

Game-Based Learning Instruction in Teaching Science for Grade 7 Students: Input For a Compendium of Learning Material

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Abstract

This study aimed to assess the effectiveness of the game-based learning in teaching science at Lucsuhin National High School. Using a descriptive research method, a questionnaire was employed as the primary data collection tool, with 72 Grade 7 learners as respondents. The data were analyzed using weighted mean, t-test, and Pearson's correlation coefficient. The findings indicated that game—based learning teaching strategies are highly effective in enhancing

students' prior knowledge, increasing student's motivation and engagement. Additionally, the study revealed that age and gender do not significantly affect the application of inquiry-based strategies, while students' grade performance is significantly influenced by these approaches. Based on these results, a compilation of lesson plan utilizing game-based learning was collected.

Keywords: *motivation, engagement, game-based learning*

INTRODUCTION

In today's education system, the integration of technology has significantly reshaped traditional teaching practices. With the growing demand for innovative instructional approaches, game-based learning (GBL) has emerged as a promising strategy, particularly in science education. Defined as the use of digital games for instructional purposes, GBL transforms students from passive recipients of knowledge into active participants, allowing them to explore concepts in interactive and meaningful ways.

The implementation of the K–12 curriculum under Republic Act No. 10533, also known as the *Enhanced Basic Education Act of 2013*, emphasizes the adoption of innovative pedagogical strategies to enhance learning outcomes. Similarly, DepEd Order No. 42, s. 2016 promotes the integration of Information and Communications Technology (ICT) in the curriculum, encouraging the use of modern tools to foster engagement and comprehension. While these policies do not explicitly mention GBL, they provide a strong foundation for its inclusion in contemporary classrooms.

Despite these reforms, science education continues to face challenges, particularly in sustaining student motivation and engagement. Research shows that enthusiasm for learning declines as learners progress through grade levels, with science subjects often perceived as abstract, difficult, and disconnected from real-world applications. This highlights the urgent need for teaching strategies that make science more engaging, relevant, and student-centered.

Game-based learning provides a viable response to this challenge. By incorporating elements of challenge, collaboration, feedback, and rewards, GBL enhances comprehension of abstract scientific concepts through simulations, problem-solving tasks, and interactive experiences. For instance, students may explore ecosystems through digital simulations or experiment with physics principles by designing virtual roller coasters, thereby fostering both critical thinking and practical application of knowledge.

The rationale for adopting GBL lies in its potential to bridge gaps left by traditional lecture-driven instruction, which often limits active participation. GBL offers immersive experiences that cultivate higher-order thinking, collaboration, and problem-solving skills. It also aligns with Vygotsky's Social Development Theory, which emphasizes the role of social interaction in learning, and with game theory, which highlights decision-making and strategic thinking in dynamic contexts. Moreover, studies such as Saeed and Zyngier (2012) reveal that intrinsically motivated learners achieve greater academic success, lower anxiety, and higher engagement—outcomes that GBL is uniquely positioned to support.

This study therefore seeks to investigate the effects of game-based learning on the motivation and engagement of students in science education. Its findings aim to inform educators, curriculum developers, and policymakers about the effectiveness of integrating GBL into classroom practice. Ultimately, it aspires to contribute to a paradigm shift in science education—moving from passive, content-heavy instruction toward active, engaging, and student-centered learning experiences that better prepare learners for the challenges of the 21st century.

Review of Related Literature

Game-based learning (GBL) has been widely recognized as an innovative approach that transforms traditional instruction into an interactive and learner-centered experience. In the field of science education, where concepts are often abstract and challenging to grasp, GBL provides students with opportunities to explore, experiment, and apply knowledge in a more engaging manner. By embedding elements such as points, badges, leaderboards, and simulation-based activities, GBL enhances motivation, engagement, and overall academic performance (Tamosevicius, 2022; Chen & Tu, 2021). Through interactive play, students shift from being passive recipients of knowledge to active problem-solvers, increasing their curiosity and willingness to participate. Research further indicates that the inclusion of competitive features enhances learner performance and drives consistent participation, making lessons more dynamic and meaningful (Lin, 2021; Arcagök, 2021).

Beyond cognitive outcomes, GBL has also been shown to positively influence students' attitudes and learning behaviors. Studies highlight that game-based environments foster a growth mindset, encouraging learners to persist despite challenges while cultivating self-confidence, collaboration, and self-satisfaction (Nadeem, 2023; Dostal, 2019). These qualities are particularly significant in science education, where students must often engage in problem-solving, critical thinking, and experimentation. GBL further supports cognitive, social, and emotional development, allowing students to not only master academic content but also build resilience, teamwork, and adaptability—skills essential in mastering scientific inquiry (Rajan, 2022; Alotaibi, 2024).

In science classrooms, GBL has been effectively implemented through digital simulations, interactive experiments, role-playing activities, and problem-solving quests. For instance, students can virtually explore ecosystems, conduct experiments on chemical reactions, or manipulate variables in physics simulations—tasks that may be too complex, costly, or unsafe in real laboratory settings. Such activities bridge the gap between theoretical concepts and real-world applications, making abstract ideas more tangible and comprehensible. Evidence shows that these methods are particularly effective for younger learners, such as junior high school students, who often struggle with abstract reasoning (Hui & Mahmud, 2023). In fact, research consistently demonstrates that GBL significantly outperforms traditional instructional approaches, both in improving academic achievement and sustaining student motivation (Tinambunan, 2023).

Despite these benefits, the integration of GBL in schools is not without challenges. Limitations include outdated technological infrastructure, lack of resources, insufficient teacher training, excessive screen time, and high implementation costs (National Library of Medicine, 2021; Nisbet, 2023; Callahan, 2024; Eng, 2020). These barriers are especially evident in public school contexts, where access to modern devices and educational software may be limited. Moreover, if games are not properly designed or aligned with the curriculum and learning objectives, they risk becoming distractions rather than effective tools for instruction. Scholars therefore stress the importance of intentional game design, ensuring that educational goals remain central while entertainment elements are used only to support learning outcomes (Adipat et al., 2021).

Overall, the literature suggests that while game-based learning presents certain challenges, its advantages—enhanced motivation, stronger engagement, improved performance, and deeper understanding of concepts—far outweigh its limitations. In science education, its potential lies in making difficult concepts more accessible, interactive, and enjoyable for students. For Grade 7 learners, who are in a critical stage of developing foundational scientific knowledge and study habits, GBL provides a platform that not only strengthens comprehension but also nurtures enthusiasm for learning. These insights reinforce the relevance of examining the role of game-based learning in enhancing student motivation and engagement, particularly in contexts such as Lucsuhin National High School, where innovative teaching strategies like GBL can bridge gaps in understanding and make science more meaningful and enjoyable for learners.

Statement of the Problem

This study aims to determine the effects of Game-based learning on the motivation and engagement of students in science subjects.

Specifically, this study sought to answer the following questions;

1. What is the level of performance of students based on the pre-test and post test scores?
2. Is there a significant difference between the pre-test and post-test scores of students after the implementation of the game-based learning?
3. What is the level of effectiveness of the game-based learning as perceived by the learners in developing the
 - 3.1 motivation;
 - 3.2 engagement;
4. What is the significant relationship with the assessment of the effectiveness of game-based learning and the post-test scores of the students?
5. Based from the findings of the study, what are the compendium of game-based instruction may be offered?

MATERIALS AND METHODS

Research Design

This study made use of a quantitative research design. Quantitative research design was utilized to collect and gather information about the effects of game-based learning on the motivation of students in the science subject. In this regard, a descriptive research design was employed to describe and identify the perceptions of learners and teachers about game-based learning. This approach was used to gather data or information through a questionnaire/survey from the respondents. Specifically, the viewpoints, thoughts, and perceptions of the respondents were described. McNeill (2018) explained that the purposes of

descriptive research are to describe, explain, and validate the objectives or hypotheses of the study. This design summarized the characteristics of individuals or groups within the research environment of the study.

The study employed a quasi-experimental design to assess the effect of game-based learning (GBL) on students. Unlike true experimental designs, it did not randomize participants but instead compared results from existing groups before and after the intervention. Pre-tests were administered to measure students' baseline knowledge, followed by post-tests to evaluate changes in their understanding, skills, motivation, and engagement. The comparison of these results helped determine the impact of GBL on students' academic performance. Although it lacked the control of randomization, the quasi-experimental design provided valuable insights into the effectiveness of GBL in teaching science.

Participants

The study involved 72 Grade 7 learners from Lucsuhin National High School. This group was essential for evaluating the effectiveness and perceptions regarding game-based learning in junior school science education. This approach ensured a thorough understanding of the influence and outcomes of game-based learning specifically within the context of Lucsuhin National High School.

Research Instrument

The main gathering tool that used in this study was the survey questionnaire. Interview will also be used to validate the answer of respondents in the questionnaire.

Questionnaire. The adapted survey questionnaire was the major instrument to collect necessary information that will be helpful in achieving the research objectives. The survey questionnaire was adapted from Abad (2023), taken from the research titled "Developing Game-Based Learning Activities for Grade 9 Students." Its validity and reliability have been confirmed through Cronbach's Alpha analysis, resulting in a high or excellent reliability value of 0.98. Hence, the questionnaire was deemed fully prepared for the actual survey.

Procedure

The researcher gathered information by reading books, articles, magazines, and other related literature. Primary data were collected from the viewpoints of Grade 7 students through questionnaires, interviews, and observations, while secondary data were sourced from books, articles, and other related studies.

First, the researcher modified and validated the questionnaire to ensure its effectiveness in gathering responses from the respondents. Next, a letter was prepared and submitted to the school head to request permission to administer the questionnaire to Grade 7 science teachers and students at Lucsuhin National High School. Once permission was granted, the researcher collected the completed questionnaires from the respondents and tallied the responses. This step was crucial for the analysis and interpretation of the gathered data.

Additionally, the researcher administered a pre-assessment to evaluate the students' prior knowledge of the subject matter. The results revealed a need for an intervention procedure to improve the students' performance. During the intervention process, the researcher encountered a challenge related to the lack of time allotted for activities during class.

Post-assessments were subsequently administered to gauge the effectiveness of the intervention. The relationship between the survey results and the post-assessment outcomes was analyzed through statistical methods to evaluate the impact of the implemented intervention.

Data Analysis

To interpret the data, the researcher used different statistical tools to answer the research questions. The statistical treatment that were used in analyzing and interpreting the data were the following:

Frequency, Percentage, Mean Scores and Standard Deviation. This was used to determine the level of performance of students based on the pre-test and post-test scores providing insights into score distribution, average performance, and variability, which help evaluate the effectiveness of game-based learning interventions.

Weighted Mean. This was used to determine the teacher's assessment on the extent of utilization of game-based learning activities in relation to motivation, engagement, performance and application.

Composite Mean. This was used to determine how effective is game-based learning as perceived by the students and teachers in developing the learners' motivation and engagement.

Dependent T-test. The dependent t-test was employed to discern whether a notable variance exists between the perspectives of learners regarding game-based learning.

Pearson's r Correlation Coefficient. This was used to determine the significant relationship between perception of student about the effectiveness of Game-based learning (GBL) and post-test scores after the implementation of the intervention.

RESULTS

1. What is the level of performance of students based on the pre-test and post test scores?

Table 1
Level of Performance based on Pre-test and Post-test

Level of Performance	Before the Intervention		After the Intervention	
	Frequency	Percentage	Frequency	Percentage
Beginning (74.99% and below)	72	100	24	33
Developing (75.00% - 79.99%)	0	0	4	5
Approaching Proficiency (80.00% - 84.99%)	0	0	5	7
Proficient (85.00% - 89.99%)	0	0	7	10
Advanced (90.00% and above)	0	0	32	44
Total	72	100	72	100
Mean Percentage Score	45.53		83.19	
Standard Deviation	3.78		8.31	
Verbal Interpretation	Beginning		Approaching Proficiency	

Before the use of Game-Based Learning (GBL), all 72 students (100%) were at the beginning level in Science, with a mean score of 45.53 and a low standard deviation of 3.78, showing little variation in performance. This indicated a clear need for intervention to improve their understanding of scientific concepts.

After the implementation of GBL, student performance improved significantly. Thirty-two students (44%) reached the advanced level, while 16 students (22%) achieved proficiency or approaching proficiency, and 4 students (5%) showed developmental progress. However, 24 students (33%) remained at the beginning level. Overall, 54% of students attained proficiency or higher, with an increased mean score of 83.19 and a relatively low standard deviation of 8.70, indicating consistent improvement across the group.

These findings highlight the strong positive impact of GBL in enhancing Science performance, moving many learners from the beginning stage to proficiency and advanced levels. This aligns with previous research (D'Angelo, 2018; Adil & Napoles, 2023), which emphasizes that integrating technology and game-based platforms boosts engagement, satisfaction, and academic success.

2. Is there a significant difference between the pre-test and post-test scores of students after the implementation of the game-based learning?

Table 2
Difference between the Pre-assessment and Post-assessment Results

Variables		T	P-value	T-crit	Decision on Ho	Interpretation
Pre-assessment Result	Post-assessment Result	306.58	0.00	3.91	Reject Ho	Significant

The analysis of the data yielded a T-value of 306.58, which is substantially higher than the critical T-value (T-crit) of 3.91. In hypothesis testing, the T-value serves as a measure of the difference between values, typically the post-test scores and the pre-test scores. When the observed T-value exceeds the critical T-value, it suggests that the observed differences between the groups are statistically significant and unlikely to be caused by random chance.

In this case, a T-value of 306.58 far surpasses the T-crit threshold, indicating a large and statistically significant difference between the pre-assessment and post-assessment results. This means that the intervention introduced (in this case, Game-Based Learning) likely played a substantial role in improving student performance, as opposed to the changes being attributable to random fluctuations or external factors.

The p-value is reported as 0.00, which is significantly lower than the commonly accepted significance level of 0.05. This indicates that the probability of obtaining the observed results—or results more extreme—if the null hypothesis were true (i.e., if no difference existed between the groups) is extremely low. Such a result provides strong evidence to reject the null hypothesis (Ho), affirming that the observed differences are statistically significant and unlikely to be due to chance. This finding underscores the effectiveness of the intervention and highlights its importance in sustaining and further improving students' high levels of performance in Science. It also emphasizes the value of incorporating similar approaches to ensure consistent academic success and engagement in the subject.

This result aligns with the findings of Caponetto et al. (2020), who demonstrated that students participating in gamified learning experiences often show heightened enthusiasm for science topics and a deeper understanding of the material. The intrinsic motivation fostered by Game-Based Learning likely played a key role in the statistically significant improvements observed in the post-assessment results. This reinforces the notion that game-based interventions can effectively enhance student engagement and performance, offering compelling evidence of their positive impact on learning outcomes.

3. *What is the level of effectiveness of the game-based learning as perceived by the learners in developing the*
 3.1 *motivation;*
 3.2 *engagement;*

Table 3

The Level of Effectiveness Perceived by Students In Terms of Motivation		
Statements	Mean	Interpretation
1. I feel more motivated to participate in class when games are part of the lessons.	3.47	Agree
2. Game-based learning makes the subject matter more enjoyable.	3.51	Strongly Agree
3. I am more interested in learning when GBL is used in the classroom.	3.53	Strongly Agree
4. I find it easier to stay focused during lessons that involve games.	3.52	Strongly Agree
5. I am more likely to complete assignments when they involve game-based activities.	3.51	Strongly Agree
6. GBL encourages me to challenge myself to improve my understanding of the subject.	3.47	Agree
7. I feel a sense of accomplishment when I succeed in game-based learning tasks.	3.45	Agree
8. GBL makes learning feel less like work and more like an enjoyable activity.	3.51	Strongly Agree
9. I feel motivated to continue learning outside of class after participating in GBL.	3.51	Strongly Agree
10. GBL increases my curiosity and desire to explore topics further.	3.52	Strongly Agree
Composite Mean	3.50	Strongly Agree

Legend: 3.50-4.00 = Strongly Agree; 2.50-3.49 = Agree; 1.50-2.49 = Disagree; 1.00-1.49 = Strongly Disagree

The study revealed that students strongly agree on the positive impact of Game-Based Learning (GBL) in science education, with a composite mean of 3.50. The highest rating (3.53) was given to the statement that GBL increases interest in learning, affirming its role in making lessons more engaging and enjoyable. Closely following were mean scores of 3.52, reflecting that GBL enhances focus and curiosity, consistent with findings that gamified environments improve motivation and attention in STEM learning. Students also recognized that GBL boosts enjoyment and participation (3.51), transforming classroom dynamics into more collaborative and interactive experiences.

In terms of personal growth, learners felt motivated and encouraged to improve themselves (3.47), highlighting the supportive environment created by GBL. However, the lowest mean (3.45) was associated with a sense of accomplishment in completing tasks, suggesting that feedback or recognition mechanisms in GBL activities may need further strengthening.

Overall, the results demonstrate that GBL effectively fosters interest, engagement, focus, and motivation among students in science. By turning abstract concepts into interactive and relatable experiences, it not only improves comprehension but also sustains curiosity. These findings are in line with previous research emphasizing GBL's cognitive and motivational benefits, reinforcing its value as a modern teaching strategy that enhances learning outcomes and promotes active participation in science.

Table 4
The Level of Effectiveness Perceived by Students In Terms of Engagement

Statements	Mean	Interpretation
1. I feel more engaged in class activities when games are used	3.50	Strongly Agree
2. Game-based learning helps me pay attention throughout the lesson	3.50	Strongly Agree
3. I actively participate in class when games are involved.	3.54	Strongly Agree
4. Games make learning more interactive and fun for me.	3.62	Strongly Agree
5. GBL helps me collaborate with my classmates more effectively.	3.55	Strongly Agree
6. I feel more connected to the learning material through interactive game-based activities.	3.55	Strongly Agree
7. I am more willing to ask questions and share ideas when GBL is used.	3.50	Strongly Agree
8. GBL helps me retain information better compared to traditional lessons.	3.50	Strongly Agree
9. I engage more deeply with problem-solving when games are part of the learning process.	3.48	Agree
10. GBL helps me connect what I learn in class with real-world situations	3.52	Strongly Agree
Composite Mean	3.53	Strongly Agree

Legend: 3.50-4.00 = Strongly Agree; 2.50-3.49 = Agree; 1.50-2.49 = Disagree; 1.00-1.49 = Strongly Disagree

Survey results revealed that students strongly agreed that games make learning interactive and fun, with the highest mean score of 3.62, highlighting the positive impact of GBL in enriching learning experiences. This aligns with studies showing that gamified tools like Kahoot increase motivation, enjoyment, and intrinsic rewards (Smiderle et al., 2019; Nand, 2019).

A mean score of 3.55 across items on participation, collaboration, and social connection indicates that students believed GBL fostered stronger teamwork and interactive learning, consistent with Vygotsky's social constructivist theory and Loes' (2022) findings on collaborative learning.

Students also agreed that GBL helps connect lessons to real-world applications (mean = 3.52), supporting research by Tzafilkou & Protogeros (2023), which notes GBL's potential but also points out challenges such as technical issues, distractions, and training needs.

Meanwhile, a mean of 3.50 on engagement, curiosity, and retention shows that students perceived GBL as effective in boosting active participation and knowledge retention, supported by studies from Oroszlanyova & Farag (2023) and Zainuddin et al. (2022). Similarly, a mean of 3.47 indicated agreement that games enhance problem-solving engagement, reinforcing Gillespie's (2022) findings on GBL's role in deepening cognitive involvement.

Overall, the composite mean of 3.53 reflects strong agreement that GBL positively influences student learning by making it enjoyable, interactive, and engaging. This is consistent with Alonso-Fernández et al. (2020) and Rebollo et al. (2022), who emphasize that GBL environments sustain motivation, focus, and active participation.

4. What is the significant relationship with the assessment of the effectiveness of game-based learning and the pot-test scores of the students?

Table 5
Relationship between the Effectiveness of the Game-Based Learning
and the Post-Test Scores

Effectiveness of the Game-Based Learning	Post-Test Scores	t-stat	R- value	p- value	Decision on Ho	Interpretation
Motivation	Students' Post-Test Scores	6.46	0.61	0.00	Reject Ho	Significant
Engagement	Scores	5.20	0.53	0.00	Reject Ho	Significant

This shows a statistically significant relationship between the effectiveness of game-based learning (GBL) and students' post-test scores in Science, Technology, and Engineering Program (STEP). Motivation yielded a p-value of 0.00 with an R-value of 0.61 and $t = 6.46$, indicating a strong positive correlation, meaning that higher motivation from GBL leads to better academic performance. Engagement also showed a p-value of 0.00, with an R-value of 0.53 and $t = 5.20$, reflecting a moderate to strong positive correlation between engagement and post-test scores.

Supporting studies (Tinambunan & Orongan, 2023; Zhao et al., 2022; Nadeem et al., 2023) affirm that GBL outperforms traditional methods in boosting achievement, motivation, and engagement, as it fosters active participation, deeper involvement, and better knowledge retention. While both motivation and engagement significantly influence outcomes, motivation showed a stronger correlation, underscoring its key role in driving performance. Overall, findings validate GBL as an effective pedagogical tool that enhances both cognitive and affective learning, making education more interactive, enjoyable, and impactful.

5. Based from the findings of the study, what are the compendium of game-based instruction may be offered?

Based from the findings of the study, an output in the form of a compendium of learning plan and instructional material was developed. The drive of compilation was learning material was provided. (<https://drive.google.com/drive/folders/1hQoISsty906VJ3egTqRposSIFGxt2o9a?usp=sharing>)

DISCUSSION

1. The study investigated the impact of game-based learning on student performance in Science. Before the intervention, students were generally at the beginning level, which highlighted the need for targeted measures to improve their understanding of scientific concepts. Following the intervention, a significant number of students demonstrated advanced or proficient levels of achievement, indicating notable progress. Although some students remained at the beginning level, the results showed substantial improvement overall, supporting the effectiveness of game-based learning in enhancing student engagement and academic performance. These findings align with previous research on the benefits of integrating technology in education, emphasizing its potential to boost academic success and student interest.
2. The data analysis revealed a significant difference between the pre-assessment and post-assessment results. This suggests that the Game-Based Learning intervention played a major role in improving student performance. Furthermore, this provides strong evidence to reject the null hypothesis, confirming that the observed improvements are meaningful and not a result of random variation.
3. The study highlights the positive effects of Game-Based Learning (GBL) on students' motivation, engagement, and academic performance in Science. GBL also improved students' focus and curiosity

and made the learning experience more interactive and participatory. Students felt motivated to improve themselves though the sense of accomplishment in completing tasks was less strongly felt suggesting room for improvement in task design. Overall, it demonstrates that students find GBL an effective and enjoyable educational strategy, reinforcing its potential to enhance motivation and learning outcomes in Science.

4. The study highlights the positive impact of Game-Based Learning (GBL) on students' learning experiences. Students found games enjoyable and engaging, which improved their participation, collaboration, and interaction. GBL also helped connect classroom learning with real-world applications, despite some challenges. Additionally, it enhanced engagement, curiosity, and information retention. The findings confirmed that GBL effectively strengthens students' problem-solving abilities, boosting motivation, collaboration, and cognitive engagement.
5. The findings demonstrate the effectiveness of game-based learning (GBL) in enhancing students' academic performance by positively influencing motivation and engagement. Motivation was shown to have a stronger impact on learning outcomes compared to engagement, emphasizing the importance of motivational strategies in improving academic achievement. These results align with prior research, which highlights how GBL leverages interactive and gamified elements to create an engaging and enjoyable learning environment. By transforming education from a passive to an active process, GBL fosters greater participation, better retention, and a deeper understanding of complex concepts. These findings validate the integration of GBL in educational practices, showcasing its potential to address diverse learning needs and achieve meaningful academic benefits.

Conclusions

Based on the highlights of the findings, the following conclusions were as follows:

1. The study shows that game-based learning effectively improved student performance in Science, especially in research. With 54% of students reaching or exceeding the proficient level, the results emphasize the positive impact of game-based learning on student engagement and understanding, supporting previous research on the benefits of technology in education.
2. Game-Based Learning intervention significantly improved student performance, as evidenced by the substantial difference between the pre-assessment and post-assessment results. This finding provides strong evidence to reject the null hypothesis, confirming that the observed improvements are meaningful and directly attributable to the intervention, rather than occurring by chance.
3. Game-Based Learning (GBL) has a positive effect on students' motivation, engagement, and performance in Science. It improves focus, curiosity, and interactivity in the learning process. Although students felt motivated, the sense of accomplishment from completing tasks was less strong, indicating a need for better task design. Overall, the findings emphasize GBL's effectiveness as an engaging strategy that can enhance student motivation and academic outcomes in Science.
4. Game-Based Learning (GBL) effectively enhances students' learning experiences by making learning enjoyable, improving participation, collaboration, and interaction. GBL also helps connect classroom learning to real-world applications, boosts engagement, curiosity, and information retention, and strengthens problem-solving abilities. Despite some challenges, the findings confirm that GBL is a valuable tool for increasing motivation, collaboration, and cognitive engagement in students.
5. Game-based learning (GBL) is an effective educational approach that enhances academic performance by boosting motivation and engagement. The strong positive correlation between these factors and post-test scores emphasizes their vital role in improving learning outcomes, with motivation having a greater impact than engagement. By creating an interactive and participatory learning environment, GBL fosters deeper understanding, better retention, and higher achievement. These findings advocate for the integration of GBL into teaching methods to address diverse student needs and enhance educational success.

After carefully gathering the necessary data, the researchers developed the following recommendations:

1. Promote the integration of GBL by providing necessary infrastructure, such as access to digital tools and platforms, and by offering training programs to help teachers effectively implement GBL in their classrooms. Develop policies that support innovative teaching approaches, including the use of GBL, to enhance student learning outcomes.
2. Embrace GBL as a teaching strategy by incorporating interactive and gamified activities that align with curriculum objectives. Participate in professional development programs focused on GBL techniques to maximize its effectiveness in fostering student engagement and performance.
3. Actively participate in game-based learning activities to enhance understanding and retention of subject matter. Provide constructive feedback to teachers about the use of GBL, helping to refine and improve its implementation for more effective learning experiences.
4. Investigate the long-term effects of GBL on student performance across different age groups and subjects. Explore how factors such as motivation, engagement, and demographic diversity influence the outcomes of GBL in educational settings.
5. Conduct comparative studies to analyze the effectiveness of GBL versus traditional teaching methods. Collaborate with educators and policymakers to develop evidence-based guidelines for implementing GBL, ensuring its alignment with diverse learning needs and educational standards.

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