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The Impacts of Game-based Learning on Thinking and Learning in Higher Education Context: A Scoping Review

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The Impacts of Game-based Learning on Thinking and Learning in Higher Education Context: A Scoping Review

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Article Info	Abstract
Article History	This article aims to systematically explore the literature on game-based learning
Received:	in higher education, focusing on its impacts on students' thinking and learning.
5 December 2024 Accepted:	Prisma method was employed to analysis the data. The article published between
12 May 2025	2016 to 2023 from Web of Science, Scopus and Eric were taken into consideration
	for this study with the selected keywords. A comprehensive search of 11 studies
	from Finland, Sweden, Spain, Costa Rica, Hungary, the Netherlands, and the USA
	reveals that game-based learning has been associated with improved reflective
Keywords	thinking, motivation, creative thinking, computational thinking, design thinking,
Thinking	problem-solving skills, and joy and engagement. The findings suggest that game-
Game-based learning	based learning can promote deeper learning and cognitive development among
Higher education	students in higher education ecosystem.
Learning	

Introduction

The advent of digital technology recently marked a significant turning point for game-based learning (GBL). As personal computers, gaming consoles, and mobile devices are becoming common goods, it paves the way for the development of sophisticated educational games that could engage learners across various subjects and disciplines at different education levels. Researchers (Pedagogical scholars) believe that game-based learning can promote students' thinking (Cook et al., 2023), motivation (Jaskri & Syujala, 2023), soft skills (Grijalva et al., 2022), and performance (Ortiz-Martínez et al., 2022). Among all the advantages shown in game-based learning, researchers found that game-based learning widely enhances students' critical thinking (Acuna-Umana et al.; Sancho, 2022) and analytical thinking (Ferro et al., 2024). Game-based learning has consistently demonstrated significant benefits at the preschool and primary school levels; however, studies have also shown its positive impact on adult learners.

Game-based Learning in Higher Education

GBL was developed based on Constructive Learning Theory (Vygotsky, 1978). According to Vygotsky (1978),

giving students the resources they need to create their methods for solving problems is essential. In other words, students engage in a collaborative process in which they work with their surroundings to solve problems. GBL is a popular teaching method among preschool and elementary school students (Hussin et al., 2019). Researchers believe that GBL can engage learners in learning activities easily (citation). However, the role of GBL is increasingly important in higher education to resolve the issues of low critical thinking skills among undergraduates (Hussin et al., 2019). Students' low level of critical thinking is generally known to be caused by the traditional teacher-centered teaching method. Prior studies (e.g. Feng et al., 2025; Mikrouli, Tzafilkou & Protogeros, 2024) acknowledged the advantages of using GBL; however, a study by Yasin et al. (2025) has suggested that by just adding the game element without proper design or learners does not guarantee better learning outcomes.

Researchers believed that GBL highlighted the importance of engagement and motivation in game-based learning in promoting collaborative learning and students' thinking skills (Mai et al., 2024). Camilleri (2023) found that GBL enhances students' critical thinking and problem-solving abilities by integrating game element into the curriculum. However, in the context of higher education, studies are scarce as compared to other areas of study. (Chen et al., 2023). Furthermore, game-based learning is still at infancy in Malaysia and therefore is not widely applied (Kheioh & Loh, 2022) in higher education. According to Kheioh and Loh (2022), generally GBL is a learning method suitable for preschool students and commonly being emphasized in preschool especially in developed countries. If game-based learning is not widely implemented in preschool, only a few higher education institutions will implement this method.

Research on pedagogy has indicated that traditional approaches may not be interesting to current students and such methods restrict creative thinking and limits development of thinking (Asri & Jamaludin, 2022). Gamebased learning is an emerging teaching method with interesting and fun elements of 'play' and 'learn.' Studies indicated that game-based learning can boost students' thinking (Agbo et al., 2023) with multiple advantages, this teaching method has great possibilities to be embedded in classroom setting of higher education. Understanding the application of GBL in the context of higher learning is important to see the current practice and how it impacted the academic performance. This article aims to explore the literature on game-based learning in relation to higher education, focusing on student thinking and learning outcomes. The purpose of this study is to explore the adoption and the impact of game-based learning (GBL) approach in the higher education ecosystem in different countries.

This review offers an extensive overview about the application of game-based learning in higher education. The review of these scholarly publications across renowned platforms like Web of Science, Scopus, and Eric will provide understanding about the status of GBL in higher education and provide justifications for future application. Furthermore, the review will ease replication and reproducibility, encouraging the transformation of higher education pedagogical approach inline with the trend and interest of current students.]The reviews serve as a roadmap for researchers and educators, guiding future inquiry and innovation. By sharing this information, we can catalyze the inception of studies focusing on game-based learning in education.

Method

A scoping review is a systematic approach to mapping current knowledge on a topic, encompassing key ideas, hypotheses, sources, and knowledge gaps (Tricco et al., 2018). This method is useful for exploring and collecting evidence to understand emerging phenomenon (Ab Wahid et al., 2024; Mahjom et al., 2022; Ramdan et al., 2024). Unlike other review types, scoping reviews do not typically synthesize and evaluate evidence quality using a formal scientific process (Peters, 2020). Instead, scoping reviewis notable for their comprehensive approach to identifying literature, including all relevant studies regardless of their methodological design (Arksey & O'Malley, 2005; Pham, 2014). This study follows the methodology outlined by Arksey and O'Malley (2005), which consists of five stages in the reviewing process.

The stages firstly involves formulating clear and direct research questions to guide the review process. This is a critical step that ensures the review remains focused and relevant, providing a solid foundation for subsequent stages. As for this research, the focus is on the impact of game-based learning in stimulating thinking among higher education students, a topic of increasing interest and importance in contemporary educational practices. By focusing on this area, the study aims to highlight valuable insights and trends that can inform future educational strategies and innovations. The research questions ensure a comprehensive collection of relevant literature and provide a broad understanding of the subject matter: Question 1: Which country employed game-based learning? Question 2: What methodology is employed in GBL? Question 3: What theme can be developed in the context of GBL? Question 4: What implications have been examined in the current literature?

The second stage involves identifying relevant studies that can answer the research questions. This involves employment of a comprehensive search strategy to locate all important studies on how game-based learning promotes thinking in higher education environment. Three major academic databases specializing in education: Web of Science (WoS), Scopus, and ERIC were systematically searched to compile a thorough and complete collection of studies related to the research focus. The search was conducted using predefined main themes and specific search terms to ensure that all relevant literature was captured. For a detailed overview of the search terms used in this scoping review, please refer to Figure 1.

The third stage of the selection process is deployed with enhanced precision and specificity. It involves the application of predefined inclusion and exclusion criteria to determine the studies that will be incorporated into the review. Firstly, the focus was solely on articles within social sciences and education. Therefore, articles from other disciplines, such as computer science, engineering, medicine, psychology, environmental science, decision sciences, and energy, were excluded from the analysis. Additionally, the selection criteria excludes conference papers, book chapters, conference reviews, reviews, and books . To establish recency, only articles published in English between 2016 and 2023 were included in this review. For a comprehensive overview of these criteria, please refer to Figure 1.

The fourth stage involves data charting to systematically show the information acquired from the specified research, ensuring a coherent and organized framework for analysis. This process involves meticulously

organizing and compiling critical details from each study, facilitating detailed analysis and meaningful comparison across different research studies. Using Microsoft Excel, , a comprehensive data chart encompasses essential information such as the author's name, publication year, variables or constructs of research, study implications, sub-themes, and main themes were mapped to provide a clear and structured overview of the studies in a particular area, highlighting significant patterns and insights. Moreover, this systematic and organized technique aids in identifying commonalities and differences among the studies, thereby enhancing the depth and breadth of the analysis.

The fifth stage involves synthesizing the data and presenting the findings cohesively. In this research, the themes and overall results extracted from the articles were organized using Microsoft Excel, enhancing comprehension of the impact of game-based learning in higher education. This process led to the development of sub-themes and themes through thematic analysis and comparison across article (the details are outlined in Table 1 in the thematic section). In thisstudy, a discussion is also presented based on the insights drawn from the findings. Finally, a comprehensive overview of the limitations encountered and recommendations for future research to advance the implementation of game-based learning to promote thinking in higher education is also discussed.

Findings

The database search yielded 326 publications initially considered for this scoping review research. However, after applying inclusion criteria focusing on empirical articles published between 2016 and 2023 in the fields of education and social sciences, only 105 publications were retained. Among these, 22 duplicates were identified and removed, resulting in 83 unique publications for analysis. After a thorough review, 71 articles were found irrelevant to the scoping review objectives and were subsequently excluded. Finally, adhering to reporting guidelines for thematic reviews, 11 articles that employed quantitative methods and were best aligned with the study goals were selected. This selection process is detailed in Figure 1 (Moher et al., 2015).

The selection criteria for publications were intentionally stringent, focusing on works published within a eightyear window and encompassing various research types, such as conceptual papers and quantitative and qualitative empirical studies. This approach aimed to capture a broad spectrum of scholarly contributions while maintaining methodological rigor. Notably, conference proceedings were excluded due to concerns about their potential lack of systematization and transparency (Hodgkinson & Ford, 2014). As a result of these criteria, the study meticulously identified a selected number of outstanding papers over the past eight years for inclusion in the scoping review. This deliberate selection process ensures that only high-quality, rigorous research informs the comprehensive exploration of the chosen topic.

Main Findings

This scoping review highlights the diverse benefits of game-based learning, revealing its positive impact on student thinking and learning outcomes across multiple dimensions (Table 1). Notably, experimental studies by Agbo et al. (2023) demonstrated that game-based learning not only fosters reflective and creative thinking but

also enhances motivation, computational thinking, and design thinking. Moreover, it significantly improves problem-solving skills while cultivating a sense of joy and engagement in the learning process. These findings underscore the potential of game-based learning to transform traditional educational paradigms by making learning more interactive, enjoyable, and intellectually stimulating.



Figure 1. Reporting Items for Systematic Reviews (PRISMA) Flow Diagram depicting the Research Selection Process (adapted from (Moher et al., 2015; Ramdan et al., 2024)

Table 1. Overview of Game-based Learning Promotes Thinking and Learning in Higher Education

	Author	Research	Research	Implication	Sub-theme	Source
		Country	Approach			
1	Agbo, et	Finland	Quantitative	This study found a	reflective	Scopus
	al.(2023)			relationship between game	thinking and	
				elements of challenge, goal	comprehension	
				clarity, and feedback as a		
				pedagogical approach,		

	Author	Research	Research	Implication	Sub-theme	Source
		Country	Approach			
				features of IVR technology,		
				and learners' reflective		
				thinking and		
				comprehension.		
2	Helberg	Sweden	Mix-method	The contribution is to show	Motivation	Scopus
	(2023)			how courses can be	and game	
				redesigned into a gamified	thinking	
				design.		
3	González-	Spain	Quantitative	The study analysed the	Motivation,	Scopus
	Yubero, et			relationship between GBL	creative	
	al. (2023)			and motivation through an	thinking	
				educational escape room.		
4	Cook, et. al.	USA	Qualitative	The game's applied cartoon	Critical-	ERIC
	(2023)			and the creative potential to	thinking	
				improve students' climate		
				literacy and critical-thinking		
				abilities.		
5	Acuna-	Costa Rica	Qualitative	The significant finding from	Critical-	ERIC
	Umana, et. al			this study is that the didactic	thinking	
	(2022)			strategies used are vital		
				ingredients to design a		
				unique theatre play based on		
				a link between the history of		
				atomic models and literature		
				toward a complete		
				understanding of spatial		
				macroscales and		
				microscales thinking.		
6	Kovácsné	Hungary	Quantitative	The impact of gamification	Computational	ERIC
	(2021)			on students in "Algorithms	thinking	
				and Data Structures" in		
				university courses was		
				investigated.		
7	van Uittert,	Netherland	Quantitative	Results indicated that	Reading	WoS
	Verhoeven,			playing the word reading	ability,	
	& Segers,			game significantly enhanced	working	
	(2022)			first graders' word reading	memory	
				efficiency directly after the		

	Author	Research	Research	Implication	Sub-theme	Source
		Country	Approach			
				intervention, but the effect		
				was no longer significant		
				2 months after the		
				intervention.		
8	Hung,	USA	Qualitative	This article uses	Design	ERIC
	(2018).			gamification as a lens to	thinking,	
				reimagine a learning	problem-	
				environment, drawing on	solving	
				design thinking methods of		
				problem solving.		
9	Urquidi	Spain	Quantitative	Students are motivated and	Motivation &	Scopus
	(2017).			concentrated during	soft skills,	
				simulations, which	Higher order	
				promotes cooperation and	thinking	
				competition. They,		
				therefore, perceive these		
				simulations as a valuable		
				tool to acquire skills,		
				especially those linked with		
				decision-making, problem-		
				solving and analysis.		
10	Deif, (2017).	USA	Quantitative	The paper offers an	Motivational,	ERIC
				assessment criteria to	cognitive	
				investigate the impact of		
				lean gamification based on		
				evaluating motivational,		
				cognitive, and social		
				processing during games.		
11	Crocco	USA	Quantitative	This study found a proof-of-	Joy,	ERIC
	(2016).			concept study designed to	engagement,	
				assess the effects of GBL on	thinking	
				enjoyment, engagement,		
				and learning in higher		
				education.		

Recent research on game-based learning (GBL) across various countries reveals diverse implications for educational practice, highlighting a wide range of effects from enhanced critical thinking to improved cognitive skills and increased student engagement. These studies, conducted in different educational settings and employing

various research approaches, provide valuable insights into the global adoption of GBL. As illustrated in Figure 2, which addresses the first research question, countries such as the USA, Spain, Finland, Sweden, the Netherlands, Costa Rica, and Hungary were included in this review. Notably, 45.5% of the European countries (including Sweden, Spain, Hungary, the Netherlands, and Finland) have actively implemented GBL. Among the selected 11 articles, the USA emerged as the leading country, contributing 36.4% of the studies, followed by Spain at 18.2%.



Figure 2. Country Employed Game-based Learning

To address the second research question regarding the methodology employed in GBL, Figure 3 presents the research methods used in the selected papers. Out of the seven papers, the majority employed quantitative research, predominantly through experimental design. Three papers utilized qualitative methods (González-Yubero, 2023; Acuna-Umana et al., 2023; Hung, 2018), and only one study adopted a mixed-method approach (Helberg, 2023). The quantitative study by Cook et al.(2023) also found positive effects of GBL on student learning outcomes. The qualitative study by Hung (2018) provided insights into the role of game-based learning in promoting design thinking and problem-solving skills. The survey study by Urquidi et al.(2017). It was found that GBL was associated with higher motivation and soft skills among Spanish university students. The findings of this scoping review suggest that GBL has the potential to promote deeper learning and cognitive development in higher education.



Figure 3. Methodology Employed in Selected GBL Studies

To address the third research question regarding themes that can be developed within the context of GBL, Figure 4 outlines several key sub-themes identified in this study. Notably, higher-order thinking skills such as critical thinking, problem-solving, creative thinking, and reflective thinking have been extensively explored. Studies consistently show that GBL enhances critical thinking and problem-solving abilities, and it is also believed to foster design thinking (Hung, 2018). Other prominent sub-themes emerging from the selected papers include joy, engagement, motivation, and working memory. Additionally, the author conducted a bibliometric analysis to identify frequently used keywords in GBL research, with 'education,' 'higher education,' 'e-learning,' 'innovation,' 'serious games,' and 'motivation' ranking as the most popular. While GBL has been shown to significantly improve critical thinking, a more thorough understanding about the implications of GBL still presents a research gap that warrants further exploration.



Figure 4. Sub-themes Developed in the Context of GBL

Finally, to address the fourth research question concerning the implications examined in the current literature, this study uncovered several key findings. Agbo et al. (2023) explored the impact of game elements and immersive virtual reality (IVR) technology on learners' perceived cognition, emphasizing the importance of integrating challenge, goal clarity, and feedback into pedagogical approaches to enhance reflective thinking and comprehension. This suggests that well-designed gamified elements can significantly improve cognitive outcomes in educational settings. Similarly, Helberg (2023) demonstrated that gamifying courses benefits both students and teachers, suggesting that rethinking course design through GBL can enhance student motivation and create a more engaging learning environment. Further studies in 2023 (e.g. Yubero et al.; Cook et al.) confirmed that GBL can be tailored to boost creative thinking, critical thinking, and motivation, effectively engaging students in complex subjects.

Acuna-Umana et al. (2022) utilized an innovative interactive theatrical play to bridge science, technology, engineering, arts, and mathematics (STEAM) education, emphasizing the role of didactic strategies in enhancing

spatial thinking and integrating diverse educational fields. Pusztai (2020) found that GBL positively influences computational thinking in an 'Algorithms and Data Structures' course, supporting its inclusion in courses focused on complex problem-solving. Moreover, van Uittert, Verhoeven, and Segers (2022) highlighted GBL's potential to enhance early literacy skills and reimagine learning environments through design thinking methods. Their study, alongside others, underscores how gamification can address complex problems and improve problem-solving skills by fostering a dynamic and creative learning approach, emphasizing the need for sustained interventions for long-term benefits. Lastly, Urquidi (2017) demonstrated that GBL promotes motivation, concentration, and decision-making skills, further validating its effectiveness in educational contexts.

Discussion

The results of this scoping review showed that in general GBL enhances critical thinking which is lacking in other traditional approaches. What is more important, the ability of GBL to promote higher-order thinking commensurate with the nature of courses in the higher education environment. As artificial intelligence (AI) enriches various facets of critical thinking, complementing the learning process with GBL will train the students to think critically (Darwin et. al., 2023). As expected, the practice of GBL in higher education is more apparent in the West as compared to the Eastern region. This may imply that teachers in the Eastern countries find it difficult to accept the element of "game" and "play" simultaneously and the perception that learning is a serious process may repudiate the application of GBL. However, GBL is acknowledged as an effective learning method and this is evidenced by an emerging upward trend in research focus in recent years. A significant increase in the numbers of research papers on this topic since 2023 indicates that more institutions at different levels and regions are incorporating GBL in teaching and learning

Most research papers selected quantitative methods with experimental or quasi-experimental designs due to several reasons. Firstly, this design is effective in measuring the impact of GBL during the intervention period. Quantitative measurement gives a more accurate indication of achievement of learning goals through the employment of GBL. On another note, a quasi-experimental design is comparatively a better approach in testing new teaching approaches such as GBL. The findings generated from quantitative methodology also showed that data-driven methods are preferred to get cause and effect relationships to answer the research questions. Despite the main methods being quantitative, qualitative studies on GBL probed into specific technique of gamification to explore the potential of GBL in enhancing learning. Examples of cartoon and theatre based gamification shows the flexibility of GBL in creating synergy between type of courses and target groups (Cook, et. al, 2023; Acuna-Umana, et. al, 2022). This shows GBL requires teachers to be creative as well in selecting the best GBL technique to be applied because the effectiveness can only be achieved with the right combination of game tasks, course, target group and interest.

Regarding research implications, the selected GBL papers indicated the underpinned Constructive Learning Theory. GBL significantly showed that it can promote higher-order thinking together with motivation, joy, and engagement. This is difficult to be achieved in the traditional setting where higher order thinking especially in complex courses requires focus and rigor in the process of learning, thus isolating the needs of joy, fun and engaging in the process. It also proved that students can open their learning possibilities or potential through learning methods such as gameplay. This condition is aligned with Vygotsky's Constructivist Learning Theory (1978) that students can develop a higher level of learning performance with the assistance of peers and tools. GBL is conducted in a collaborative setting, which allows peer-to-peer learning to happen. Students will discuss on the topic and strategize to win in a game setting. As the result, the more intelligent students will help the slow learners and indirect learning will persist in the process. In a nutshell, GBL creates a healthy and fun learning environment, where students learn without stress and in fact enjoy the learning atmosphere. The students will immersed themselves in the process of learning via playing in a competitive environment.

The reviewed studies underscore the diverse applications of GBL across various educational settings. Key findings include enhanced reflective thinking, creative thinking, problem-solving and comprehension. Game elements that challenge the students to provide clear goals and offer feedback effectively promote higher thinking order. GBL can increase motivation with proper designs and educational settings. It also enhances the development of critical and creative thinking while players engage in the game. Additionally, GBL can improve computational thinking, reading ability, and working memory, although effects may diminish without reinforcement. Studies showed that GBL can be used to redesign learning environments, integrating design thinking and problem-solving methods to enhance educational outcomes. The findings of the selected studies also showed that GBL enhances learners' motivation.



Figure 5. A Summary of GBL Enhances Thinking and Learning

Based on the scoping review, it can be encapsulated that the application of GBL involves intense interaction between people, process and outcomes. As illustrated in Figure 5, the interaction between people and process will ultimately lead to multiple outcomes incumbent in the learning environment. The main players in a GBL environment are the teachers and the students, and the review indicates that certain characteristics are discernible. For the teachers, apparently the teachers are innovative to incorporate GBL in the process, creative in selecting the best tools and strategic in identifying the appropriateness of the tools to the learning outcome intended to be achieved. The students are high spirit and enthusiastic to immerse in the activities and competitive to be engaged in the process. In the process of executing the games, various types of techniques can be applied that commensurate to the people and outcome intended to achieve. The level of subject matter that are involved in the studies of complex, high level and technical indicates the huge potential of GBL in achieving learning goals that are normally difficult and challenging to be achieved in a traditional setting. Looking at the variations of outcomes

explored in the studies, obviously GBL is a lucrative platform that provides comprehensive development of students' cognitive and personal development that is normally difficult to be achieved using a single approach. In other words, GBL offers a complete platform for learning to happen in different facets and outcomes.

Limitation and Recommendation

While game-based learning has demonstrated potential to promote motivation and higher order thinking in higher education, it is not without its limitations. This paper has it limitation in term of source because it only cover database of WoS, Scopus and Eric only. Another big database Google Scholar was not involved. Additionally, the scope of game-based learning is only focused in higher education. One of the main concerns is that gamification could lead to a situation in which students are motivated by reward or competition aspect rather than a sincere interest in it.

Additionally, the necessity to reduce material to fit within a gaming format may jeopardize the depth and complexity of learning outcomes. Furthermore, a one-size-fits-all strategy that ignores the unique demands and learning preferences of each student may result from the existing game-based learning systems' lack of customization and flexibility. It is recommended that educators incorporate game-based learning into their regular classroom instruction as a way to overcome these shortcomings. Educators should explain to students the learning outcome by integrated game in lesson. Proper advise and reminder should give to students from time to time and proper planning and relevant class management should be implemented while using game-based learning are very important.

Conclusion

This scoping review provides a comprehensive overview of the literature on game-based learning in higher education and its impact on student thinking and learning outcomes. The findings suggest that game-based learning can promote improved reflective thinking, motivation, creative thinking, computational thinking, design thinking, problem-solving skills, and joy and engagement among students. Furthermore, the review points out the importance of GBL in promoting students' learning outcomes and higher-order thinking. Students engaged in GBL are likely to participate thoroughly in their learning, improving their thinking and performance in a more exciting learning environment. By tapping into students' interests and providing engaging learning experiences, educators can establish a positive learning environment that fosters students' learning abilities and enthusiasm. Nevertheless, this review also has some constraints, such as being limited to only one aspect of GBL. Therefore, future research should explore a more extensive scope of GBL using bibliometric analysis and systematic review.

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