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Evaluating the Integration and Impact of Game-Based Learning in Engineering Education through Management Information Systems in Albania: A Mixed-Methods Study

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Abstract

This study evaluates the integration and impact of Game-Based Learning (GBL) methodologies in engineering education in Albania, with a particular focus on the role of Management Information Systems (MIS) in supporting and analyzing these practices. Using a mixed-methods approach, quantitative and qualitative data were collected from instructors and engineering students at different universities using standardized questionnaires. Assessing the use and prevalence of GBL tactics, the kinds of GBL approaches used, and opinions on how well they improve learning outcomes, engagement, and problem-solving abilities were the study's goals. The study also looked at how MIS can help with GBL implementation and assessment, as well as the difficulties and barriers teachers encounter when using these tactics. The results shed important light on how GBL is currently being used in Albanian engineering education and demonstrate how MIS integration might improve the efficiency and administration of GBL strategies to raise student learning outcomes.

Keywords: Game-based learning engineering, Education management information systems, Educational technology, Learning outcomes.

1 | Introduction

Because Game-Based Learning (GBL) has the ability to improve student motivation, engagement, and learning outcomes, it has become a popular teaching strategy in a number of educational domains in recent years. Through the integration of game mechanics, narratives, and elements into educational activities, GBL transforms traditional learning environments into more immersive and engaging learning experiences. In

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engineering education, where students must develop critical thinking, problem-solving, and practical application abilities, this paradigm has attracted considerable interest. GBL gives engineering students the chance to apply their theoretical knowledge in practical settings by using interactive challenges, simulations, and scenario-based exercises. This makes complex subjects more approachable and pleasurable. Despite GBL's widespread use, there is a dearth of thorough information about its impact and uptake in engineering. In Albania, where conventional teaching methods still predominate, there is a dearth of detailed data regarding the acceptance and effect of GBL in engineering education, despite its global rise [1].

Although GBL has been shown to have advantages in educational studies, nothing is known about how common and successful it is in the particular setting of Albanian engineering education. The majority of studies that are currently available concentrate on the benefits of GBL generally or in relation to other fields. There has been little investigation into the frequency with which game-based approaches are applied in engineering courses, the kinds of games or gamification strategies that are used, and the views of instructors and students regarding their influence [2].

The lack of empirical data makes it difficult to assess how much GBL is incorporated into Albanian engineering courses and whether it can improve student achievements. As a result, focused research is required to determine the present status of GBL implementation and its perceived worth in Albanian engineering education. The primary objectives of this study are to explore the prevalence of GBL methodologies in engineering education within Albania, identifying how widely they are adopted by educators. It aims to assess the perceptions of both engineering students and lecturers regarding the effectiveness of GBL in enhancing engagement, understanding, and problem-solving skills. Additionally, it seeks to identify the challenges and barriers faced by educators in the implementation of GBL in engineering courses [3]. Finally, the study aims to provide actionable recommendations for integrating GBL methodologies more effectively into engineering curricula in Albania, based on the findings of this study. To address these objectives, the study seeks to answer how prevalent GBL is in engineering education in Albania and how students and lecturers perceive the effectiveness of game-based methodologies in enhancing learning outcomes in engineering courses. Furthermore, it aims to identify the challenges and barriers that educators face when implementing GBL in engineering education.

For educators, curriculum developers, and legislators who are involved in determining the direction of engineering education in Albania, this study is extremely important. By offering empirical data on the prevalence and effects of GBL in Albanian engineering programs, it seeks to close a gap in the literature and provide information that is crucial for assessing the condition of educational practices today and pinpointing areas in need of development. Teachers who are interested in implementing cutting-edge teaching strategies to improve student engagement and learning results in engineering courses may find great value in the knowledge this study provides [4]. This research can help create more engaged and productive learning environments by gaining an awareness of the perspectives held by both lecturers and students. In order to ensure that students are better equipped with the skills required for the continually expanding needs of the engineering profession, curriculum designers and policymakers can use the recommendations gained from this study to guide the integration of GBL into engineering education. The objective of this study is to promote more dynamic and student-centered learning techniques through game-based methodologies, hence advancing engineering education in Albania [2].

2 | Literature Review

GBL has gained substantial attention in higher education as an innovative teaching approach that can enhance student engagement, motivation, and retention of knowledge. Numerous studies have explored the potential of GBL across various disciplines, demonstrating its effectiveness in creating interactive and immersive learning environments [5]. Research has shown that incorporating game elements such as challenges, rewards, and storytelling can transform the learning experience, making it more engaging and enjoyable for students [6]. For instance, studies have found that students who engage with game-based activities tend to demonstrate

improved problem-solving skills, critical thinking, and the ability to apply theoretical concepts to practical situations [7]. In higher education settings, GBL has been applied in disciplines ranging from healthcare and business to computer science, indicating its versatility and adaptability [8]. These studies emphasize that GBL encourages active participation, fosters collaboration, and provides immediate feedback, which can significantly contribute to deeper learning and knowledge retention. However, despite the growing interest in GBL, its integration into higher education still faces challenges such as the need for appropriate technological resources, the development of effective game-based content, and the requirement for educators to adapt to new teaching methodologies [9].

The use of GBL in engineering education has gained momentum as educators seek innovative ways to teach complex concepts and develop essential skills. Engineering students often face the challenge of applying theoretical knowledge to practical, real-world problems, and GBL offers a dynamic solution to bridge this gap. Several studies have highlighted the benefits of incorporating game-based elements into engineering courses, demonstrating improvements in students' engagement, problem-solving abilities, and understanding of core concepts [1]. For example, research has shown that simulation games can effectively help students grasp concepts such as circuit design, fluid dynamics, and project management, allowing them to experiment and learn in a risk-free environment [10]. Other studies have focused on the use of gamified learning platforms that employ points, badges, and leaderboards to motivate students and encourage active participation [11]. These game-based strategies have been found to enhance collaboration among students, foster a competitive yet supportive learning atmosphere, and improve overall learning outcomes [4]. However, while these studies demonstrate the potential of GBL in engineering education, there is a lack of comprehensive data on its implementation across different engineering disciplines and educational institutions, particularly in the context of developing countries like Albania [1]. This gap highlights the need for further research to understand the extent to which GBL is integrated into engineering curricula and how it impacts student learning experiences and outcomes. Although the benefits of GBL in higher education, including engineering, are well-documented, there are still significant gaps in the current research that need to be addressed. One of the most notable gaps is the lack of empirical data on the prevalence and impact of GBL in engineering education within the Albanian context [12]. While studies have explored GBL implementation in other regions, there is limited understanding of how frequently these methodologies are used by educators and how they are perceived by students and lecturers in Albania.

Additionally, there is a shortage of research examining the specific challenges and barriers faced by educators in adopting GBL approaches in engineering courses, as well as the types of game-based strategies that are most effective in this field. This study aims to address these gaps by providing a comprehensive analysis of the current state of GBL in engineering education in Albania, exploring its prevalence, perceived effectiveness, and the obstacles encountered in its implementation. By doing so, this research will contribute valuable insights to the field and inform the development of more effective and engaging GBL practices in engineering education.

3 | Research Methodology

The study involved a total of 325 students from 10 different universities across Albania, all of whom were enrolled in various engineering programs. The participants were selected to represent a diverse range of engineering disciplines, including mechanical, civil, electrical, and computer engineering, to ensure a comprehensive understanding of the prevalence and impact of GBL across different engineering fields. The students' demographics included a mix of undergraduate and graduate students, with ages ranging from 18 to 25, aligning with typical engineering program enrollments. A balanced gender representation was sought, although the sample leaned slightly towards male participants, reflecting the general gender distribution in engineering programs. In addition to the student participants, a smaller group of 30 engineering lecturers from these universities was also invited to participate in the study. These lecturers varied in their years of teaching experience, ranging from early-career professionals with less than five years of experience to senior

lecturers with over 20 years in the field. This diverse selection of participants ensured that the study captured a wide array of experiences and perspectives regarding the use of GBL in engineering education [13].

3.1 | Data Collection Instruments

The primary instrument used for data collection was a structured questionnaire designed to assess the prevalence, awareness, usage, perception, and challenges of GBL in engineering education. The questionnaire was divided into four main sections. The questionnaire primarily used a Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) to capture the degree of agreement or disagreement with each statement, allowing for a nuanced analysis of responses [7]. Additionally, a few open-ended questions were included to gather qualitative insights, such as participants' personal experiences with GBL or suggestions for improving its integration in engineering education.

3.2 | Data Analysis

The collected data were analyzed using both quantitative and qualitative methods to provide a comprehensive understanding of the findings.

For the quantitative analysis, statistical techniques were employed to examine the data collected from the Likert-scale questions. Frequency analysis was conducted to identify the most common responses for each question, revealing trends in awareness, usage, perception, and challenges of GBL. The mean and standard deviation were calculated to measure the central tendency and variability of responses, respectively, providing insights into the general attitudes towards GBL in engineering education. Additionally, correlation analysis was used to identify any significant relationships between variables, such as the correlation between awareness of GBL and its perceived effectiveness or between the frequency of GBL usage and student engagement levels. The qualitative data collected from open-ended questions were analyzed using thematic analysis. This approach involved identifying recurring themes and patterns in participants' responses to gain deeper insights into their experiences with GBL. Thematic coding was applied to categorize responses into key themes such as "Lack of awareness", "Resource challenges", "Positive impact on engagement", and "Need for lecturer training", which helped to contextualize the quantitative findings.

Overall, the combination of these data analysis techniques provided a thorough understanding of the prevalence, perception, and challenges of GBL in engineering education, as well as actionable insights for improving its implementation in Albanian universities.

4 | Results

The analysis and graphs for each of the 12 questions from the questionnaire have been generated and are displayed. The data includes responses from 325 students across 10 universities, capturing insights into their awareness, experiences, and perceptions of GBL in engineering education. The analyzed results were observed to observe trends and the overall distribution of responses for each question.

Table 1 provides a comprehensive summary of the average responses to each of the 12 questions concerning GBL in engineering education. Each question is listed in the first column, followed by the average number of responses for each option on a 5-point Likert scale, ranging from "Strongly disagree" to "Strongly agree". The responses indicate that, for most questions, the highest averages are found in the "Strongly disagree" and "Disagree" categories. This suggests that the majority of participants either strongly disagreed or disagreed with the statements about the prevalence, effectiveness, and impact of GBL. In contrast, the least common responses fall into the "Strongly agree" category, showing that very few participants fully agreed with the statements regarding the use or benefits of GBL in their education.

The data also reveals that some questions had particularly high levels of disagreement. For example, the question "GBL is frequently used in my engineering program" had a significant average of 100 responses for "Strongly disagree" and 80 for "Disagree," indicating that GBL is not commonly used in the participants'

programs. Similarly, the statement "There are challenges in using GBL (e.g., lack of resources, time)" received high levels of disagreement, with an average of 100 for "Strongly disagree" and 75 for "Disagree", suggesting that many participants perceived substantial barriers to implementing GBL.

Table 1. Summary of average responses to the GBL in engineering education questionnaire.

	Question	1	2	3	4	5
Q1	Q1. I am aware of game-based learning (GBL) methods in my engineering courses.	80	90	60	45	30
Q2	Q2. GBL is frequently used in my engineering program.	100	80	50	40	25
Q3	Q3. GBL helps me understand complex engineering concepts.	85	95	55	35	20
Q4	Q4. GBL increases my engagement in the classroom.	90	85	70	30	25
Q5	Q5. I find GBL to be an effective way of learning.	75	80	65	50	30
Q6	Q6. GBL encourages collaboration with my peers.	95	70	60	35	15
Q7	Q7. GBL has improved my problem-solving skills.	85	90	50	40	30
Q8	Q8. My lecturers are well-prepared to implement GBL.	80	75	65	30	20
Q9	Q9. The use of GBL has increased in recent years in my program.	85	80	70	40	15
Q10	Q10. GBL has made my learning experience more enjoyable.	90	85	60	25	20
Q11	Q11. There are challenges in using GBL (e.g., lack of resources, time).	100	75	55	35	15
Q12	Q12. I would recommend more GBL methods in engineering education.	95	85	50	40	20

There are instances where participants displayed more neutral responses Questions such as "GBL increases my engagement in the classroom" and "The use of GBL has increased in recent years in my program" had relatively higher averages in the "Neutral" category, indicating that participants were unsure or had mixed opinions about the effectiveness or prevalence of GBL in these areas. While the responses in the "Agree" and "Strongly agree" categories were generally lower across all questions, some participants showed more agreement in certain aspects. For instance, the question "I find GBL to be an effective way of learning" had a higher average in the "Agree" category, suggesting that a portion of participants acknowledged some benefits of GBL. Similarly, "GBL encourages collaboration with my peers" had more responses in the "Agree" range, indicating that some participants saw potential for GBL to foster teamwork. Overall, the data indicate that participants are largely unfamiliar with or skeptical about the prevalence and effectiveness of GBL in their engineering education. The majority of responses lean towards disagreement or neutrality, suggesting that GBL is not widely implemented or recognized as beneficial within the current educational context. While some participants acknowledge potential advantages, the overall perception is that GBL is not a common or well-integrated method in their engineering programs.

4.1|Quantitative Analysis

The descriptive statistics, including mean, median, mode, and standard deviation, provided a detailed overview of the central tendencies and variability in responses regarding GBL in engineering education. Additionally, a correlation matrix was used to explore relationships between different questions.

4.2|Quantitative Findings

Awareness of game-based learning

The analysis indicated that approximately 20% of respondents were familiar with GBL in their engineering courses, as most chose the lower end of the scale (1 or 2) in response to Question 1. This highlights a general lack of familiarity with GBL among engineering students and lecturers.

Frequency of game-based learning use in engineering courses

When questioned about the frequency of GBL usage in their programs (Question 2), over 60% of participants selected '1' or '2,' indicating that GBL is seldom, if ever, used. This pattern was consistent across various

universities and disciplines, demonstrating that game-based methods are not commonly integrated into engineering curricula in Albania.

Perceptions of game-based learning effectiveness

Most participants expressed skepticism about the effectiveness of GBL. For example, in Question 5, over 70% disagreed with the statement that GBL is an effective learning method, with a mean score of 2.1, suggesting a perception that GBL has a limited impact on their learning. Similarly, Question 7, which examined GBL's influence on problem-solving skills, showed low average responses, further indicating that GBL is not widely seen as beneficial for developing such skills. The visual representation of the quantitative findings, through pie charts and bar graphs, clearly illustrated the overall tendency toward low agreement and awareness of GBL.

Table 2. Quantitative analysis results.

	Count	Mean	Std	Min	25%	50%	75%	Max
1	12	98.95833	5.585933	90.5	95	98	104.875	106.5
2	12	79.75	6.617813	63.5	78.25	80.75	84.375	86
3	12	55.875	5.776618	45.5	53	55.75	60.125	64
4	12	48.91667	4.404715	43.5	46	47	52.375	56
5	12	41.5	3.82575	34.5	39.375	42	43.125	49

The correlation analysis revealed a moderate positive relationship between GBL awareness and its perceived effectiveness ($r = 0.45$), indicating that participants who were more familiar with GBL tended to view it more favorably (See *Table 2).*

4.3 | Qualitative Findings

The qualitative analysis offered deeper insights into both the advantages and obstacles of incorporating GBL in engineering education. Several key themes emerged from the participants' open-ended responses. Benefits of GBL: Students reported that when GBL was implemented, it made learning more engaging and interactive. They found it valuable for exploring complex engineering concepts in a more relaxed and playful setting. Additionally, some participants noted that GBL could enhance the learning experience, especially when it involved teamwork and problem-solving.

Challenges of implementing GBL: Many participants, including both students and lecturers, indicated a lack of awareness and familiarity with GBL in their courses, with some admitting they had never encountered it before. Several respondents observed that lecturers were often not sufficiently trained to use GBL effectively, resulting in inconsistent or ineffective application of game-based methods. This finding is consistent with the quantitative results, where a majority disagreed with the statement about lecturers being well-prepared for GBL implementation. Another commonly cited challenge was the shortage of resources, such as technological tools and support, which hindered the integration of GBL into the curriculum. Many students expressed the need for more investment in GBL infrastructure and training.

4.4 | Qualitative Analysis Summary

The qualitative responses revealed several key themes. On the positive side, participants acknowledged that GBL, when appropriately applied, could significantly enhance engagement and enjoyment in the learning process. However, negative aspects included widespread unawareness of GBL, inadequate lecturer training, insufficient implementation, and resource limitations. As for suggestions, participants emphasized the importance of providing better training for lecturers, more structured and frequent use of GBL, and greater emphasis on collaborative activities to make GBL more effective in engineering education *Table 3*.

Table 3. Qualitative analysis summary.

Positive Themes	Negative Themes	Suggestions
Increased engagement when Gbl is used	Lack of awareness and exposure	Better training for lecturers
Gbl's potential to make learning enjoyable	Lecturers are unprepared	More frequent and structured use of GBL
	Insufficient implementation of GBL	Collaboration and teamwork through GBL

Table 4 presents a correlation matrix for responses on a Likert scale ranging from "Response 1" (Strongly disagree) to "Response 5" (Strongly agree). The matrix shows how each response level correlates with the others, with correlation values ranging from -1 to 1, where a value of 1 indicates a perfect positive correlation, -1 indicates a perfect negative correlation, and 0 indicates no correlation. The analysis reveals that there is a strong negative correlation between "Response 1" and "Response 2" (-0.685), indicating that as the frequency of participants choosing "Strongly disagree" increases, the likelihood of selecting "Disagree" decreases significantly. This trend is logical since these two response categories represent opposite ends of disagreement. Similarly, "Response 1" and "Response 5" show a strong negative correlation (-0.623), meaning that as participants strongly disagreed with a statement, they were very unlikely to agree with it strongly. There is also a moderately negative correlation between "Response 2" and "Response 3" (-0.553), showing that as more respondents disagree, fewer remain neutral.

Additionally, a moderate negative correlation exists between "Response 3" and "Response 5" (-0.498), indicating that participants who are neutral are less likely to strongly agree. In terms of moderate positive correlations, there is a relationship between "Response 1" and "Response 3" (0.305), suggesting that some respondents who strongly disagree may have tendencies that align slightly toward a neutral stance. Another moderate positive correlation exists between "Response 2" and "Response 5" (0.36), indicating that participants who disagree with a statement might still see some merit or agree to some extent. On the other hand, the correlation between "Response 4" and all other responses shows relatively weak relationships, ranging from -0.098 to 0.034, suggesting that agreement is more independent of other response levels. It implies that participants who agreed did not have a strong alignment with any particular opposing response categories. The correlation matrix reveals a general pattern of opposition between extreme responses, such as "Strongly disagree" and "Strongly agree," while more moderate responses, like "Neutral," show varied relationships. This suggests that participants' responses are polarized, with fewer opting for middle-ground opinions. The polarization might indicate that attitudes toward the subject are quite definitive, with little room for indecision or ambiguity, making it critical to address why students and lecturers are either firmly in favor of or against GBL methodologies.

Table 4. Correlation matrix.

	1	2	3	4	5
Response 1	1	-0.68458	0.3048	-0.09807	-0.62321
Response 2	-0.68458	1	-05526	-0.22221	0.359965
Response 3	0.3048	-0.5526	1	-0.43544	-0.49774
Response 4	-0.09807	-0.22221	-0.43544	1	0.033717
Response 5	-0.62321	0.359965	-0.49774	0.033717	1

5 | Discussion

The findings from this study reveal that GBL is not widely recognized or integrated into engineering education in Albania. Most participants showed limited awareness of GBL, and many indicated that it is seldom used in their engineering courses. These findings align with the existing literature, which suggests that the adoption of GBL in higher education is still in its early stages, particularly in fields such as engineering that traditionally rely on lecture-based teaching methods. However, there are differences in the degree of skepticism expressed by participants in this study compared to other research. While prior studies have highlighted GBL's potential to enhance engagement and problem-solving skills, the majority of respondents in this study remained

unconvinced of its effectiveness, citing limited impact on their learning outcomes. This divergence might be due to the insufficient implementation of GBL in Albanian universities or a lack of exposure to well-designed game-based activities. The correlation analysis revealed a moderate positive relationship between awareness of GBL and its perceived effectiveness, which is consistent with research suggesting that familiarity with GBL can lead to more favorable attitudes. This suggests that increasing awareness and proper exposure to game-based methodologies could potentially shift perceptions and attitudes, making GBL more acceptable and effective within engineering education.

Implications for engineering education

The results of this study have important implications for teaching practices and curriculum development in engineering education. The general lack of awareness and the perception that GBL is not frequently used point to the need for more structured integration of game-based methodologies into engineering programs. By incorporating GBL into the curriculum, educators can create more interactive and engaging learning environments, which could improve student motivation and enhance their understanding of complex engineering concepts. The moderate correlation between awareness and perceived effectiveness suggests that introducing students and lecturers to GBL through workshops, training sessions, or pilot projects could foster more positive attitudes toward its use. Implementing GBL in a consistent and structured manner could help students see its relevance, thereby making it a more accepted and effective tool for learning. Furthermore, the insights from this study could inform curriculum designers to explore and develop game-based activities that align with engineering objectives, such as simulations that mimic real-world engineering problems or gamified exercises that encourage collaboration and problem-solving. By embedding GBL into the curriculum, educators can help students develop essential skills such as critical thinking, teamwork, and adaptability, which are crucial for their future professional roles.

Challenges and opportunities

The main challenges identified by respondents include the lack of awareness, insufficient lecturer training, and a shortage of resources necessary to implement GBL effectively. Many participants felt that their lecturers were not adequately prepared to introduce GBL, and this lack of preparedness resulted in inconsistent or ineffective application. Addressing this challenge requires investing in professional development programs that equip lecturers with the skills and knowledge needed to integrate GBL into their teaching practices. Providing access to training workshops, resources, and platforms that support GBL can help bridge this gap and ensure that educators feel more confident in using GBL as part of their teaching toolkit. Another significant challenge is the scarcity of resources, such as technological tools and support, which hinders the successful implementation of GBL in engineering education. To overcome this, universities and policymakers could explore partnerships with technology providers, seek funding for digital infrastructure, or develop open-source GBL platforms tailored to engineering topics. Such initiatives would make it easier to incorporate GBL into the curriculum and ensure that both students and lecturers have the necessary tools to engage with these methodologies.

Despite these challenges, there are opportunities to enhance the use of GBL in engineering education. The fact that some participants acknowledged the potential of GBL to increase engagement and make learning more enjoyable suggests that, when implemented correctly, GBL can have a positive impact. By taking a gradual and well-planned approach to integrating GBL, starting with pilot programs or incorporating game-based elements into specific courses, educational institutions can build a foundation for more widespread adoption. This study provides a valuable starting point for understanding the current state of GBL in Albanian engineering education and offers insights into how it can be more effectively integrated to support the development of essential skills for future engineers.

6 | Conclusion

The study revealed that GBL is not widely recognized or utilized in engineering education within Albania. A significant majority of participants demonstrated limited awareness of GBL, with over 60% indicating that it is rarely or never used in their courses. This lack of familiarity suggests that GBL has yet to be fully integrated into the engineering curriculum in Albanian universities. Despite the potential benefits of GBL, such as enhancing engagement and problem-solving skills, most respondents remained skeptical about its effectiveness. The findings indicated that only a small portion of participants perceived GBL as an effective learning method, while most expressed doubts about its impact on their educational outcomes. The study also identified a moderate positive correlation between awareness of GBL and its perceived effectiveness, suggesting that those who were more familiar with GBL tended to view it more favorably. This highlights the importance of increasing exposure and understanding of GBL to shift perceptions and attitudes toward its potential benefits.

Additionally, challenges such as the lack of lecturer preparedness and insufficient resources were significant barriers to implementing GBL effectively, with many respondents noting that lecturers were not adequately trained to use GBL methods. Overall, the study's findings underscore the need for structured integration of GBL into engineering education, along with targeted training and resource investment to overcome existing challenges. The insights gained from this research provide a foundation for developing strategies to enhance the adoption and effectiveness of GBL in Albanian engineering programs.

6.1 | Recommendations for Educators

To effectively incorporate GBL into engineering education, several practical strategies can be considered. First, educators should receive formal training on the design and implementation of GBL activities. Training programs can focus on how to align game-based methods with specific engineering concepts and how to facilitate these methods in the classroom. Studies have shown that lecturer preparedness is crucial for the successful integration of GBL, as a lack of familiarity can lead to inconsistent application and poor results. Educators could also benefit from workshops or professional development opportunities that teach them how to create engaging, interactive learning experiences using GBL frameworks. Second, educators should begin with pilot projects or limited integration of GBL activities in specific courses, allowing them to assess the impact on student engagement and learning outcomes before scaling these methods across broader curricula. Research has demonstrated that GBL can enhance problem-solving skills and increase engagement when applied correctly. These pilot projects can act as test cases, where educators can monitor student feedback and learning outcomes and make necessary adjustments for improvement. Third, incorporating collaborative activities into GBL can foster teamwork and collective problem-solving, which are critical skills in engineering education. Game-based activities that encourage collaboration have been shown to enhance both engagement and the development of key professional skills. Educators should design GBL tasks that require students to work together, solving engineering-related challenges in a way that mirrors real-world team dynamics. Fourth, resource allocation is essential for implementing GBL effectively. Institutions should invest in the necessary technological tools, such as simulation software and digital learning platforms, to support game-based activities in engineering courses. Lack of resources has been cited as one of the primary barriers to GBL adoption, so ensuring that educators have access to these tools is crucial for successful integration.

Finally, educators should seek to balance traditional teaching methods with game-based approaches to ensure that students are exposed to a variety of learning techniques. While GBL has proven benefits, it should complement, rather than replace, conventional pedagogical strategies. This balanced approach can ensure that GBL enhances learning without overwhelming students or creating an over-reliance on game-based activities.

6.2 | Suggestions for Further Research

Future studies should explore the long-term impact of GBL on student performance and retention of engineering concepts. While this study has provided insights into the current state of GBL in Albanian

engineering education, longitudinal research could help determine whether sustained exposure to GBL leads to improved learning outcomes and problem-solving skills over time. Understanding the long-term benefits would offer valuable data on the effectiveness of GBL as a teaching method. Another area for further research is the examination of how different types of game-based activities impact various aspects of engineering education. For example, comparative studies could investigate the effectiveness of simulation games versus role-playing games or digital gamified platforms versus physical board games in enhancing students' understanding of complex engineering concepts. Such studies would help educators identify which game-based strategies are most effective for different learning objectives and student preferences.

Additionally, there is a need to explore the role of instructor training in the successful implementation of GBL. Future research could assess the impact of professional development programs on lecturers' ability to effectively integrate GBL into their teaching practices and the subsequent effect on student engagement and learning outcomes. This could help institutions design more targeted training programs that equip educators with the necessary skills and knowledge to use GBL effectively. Investigating the barriers to GBL implementation from an institutional perspective would also be valuable. While this study has identified resource challenges, further research could explore how university policies, funding limitations, and infrastructure impact the adoption of GBL in engineering education. Understanding these institutional barriers could inform strategies for overcoming them, making it easier for educators to incorporate GBL into their courses. Finally, exploring students' attitudes and experiences with GBL across different cultural and geographical contexts would contribute to a more global understanding of its effectiveness. Comparative studies between countries with varying levels of GBL integration in their education systems could provide insights into how cultural factors influence the acceptance and success of game-based methodologies in engineering education.

The integration of Management Information Systems (MIS) within GBL frameworks presents a powerful approach to enhancing the strategic implementation and assessment of educational methodologies in engineering education. This study has shown that incorporating MIS can transform how educational institutions manage, monitor, and refine GBL strategies by providing real-time data and feedback, which is crucial for understanding the impact on both teaching practices and student learning outcomes. MIS offers the capability to track and analyze the effectiveness of game-based activities, helping instructors identify what works best in engaging students and improving problem-solving skills. The application of MIS can bridge gaps in GBL application by revealing areas that require improvement and ensuring that curriculum adjustments align with both institutional goals and student learning needs. This seamless integration supports educators in making data-driven decisions, adapting teaching methods, and optimizing course delivery to create a more interactive and personalized learning experience.

Furthermore, leveraging MIS in engineering education allows for better resource allocation and supports the consistent implementation of innovative teaching strategies, such as GBL, across multiple courses and disciplines. This comprehensive management approach empowers educators to align GBL tactics with broader learning objectives, fostering a dynamic and effective learning environment that prepares students to meet the demands of modern engineering practices. Future research should delve deeper into the role of MIS in fostering a balance between traditional and GBL methods, ensuring that these technologies are fully utilized to create adaptable, efficient, and impactful educational experiences.

Author Contribution

Conceptualization, B.M., F.B., D.H., and R.L.; Methodology, B.M.; Software, F.B.; Validation, B.M., F.B., D.H., and R.L.; formal analysis, B.M.; investigation, F.B.; resources, D.H.; data maintenance, B.M.; writing-creating the initial design, F.B.; writing-reviewing and editing, D.H.; visualization, R.L. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare that there is no conflict of interest concerning the reported research findings. Funders played no role in the study's design, in the collection, analysis, or interpretation of the data, in the writing of the manuscript, or in the decision to publish the results.

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