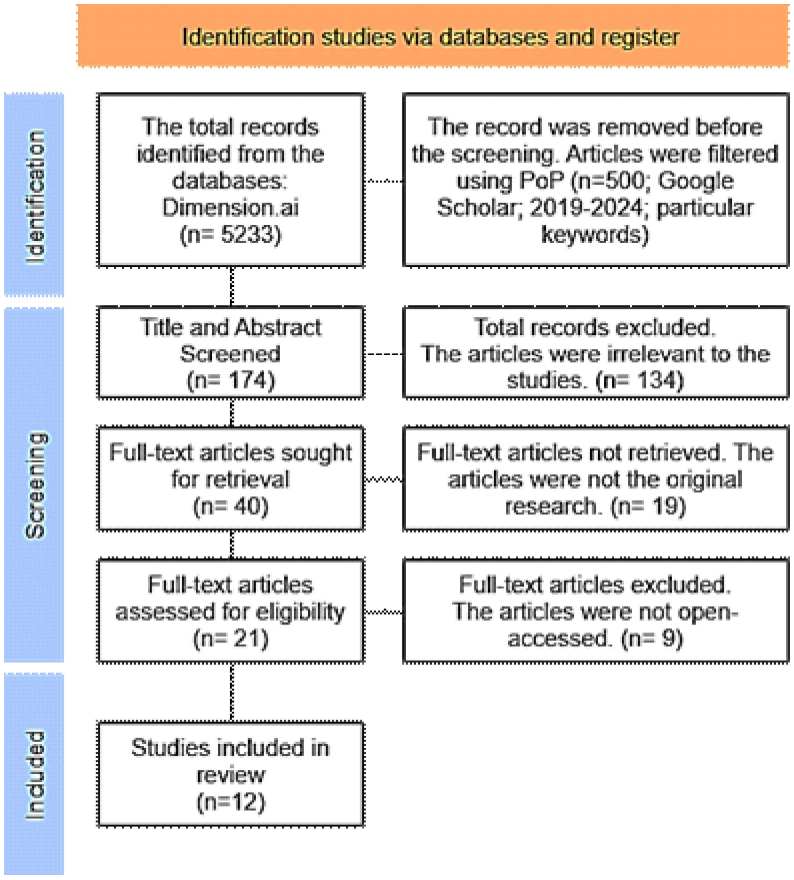

Figure 1. Prisma flow diagram on data selection

Five thousand two hundred thirty three (5,233) initially collected studies from Dimension.ai were scrutinized to remove studies that did not meet the inclusion criteria. The initial studies collected were from Google Scholar with particular keywords (n = 500). From the 174 initially collected published research articles, the following studies were deleted due to: 134 studies due to irrelevant to the studies, 19 studies due to originality, 9 studies did not open accessed. With these reasons, a total of 162 studies were massively reduced from the initially collected articles that yielded to final twelve (12) studies for the meta-synthesis. The twelve (12) studies were described as indicated in Table 1.

Table 1. Descriptive data of the 12 included on gamified mobile learning for critical thinking

No.	Author(s)	Year	Setting	Subject	Themes/ Issues
1	Cash	2023	USA	Chemistry	Problem-solving
2	Chen et al.	2023	China	Multidisciplinary	Problem-solving Progress Tracking and Rewards
3	Gladman et al.	2020	New Zealand	Health Education	Decision-making
4	Hamza & Tóvölgyi	2022	Lebanon	Finance	Collaborative Learning
5	Jaca et al.	2023	Philippines	Language	Problem-solving

6	Kian et al.	2022	Malaysia	General Studies	Collaborative Learning
7	Mamotheti & Daramola	2022	South African	Multidisciplinary	Problem-solving
8	Palaniappan & Noor	2022	Malaysia	Informatics	Feedback and Reflection
9	Robert et al.	2023	UK	Music	Collaborative Learning
10	Sailer & Sailer	2020	Germany	Educational Sciences	Feedback and Reflection
11	Xiao & Hew	2023	Hongkong	Business	Progress Tracking and Rewards
12	Yu	2023	China	English	Problem-solving

Twelve (12) studies were analyzed and described as shown in Table 1, including the discipline or subjects taught. The research results were grouped and analyzed using six-step thematic analysis, resulting in five (5) themes, namely: (1) Problem-Solving Challenges, (2) decision-making scenarios, (3) feedback and reflection, (4) progress tracking and rewards, and (5) collaborative learning. Clustering all themes have emerged one meta-theme, gamified mobile learning for critical thinking. The said themes and meta-theme are described below.

Theme 1: Problem-Solving Challenges

Gamified learning has emerged as a powerful instructional strategy that enhances student motivation and engagement (Buckley & Doyle, 2014). By integrating elements of games into educational activities, gamified learning can present learners with complex problems or scenarios that require critical thinking to solve (Chen et al., 2023). This approach not only motivates students to learn but also promotes advanced problem-solving skills (Chen et al., 2023). Research indicates that gamified assessments can increase student engagement and confidence (Cash, 2023). Moreover, gamified learning interventions have been shown to have a positive impact on student learning outcomes (Buckley & Doyle, 2014). For instance, in the context of English vocabulary learning, gamified approaches have demonstrated promising results in improving learning outcomes, motivation, and satisfaction (Yu, 2023). Gamified learning activities can be further enhanced by incorporating technology to provide immediate and explicit feedback to learners during the learning process (Hou & Wu, 2022). This immediate feedback mechanism can help students analyze information, evaluate options, and make decisions in a structured and supportive environment (Hou & Wu, 2022). Furthermore, gamified learning environments have been found to blend serious learning with fun, providing students with an engaging and interactive platform for learning (Mamotheti & Daramola, 2022). By offering a mix of challenges, rewards, and interactive elements, gamified learning can motivate students to utilize critical thinking and problem-solving skills across various subjects, including mathematics, language learning, and environmental awareness (Jaca et al., 2023).

Theme 2: Decision-Making Scenarios

Mobile learning apps have significantly impacted education by offering interactive platforms for decision-making scenarios and critical thinking exercises. These apps provide users with the opportunity to explore various options and their consequences in simulated real-

life environments (Gladman et al., 2021). The use of mobile apps for teaching and learning has grown notably with the rise of smartphones, focusing on enhancing competency-based learning through gamification and technology-enhanced tools (Krishnamurthy et al., 2022). Research has examined the acceptance and desired features of mobile apps for vocabulary learning, emphasizing the significance of user preferences and app functionalities in educational settings (Deris & Shukor, 2019). Additionally, studies have explored the potential of mobile health apps to take over certain tasks traditionally carried out by general practitioners, signaling a shift towards mobile platforms for diagnosis and treatment decision support (Wattanapisit et al., 2020). The usability and effectiveness of mobile learning apps have been investigated, highlighting their value in improving student learning experiences and providing education access anytime and anywhere (Gladman et al., 2020). Moreover, the use of smartphones and mobile apps among physicians has been shown to support various aspects of clinical practice, including communication, medical education, decision-making, and access to medical information (Lee et al., 2023). Furthermore, research has examined factors influencing user satisfaction with mobile learning apps, with perceived responsiveness and content quality identified as crucial determinants of user experience and satisfaction (Liu et al., 2018). Mobile apps have also been used to facilitate reflective learning in healthcare settings, such as in understanding and caring for older people with dementia, demonstrating the diverse applications of mobile technology in education and healthcare (Pitts et al., 2015).

Theme 3: Feedback and Reflection

Gamified learning platforms have been recognized for their ability to provide immediate feedback to learners, aiding in the reflection of their decision-making processes and enhancing critical thinking skills by pinpointing strengths and areas for improvement. Immediate feedback in gamified learning is crucial as it guides learners in refining their critical thinking abilities (Chen et al., 2023). This feedback mechanism plays a significant role in encouraging student engagement in the learning process (Hou & Wu, 2022). Moreover, feedback in gamified learning should be immediate, positive, easily accessible, align with instructional goals, and promote learning motivation (Li & Chu, 2020). Studies have shown that gamified learning environments can lead to increased student engagement and motivation (Sailer & Sailer, 2020). Immediate task-level feedback provided by points in gamified quizzes has been highlighted as having a high potential to scaffold the learning process performance (Palaniappan & Noor, 2022). Additionally, the gamification strategy used in online learning environments has shown a positive influence in supporting learners' self-directed learning (Krishnamurthy et al., 2022). Gamification has been found to improve learning outcomes, engagement, and cooperation by allowing for real-world application.

Theme 4: Progress Tracking and Rewards

Rewards systems have been extensively studied in various fields, particularly in education, to enhance motivation and engagement among learners (Javed & Muhammad, 2021). Research supports the use of reward systems in educational settings, showing a positive impact on student motivation and behavior (Chen, 2023). Teachers commonly utilize reward systems to improve student academic performance and encourage appropriate conduct (Javed & Muhammad, 2021). Studies have also demonstrated the influence of reward systems on organizational commitment, particularly in educational institutions (Widodo & Gunawan, 2020). While the benefits of reward systems in education are recognized, caution is advised against relying too

heavily on extrinsic rewards to motivate learners (Deci & Ryan, 1985). Critics emphasize the importance of intrinsic motivation in the learning process and warn about the potential drawbacks of excessive dependence on rewards (Deci et al., 1999). Balancing extrinsic rewards, such as points and badges, with intrinsic motivation is crucial for sustainable engagement and positive learning outcomes. In the realm of gamification and learning, intangible rewards like virtual points and badges have been identified as effective strategies to enhance learner engagement (Xiao & Hew, 2023). Feedback, often integrated into reward systems, aligns with goal-setting theory, allowing individuals to monitor their progress toward learning objectives (Landers et al., 2014). Moreover, incorporating reward systems into educational technology has been shown to boost learner motivation and engagement with instructional material (Yi, 2022). In the context of faculty and staff, reward systems significantly impact job satisfaction, turnover rates, and overall performance (Froese et al., 2018). Different demographic groups within organizations may perceive and value reward systems differently, underscoring the importance of tailored approaches to incentivize diverse staff effectively (Froese et al., 2018). Furthermore, reforming reward systems in educational leadership programs is crucial for program enhancement (Crow et al., 2012). While reward systems can be potent motivators, their design and implementation necessitate careful consideration to align with educational goals and avoid unintended consequences (Yani et al., 2022). By leveraging research on motivation, gamification, and organizational behavior, educators and institutions can develop reward systems that effectively learners and critical thinking abilities.

Theme 5: Collaborative Learning

Gamified mobile learning has emerged as a promising approach to enhance collaboration among learners, fostering idea exchange, strategy discussions, and problem-solving collectively. Collaborative activities within gamified learning environments have been shown to stimulate critical thinking by encouraging learners to explore diverse perspectives and justify their viewpoints (Su & Cheng, 2014). Research indicates that gamified learning can significantly impact motivation, achievement, and engagement in various educational contexts. For instance, a study on gamified learning in science education demonstrated positive effects on motivation and student learning outcomes (Su & Cheng, 2014). Similarly, the use of gamified mobile apps has been linked to increased pro-environmental behaviors among university students, highlighting the potential of gamification in influencing behaviors (Boncu et al., 2023). In the realm of language learning, gamified approaches have shown promise in enhancing vocabulary acquisition and overall learning outcomes (Yu, 2023). Moreover, gamified interventions in mathematics education have been found to boost students' motivation despite challenges such as the COVID-19 pandemic (Chen et al., 2023). Gamified learning activities can be further enriched by incorporating technology to provide immediate and explicit feedback to learners, enhancing the learning experience (Hou & Wu, 2022). Additionally, the integration of gamified elements in e-learning platforms has been shown to improve employee engagement and facilitate communication across different departments (Hamza & Tóvölgyi, 2022). The effectiveness of gamified learning lies in its ability to promote collaboration, teamwork, and engagement. Studies have highlighted the importance of intrinsic game elements in gamified platforms to cater to different learner types and enhance motivation (Kian et al., 2022). Furthermore, gamified interventions have been successful in promoting music literacy, creativity, and civic engagement, emphasizing the role of enjoyment in effective learning (Robert et al., 2023; Romano et al., 2021).

Meta-theme: Gamified Mobile Learning for Critical Thinking

Gamified mobile learning for critical thinking integrates game-like features into mobile educational platforms, fostering enhanced critical thinking skills. Through interactive challenges, quests, and rewards, learners engage actively with content, promoting deeper comprehension and analytical thinking (Palaniappan & Noor, 2022; Chen et al.; 2023; Xiao & Hew, 2023). Gamification elements, such as points, levels, and leaderboards, incentivize participation and progression. This approach harnesses the inherent motivation of gaming to make learning enjoyable and effective. By presenting complex concepts in engaging formats, it cultivates problem-solving abilities, decision-making skills, and creativity (Gladman et al., 2020; Mamotheti & Daramola, 2022; Cash, 2023). Ultimately, gamified mobile learning for critical thinking offers a dynamic and immersive educational experience, empowering learners to navigate and thrive in an increasingly complex world.

CONCLUSION

Gamified mobile learning holds significant promise for nurturing critical thinking skills among learners. By integrating game elements into educational experiences, educators can create dynamic and engaging environments that stimulate learners' cognitive abilities and promote deeper learning. Through gamified challenges, decision-making scenarios, and immersive narratives, learners are motivated to actively engage with content, apply problem-solving strategies, and reflect on their reasoning processes. Furthermore, gamified mobile learning platforms offer opportunities for collaborative learning, personalized feedback, and adaptive pathways, allowing learners to progress at their own pace and receive targeted support where needed. By leveraging the motivational power of games, educators can inspire learners to persist in the face of challenges, take risks, and explore alternative solutions—an essential aspect of developing robust critical thinking skills.

Gamified mobile learning has the potential to revolutionize education by providing learners with meaningful, interactive, and enjoyable learning experiences that cultivate not only knowledge but also the skills and dispositions necessary for success in the 21st century. As educators continue to explore innovative approaches to teaching and learning, gamified mobile learning stands out as a powerful tool for empowering learners to think critically, solve complex problems, and become lifelong learners in an ever-changing world.

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