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Exploring Student Academic Achievement and Motivation through Game-Based Learning on Interactive Whiteboards

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ABSTRACT: This study investigates the effectiveness of integrating Wordwall.net games with interactive whiteboards to enhance student motivation and academic achievement in a 10-week financial instruments course. The primary research questions focus on how this combination impacts students' learning motivation and performance. Utilizing a single-group pretest-posttest experimental design, the research involved 33 undergraduate students who completed assessments, including the Financial Instruments Quiz and the Learning Motivation Scale, which encompasses five dimensions: intrinsic goal orientation, extrinsic goal orientation, task value, control beliefs, and self-efficacy. The results revealed a statistically significant increase of 31 points in quiz scores from pre- to post-test, with 97% of participants achieving passing grades after the intervention. Additionally, motivation measures demonstrated considerable gains across all five dimensions. Qualitative feedback highlighted that the interactive game-based format promoted enjoyment, facilitated social collaboration, and increased engagement with digital content. The findings provide empirical evidence that combining Wordwall.net with interactive whiteboards can significantly improve student motivation and understanding of complex concepts. These results suggest that educators should consider this integration to create a more engaging learning environment. Future research is recommended to explore long-term effects and identify specific features of Wordwall.net that enhance learning outcomes when used with interactive whiteboards.

KEYWORDS: game-based learning, interactive whiteboard, Wordwall.net, learning motivation, academic achievement

INTRODUCTION

Technology integration in education has fundamentally transformed traditional teaching methodologies, particularly with the emergence of interactive whiteboards (IWBs) and educational software like Wordwall.net. IWBs have become increasingly prevalent in classrooms, providing educators with tools to create dynamic, interactive learning environments catering to diverse student needs. Research has shown that IWBs facilitate enhanced engagement and participation by allowing real-time interaction and visual representation of information (Glover & Miller, 2001). This shift towards technology-enhanced learning is crucial in fostering an engaging educational experience, especially in modern pedagogical contexts.

Wordwall.net has gained recognition as a versatile platform that enables teachers to create a variety of interactive activities, including quizzes, games, and collaborative tasks. These activities can be utilized online and face-to-face, making Wordwall.net a valuable resource for educators seeking to enhance student engagement and motivation (Idzi'Layyinnati, 2021; Savira & Gunawan, 2022). The platform's user-friendly interface allows teachers to design customized activities tailored to their curriculum needs, promoting a more personalized learning experience. Furthermore, tracking student performance through the platform provides educators with insights into individual and collective learning progress, enabling them to adjust their instructional strategies accordingly (Marensi et al., 2023).

Despite the growing body of literature on the benefits of IWBs and gamified learning platforms like Wordwall.net, there remains a significant gap in empirical research specifically examining the impact of Wordwall.net on student motivation and academic performance when used alongside IWBs. Existing studies have primarily focused on broader applications of IWBs or general gamification strategies (Cuthell, 2006; Glover & Miller, 2009; Sarsa & Soler, 2011), leaving unanswered questions about how Wordwall.net can uniquely contribute to enhancing educational outcomes in IWB-supported classrooms. Additionally, while previous research has indicated that interactive whiteboard technology can significantly influence students' perceptions of learning (Wall et al., 2005), more exploration of how specific software like Wordwall.net can optimize these benefits must be explored.

Furthermore, studies have suggested that interactive tools enhance students' motivation and engagement (Sari, 2021). This study aims to address these gaps by investigating the specific effects of Wordwall.net activities on student motivation and academic performance, thereby providing valuable insights for educators looking to optimize their teaching practices through technology integration.

Problem Statement

The integration of Wordwall.net into educational settings, particularly in conjunction with interactive whiteboards (IWBs), has been met with enthusiasm from educators seeking to enhance student engagement and learning outcomes. However, despite its potential, there needs to be more empirical evidence regarding the specific impact of Wordwall.net activities on student motivation and academic performance. The existing literature (Glover & Miller, 2009; Goodison, 2002) primarily discusses the general advantages of interactive whiteboards (IWBs) and gamification in education. However, there remains a significant gap in understanding how Wordwall.net specifically impacts these factors within classrooms that utilize IWBs.

Research has indicated that technology-enhanced learning environments can increase student participation and motivation (Glover & Miller, 2009). However, the direct relationship between using Wordwall.net and measurable improvements in student engagement still needs to be explored. For instance, while some studies suggest that gamified activities can foster a more interactive classroom atmosphere (Savira & Gunawan, 2022), insufficient data specifically examines how Wordwall.net contributes to this dynamic. This lack of targeted research challenges educators eager to implement effective technology-driven classroom strategies.

Moreover, existing studies still need to fully address how Wordwall.net can facilitate student behavioral engagement and academic achievement. Although previous research highlights the positive effects of interactive tools on learning motivation (Idzi' Layyinnati, 2021), it needs to provide comprehensive insights into the specific mechanisms through which Wordwall.net operates in IWB contexts. Therefore, this study aims to investigate two critical questions:

(1) How effectively do Wordwall.net activities on IWBs affect students' learning motivation?
(2) How effectively do Wordwall.net activities on IWBs influence students' academic achievement?

Addressing these questions will provide valuable insights to inform teaching practices and enhance technology integration in educational settings.

Significance

The significance of this study lies in its potential to provide valuable insights into the effective integration of educational technology in classrooms, particularly through the use of Wordwall.net in conjunction with IWBs. By investigating the specific effects of Wordwall.net on student motivation and academic achievement, this research aims to offer empirical evidence that can inform teaching practices and enhance learning outcomes. Understanding how Wordwall.net influences student engagement is crucial, especially given that previous studies have indicated that gamified learning environments can foster greater student participation and enthusiasm (Idzi' Layyinnati, 2021; Savira & Gunawan, 2022).

In contrast to studies focusing on Kahoot!, which have been extensively researched for their impact on student engagement and academic performance (Fuster-Guilló et al., 2019; Wang & Tahir, 2020), this research investigates the use of Wordwall.net as an educational technology tool specifically designed to foster interactive learning within the context of IWBs. Wordwall.net allows educators to create various personalized interactive resources, enhancing individual and collaborative learning experiences. Its extensive templates—including quizzes, matching exercises, word searches, and crossword puzzles—enable teachers to adapt activities to meet diverse educational needs. This adaptability promotes a more engaging and interactive classroom environment, essential for effective learning.

Moreover, this study addresses a critical gap in existing literature regarding the application of Wordwall.net within IWB-supported classrooms. While prior research has highlighted the benefits of IWBs in enhancing interactive learning experiences (Glover & Miller, 2009; Goodison, 2002), there has been limited exploration of how specific software like Wordwall.net can optimize these benefits. Unlike previous studies that primarily focused on Wordwall.net in English language learning contexts (Pradini & Adnyayanti, 2022; Swari, 2023), this research explores its unique contributions to a Financial Instruments course.

The findings from this study will not only contribute to academic discourse but also provide practical recommendations for educators seeking to implement effective technology-driven strategies in their teaching. Additionally, by demonstrating the impact of Wordwall.net on student academic performance, this research may influence educational policies and practices aimed at improving teaching and learning through technology integration. As educators increasingly seek innovative methods to engage students and enhance their learning experiences, this study will be a valuable resource for those looking to adopt interactive tools that promote

active participation and achievement in educational settings. Ultimately, the implications of this research extend beyond individual classrooms; they may shape broader educational practices that leverage technology to foster meaningful learning experiences for students.

LITERATURE REVIEW

Game-Based Learning Platform, Wordwall.net, and Student Learning

Gamification, as defined by Zichermann and Cunningham (2011) and further explored by Seaborn and Fels (2015), represents an engaging instructional approach for problem-solving, effectively boosting students' motivation and participation. It involves leveraging key elements and mechanics from games to achieve educational goals without the requirement of constant gameplay. The advantages of gamification can be fully harnessed by recognizing the necessity, similar to other pedagogical strategies, to continually adapt and refine teaching methods to suit individual learners' unique requirements and contexts. Santosa et al. (2022) claimed that applying gamification is similar to resolving real-world issues, which presents challenges that users must overcome. Teachers can also match the content to the student's interests through gamification.

Wordwall.net is an online educational platform designed to enhance interactive learning experiences in the classroom. It offers a variety of customizable games and activities for teachers to create and share with their students. These games span diverse formats, including quizzes, word games, and interactive puzzles. Wordwall.net aims to make learning more enjoyable by providing teachers with tools to create interactive lessons that capture students' attention and promote active participation in the educational process.

Studies have shown that using Wordwall.net as a learning medium can enhance student learning. Fun, quiz-based game features of Wordwall.net increase student engagement and interactivity in the classroom (Sari & Yarza, 2021). According to research by Rodríguez-Escobar et al. (2023), Wordwall.net was considered an efficient instrument for teaching and acquiring vocabulary by pre-service EFL teachers. Wordwall.net's interactive games and activities increased student engagement and encouraged group learning. Additionally, it was thought that the platform's capability to give students feedback helped enhance their learning.

Also, several studies have demonstrated that utilizing Wordwall.net in classroom activities can boost student participation and involvement. Sari (2021) concluded that Wordwall.net media increased student activity and understanding of the material. Similarly, Aidah and Nurafni (2022) found that Wordwall.net media could raise student learning activities. The interactive and game-based features of Wordwall.net motivate students to take part in the learning process actively.

In addition to student engagement, Wordwall.net usage has also been linked to better learning performance. According to Minarta and Pamungkas (2022), Wordwall.net effectively enhanced economics learning outcomes related to taxation concepts. The competitive game format allowed students to test their knowledge and improve retention repeatedly.

Research also indicates that Wordwall.net can increase student motivation to learn. Savira and Gunawan (2022) explained that the varied templates and creative application design attracted students' interest and generated enthusiasm for learning new material. The interactive multimedia approach caters to different learning preferences.

Studies on implementing Wordwall.net in educational settings reveal its positive effects on key aspects of the learning process (Sari & Yarza, 2021). Research indicates that Wordwall.net enhances student participation, comprehension, academic achievement, and motivation (Rodríguez-Escobar et al., 2023). The platform's game-based design fosters active learning and interactivity, making it an effective tool for engaging students (Savira & Gunawan, 2022). Furthermore, existing literature underscores its effectiveness as an educational technology resource across various grade levels (Aidah & Nurafni, 2022; Minarta & Pamungkas, 2022). Wordwall.net is a valuable asset in promoting an engaging and interactive learning environment.

The Role of Interactive Whiteboards in Student Learning

Over the past few decades, interactive whiteboards, or IWBs, have gained popularity as a teaching tool in classrooms. Based on Uduakand and Kasumu's (2022) research, students perceived interactive whiteboards as effectively integrating various learning styles into a unified educational experience within tertiary institutions. Additionally, students highlighted that interactive whiteboards contribute to maintaining a tidy learning environment, are easy to upkeep, and eliminate the need for conventional writing tools such as chalk or markers.

The effects of IWBs on various educational outcomes, such as student motivation, engagement, and achievement, have been studied in research. Several researches have shown that utilizing IWBs in the classroom has advantages. IWBs can improve student

enthusiasm and collaboration (Miller et al., 2005), make it easier to incorporate multimedia into classes (Goodison, 2002), and, in some situations, have a beneficial effect on achievement (Wall et al., 2005). The literature mentions a few specific advantages, such as the capacity to easily incorporate videos and web links, display dynamic visuals, facilitate student interaction and collaboration at the board, save annotations for later review, conceal and reveal content, and modify activities for a variety of learners (Bell, 2000; Branzburg, 2007).

The use of IWBs has been studied for its potential effects on various student outcomes like motivation, attitudes, and academic achievement. Research suggests IWBs can enhance motivation and engagement through interactive elements promoting student collaboration (Glover & Miller, 2001; Miller et al., 2005). According to technology acceptance theories, the perceived usefulness and ease of use of IWBs play a moderating role in how engagement influences users' attitudes and intentions to utilize these tools (Teo et al., 2003). The increased interactivity among teachers, students, and content during IWB lessons has the potential to yield positive learning outcomes.

While IWBs offer a wide range of features to create captivating, interactive multimedia lessons, the extent to which they improve student engagement, collaboration, and learning depends heavily on how effectively instructors leverage the capabilities of the technology. Integrating appropriate educational platforms and software like Wordwall.net with IWBs may hold valuable potential. By examining the efficacy of using Wordwall.net games on IWBs in relation to student motivation and achievement outcomes, the present study aims to shed light on optimizing the instructional use of these technologies in combination.

Student Motivation in Educational Contexts

Motivation is widely recognized as a crucial factor influencing students' achievement and learning outcomes across various educational contexts. It drives individuals' behaviors and desires, leading to engagement or avoidance of activities (Elliot & Covington, 2001). Motivation plays a significant role in shaping students' learning processes and overall success in academic settings, particularly in technology-enhanced learning.

Researchers categorize motivation into two primary types: intrinsic and extrinsic. Intrinsic motivation refers to an internal drive to learn, often associated with personal fulfillment and engagement with the material (Alizadeh, 2016). In contrast, extrinsic motivation is influenced by external factors such as rewards, recognition, or approval from others (Setyoningsih, 2022). Both types of motivation are essential in educational contexts but affect student behavior differently; intrinsically motivated students tend to employ effective learning strategies and engage more deeply in their studies, while those driven by extrinsic factors may focus primarily on meeting external expectations (Lepper, 1988).

Empirical research consistently supports the importance of motivation in learning environments. Motivated learners—those driven by curiosity or personal fulfillment—are generally more engaged in their studies (Lepper, 1988). Integrative motivation, which involves a desire to learn about the culture associated with the target subject matter, is particularly significant for successful learning outcomes (Gardner & Lambert, 1972; Ellis, 1997; Cheung, 2001). Conversely, instrumental motivation focuses on practical goals such as career advancement or passing exams but might not foster the same level of long-term engagement.

Gardner (1985) emphasized three critical components of motivation in learning: the attempt to acquire knowledge or skills, eagerness to achieve learning goals, and a positive attitude toward learning tasks. Gardner (2001) further elaborated that motivated learners are characterized by their hard work, clear objectives, and enjoyment of the learning process. Such learners are more likely to invest time and effort into their studies, leading to improved academic outcomes.

Learner autonomy and self-motivation are essential components of effective learning experiences, as students who take ownership of their education demonstrate higher proficiency levels (Dornyei, 2001; Rogers, 1991). Recognizing and enhancing student motivation is crucial for improving educational outcomes. This understanding will be pivotal in the upcoming methodology chapter, which will explore how integrating Wordwall.net with interactive whiteboards can further boost student motivation and academic achievement. By focusing on these elements, the study aims to provide insights into optimizing technology use in educational settings.

METHODOLOGY

Research Design

To better understand the combining interactive whiteboards and Wordwall.net software on student learning and motivation, a 10-week study was designed to examine the experiences of junior public finance and taxation majors at a private university in Taiwan.

The researcher gave two hours of instruction every week in the "Financial Instruments" course. The first ninety-minute portion consists of conventional lecture-style teaching blended with group discussions, while the second thirty-minute portion includes interactive Wordwall.net sessions on IWB intended to increase student participation.

A single-group pretest-posttest experimental design was used in our study. After eliminating individuals who did not participate in both the pretest and posttest and invalid replies, a cohort of 33 individuals makes up the final sample used for statistical analysis.

Using the Wordwall.net application on IWB, assessment instruments, such as the Learning Motivation Scale (LMS) and the Financial Instruments Quiz (FIQ), were used to determine students' academic achievement and motivation for learning. Participants undergo an initial assessment with LMS and FIQ to determine baseline values at the beginning of the study. The same two instruments are re-administered after the trial to identify learning results and motivation changes.

Instruments

The study employed two distinct instruments: the Learning Motivation Scale (LMS) and the Financial Instruments Quiz (FIQ). Learning motivation reflects the psychological processes and internal drive individuals engage in towards achieving a teacher's objectives, facilitating the initiation and sustained participation in learning activities. When motivation is high, learners are more likely to invest energy into understanding and mastering the subject matter.

Additionally, a Learning Motivation Scale (LMS) was implemented to assess the impact of Wordwall.net, in conjunction with interactive whiteboards, on students' learning motivation. The Learning Motivation Scale (LMS) used in this study was adapted from the validated Motivated Strategies for Learning Questionnaire developed by Pintrich et al. (1991). Specifically, items from five subscales were incorporated into the LMS to assess: 1) Intrinsic Goal Orientation (IGO), focusing on intrinsic reasons for engaging in a task; 2) Extrinsic Goal Orientation (EGO), concerning extrinsic reasons for undertaking a task; 3) Task Value (TV), relating to how students value the importance and usefulness of course content; 4) Control Beliefs (CB), measuring students' beliefs about their ability to perform tasks successfully; and 5) Self-Efficacy for Learning and Performance (SLP), evaluating students' self-judgements about their capabilities to meet designated performance requirements.

For the revised Learning Motivation Scale (LMS) questionnaire utilized in this study, 20 items were retained from the original Motivated Strategies for Learning Questionnaire upon which it was based. A reliability analysis assessed the internal consistency of scores on the LMS subscales. Cronbach's α was calculated, revealing an excellent level of reliability at .979. This high Cronbach's α value supports the homogeneity of items measuring the same underlying constructs within the LMS questionnaire administered to participants before and after the Wordwall.net on IWBs intervention.

To obtain more qualitative feedback, the revised LMS included four supplemental open-ended questions. These questions aimed to capture participants' responses to using the Wordwall.net application on the interactive whiteboards during class sessions. Responses to quantitative LMS items adopted a standard 5-point Likert scale ranging from "Strongly Agree" to "Strongly Disagree".

Before Wordwall.net was implemented on interactive whiteboards, a pretest using the Financial Instruments Quiz (FIQ) was used to determine the baseline of students' proficiency in financial instruments. By serving as a control measure, the pretest made it possible to compare students' starting knowledge levels with their final performance. The study shows how the intervention affected academic achievement by measuring the knowledge gains made during the intervention period by assessing both pretest and posttest scores.

RESULTS

The Effectiveness of Wordwall.net on IWBs in Fostering Learning Motivation

To understand the impact of using Wordwall.net on IWB on students' learning motivation, participants completed the Learning Motivation Scale (LMS) as both a pretest and posttest. As shown in Table 1, students reported relatively high levels of motivation before the intervention ($M = 4.21$, $SD = 0.45$), with mean scores ranging from 4.08 to 4.30 across the five dimensions. Following the 10-week Wordwall.net treatment, a paired-sample t-test found a statistically significant increase in overall learning motivation ($t = -5.63$, $p < .001$).

When examining each dimension independently, significant pre-post differences were also observed. Specifically, Intrinsic Goal Orientation (IGO) saw a meaningful increase ($t = -3.17$, $p = .003$), suggesting Wordwall.net activities on interactive whiteboards were able to make learning feel more intrinsically rewarding and engaging for students. Extrinsic Goal Orientation (EGO) saw a significant increase from pre to posttest ($t = -3.15$, $p = .003$). This suggests that the Wordwall.net activities on IWBs motivate students more because of external factors like grades, rewards, and competition. They may have enjoyed the interactive nature of the IWBs and the competitive elements and feedback features of the Wordwall.net games. Task Value (TV) also improved significantly ($t = -2.99$, $p = .005$). Successful performance on Wordwall.net with IWBs that deepened their knowledge may have

convinced students of the personal importance and value of mastering the content. Control Beliefs (CB) witnessed a positive change as well (t = -2.55, p = .016), indicating getting immediate feedback from Wordwall.net on IWBs helped students recognize what they did/didn't understand in real time. This empowered their control beliefs by highlighting areas to focus on. Self-efficacy for Learning and Performance (SLP) witnessed a meaningful boost as well (t = -3.10, p = .004). This suggests that using Wordwall.net on IWBs in an engaging, interactive format has strengthened students' beliefs in their capabilities to understand complex content, achieve high-performance standards, and complete academic tasks. Their self-efficacy and confidence in their academic abilities were elevated compared to baseline levels before the intervention.

Table 1. Paired Samples t-test of Learning Motivation (N=33)

Dimension	No. of items	Mean (SD)				df	t	p
		Pretest		Posttest				
IGO	3	4.08	(0.76)	4.53	(0.56)	32	-3.17	.003
EGO	3	4.25	(0.71)	4.61	(0.52)	32	-3.15	.003
TV	5	4.20	(0.71)	4.57	(0.52)	32	-2.99	.005
CB	3	4.30	(0.61)	4.58	(0.49)	32	-2.55	.016
SLP	6	4.22	(0.61)	4.46	(0.57)	32	-3.10	.004
Learning Motivation	20	4.21	(0.45)	4.55	(0.46)	32	-5.63	.000

The Effectiveness of Wordlwall.net on IWBs in Student Academic Achievement

The Financial Instruments Quiz (FIQ) data were analyzed using a paired sample t-test to compare the pretest and posttest results. A noteworthy result (t = -8.85, P < .001) was revealed in Table 2 after a 10-week Wordwall.net games on IWBs intervention. The average increase in post-test scores was 31. A remarkable 32 out of 33 participants, or 97% of the total, successfully passed the Financial Instruments Quiz.

Table 2 . Paired Sample t-test of Academic Achievement (N=33)

	Mean (SD)				df	t	p
	Pretest		Posttest				
Academic Achievement	56.70	(18.72)	87.73	(13.58)	32	-8.85	.000

The results from the paired sample t-test and pass rate data prove that using Wordwall.net games on IWBs for 10 weeks significantly improved students' learning outcomes in financial instruments concepts. The highly significant increase in average quiz scores from pretest to posttest demonstrates convincingly that the Wordwall.net on IWBs treatment was highly effective at deepening students' knowledge and command of subject matter. Nearly all students could then apply what they learned to pass the cumulative performance evaluation. Interactive, puzzle-based activities delivered via IWBs have helped solidify financial term definitions and foster connections between abstract ideas in a memorable, tangible way for learners. Presenting complex content as an engaging challenge through Wordwall.net games on the large, collaborative classroom displays has made learning attainable for nearly the entire class. The interactive format integrated multiple modalities to support diverse learner needs, cementing the understanding assessed on the quiz. Overall, the results affirm that Wordwall.net activities on IWBs are a promising means of markedly enhancing student achievement outcomes in this subject are

Qualitative Results

The results from the revised Learning Motivation Scale, which included four open-ended questions, are presented in Table 3 to gain further qualitative insights. Regarding question 1, concerning participants' preferences for Wordwall.net on interactive whiteboards, nearly half of the respondents (48.48%) found the games on Wordwall.net to be engaging and enjoyable to play. Many students find classroom learning more enjoyable and engaging when course material is gamified through Wordwall.net's stimulating puzzles and team activities. A boost in intrinsic motivation was probably influenced by this connection between learning and having more

enjoyment. Furthermore, 15.15% of students valued the opportunity Wordwall.net games provided for social contact and teamwork. It appeared that friendly competition and cooperative play enhanced motivation even more. Additionally, more than one-third of respondents (36.36%) said they enjoyed using the interactive whiteboards to perform Wordwall.net activities. This shows that students' enjoyment and motivation to engage more fully in the Wordwall.net intervention were enhanced by the immersive experience of working with the large-screen digital puzzles in the shared classroom setting. The critical context provided by these qualitative comments supports the conclusion that Wordwall.net implemented via IWBs effectively boosts learning motivation by positively altering student interest, social dynamics, and digital learning experience.

Regarding question 2, which asked participants to name the component they dislike, 81.82% of respondents said they didn't have any dislikes. Some complained that the game's content could have been more challenging and that IWBs occasionally replied too slowly.

The third question asking whether students wanted to play Wordwall.net on IWBs again showed a resounding 93.94% saying yes. This overwhelmingly positive feedback demonstrates students immensely enjoyed this blended learning approach. With 6% dissenting, it's clear Wordwall.net on IWBs captured their engagement and interest. The eagerness to repeat the experience affirms the value of Wordwall.net for motivating learning when delivered via an interactive platform.

The final question concerned how Wordwall.net games and learning objectives aligned. Everyone agreed that the goals had been met, aligning with the quantitative results. Students acknowledged that Wordwall.net helped with the material review. This indicated that objectives were met because they matched the 97% pass rate on the financial instruments quiz. High scores and qualitative feedback highlighting Wordwall.net's review support clearly demonstrate that learning objectives were reached. Wordwall.net games effectively enhance concept review when used in conjunction with interactive whiteboards, as evidenced by the convergence of perceived value and demonstrated achievement.

Table 3. Qualitative Results of Wordwall.net on IWBs (N=33)

	Question	Responses	N	%
1	What part of Wordwall.net on IWBs do you like? Why?	Interesting & Fun	16	48.48
		Collaboration	5	15.15
		Interactive Whiteboard	12	36.36
		Total	33	100
2	What part of Wordwall.net do you dislike? Why not?	N/A	27	81.82
		the content is too difficult	4	12.12
		IWBs responds too slowly	2	6.06
		Total	33	100
3	Will you play Wordwall.net games on IWBs again? Why?	Yes	31	93.94
		No	2	6.06
		Total	33	100
4	Does this game on IWBs correspond to the learning objectives? Why?	Yes	33	100
		No	0	0
		Total	33	100

DISCUSSION

This study investigates the effectiveness of integrating Wordwall.net games with interactive whiteboards to enhance student motivation and academic achievement in a Financial Instruments course. The results demonstrate a statistically significant increase in quiz scores, with an average improvement of 31 points from pretest to posttest, and 97% of participants achieving passing grades. Additionally, motivation levels across five dimensions—intrinsic goal orientation, extrinsic goal orientation, task value, control

beliefs, and self-efficacy—showed significant gains. Qualitative feedback indicated that the interactive game-based format enhanced student enjoyment, collaboration, and engagement with digital content.

Existing literature highlights the benefits of IWBs and gamified learning platforms like Wordwall.net for enhancing student engagement and learning outcomes. Research has established that IWBs facilitate increased student participation and interaction through dynamic presentations and real-time feedback. Studies have shown that gamification strategies can boost motivation and engagement by making learning more enjoyable. However, while evidence supports these technologies' effectiveness individually, there remains a notable gap in empirical research examining their combined impact on educational outcomes.

This study contributes to the existing body of knowledge by specifically exploring how Wordwall.net activities influence student motivation and academic performance when integrated with IWBs. Unlike previous studies that focused broadly on IWBs or general gamification strategies, this research provides targeted insights into the unique effects of Wordwall.net within IWB-supported classrooms. The significant improvement in quiz scores and motivation levels observed in this study underscores the potential of combining these technologies to create more engaging learning environments, offering a hopeful outlook for the future of educational technology.

A notable similarity between this study and prior research is the acknowledgment that technology-enhanced learning environments can increase student participation and motivation. For instance, Glover and Miller (2001) found that IWBs significantly influence students' perceptions of learning, which aligns with this study's findings on improved motivation levels. Additionally, Sari (2021) noted that interactive tools generally enhance motivation, corroborating the observed gains in this research.

However, this study diverges from earlier research by focusing specifically on the integration of Wordwall.net in a Financial Instruments course. While previous studies have primarily examined broader applications of IWBs or general gamification strategies (Cuthell, 2006; Glover & Miller, 2009), this research quantifies the specific effects of Wordwall.net within a structured educational setting. The qualitative feedback collected aligns with findings from Rodríguez-Escobar et al. (2023), which emphasized the role of interactive platforms in fostering collaborative learning experiences.

Moreover, existing literature has highlighted that using Wordwall.net can enhance student engagement (Savira & Gunawan, 2022) and improve academic performance (Minarta & Pamungkas, 2022). This study builds on those findings by providing empirical evidence demonstrating measurable improvements in academic performance attributable to Wordwall.net's interactive features when used alongside IWBs.

LIMITATIONS AND FUTURE RESEARCH

This study acknowledges several limitations that may affect the generalizability of its findings. Firstly, the research was conducted in a specific educational context, which may not reflect the diverse settings found in different schools or regions. As a result, the applicability of the results to broader educational environments may be limited. Future research should consider conducting similar studies across various contexts to enhance the external validity of the findings.

Secondly, the study relied on self-reported student motivation and academic performance measures. While self-reports can provide valuable insights, they may also be subject to biases such as social desirability or inaccurate self-assessment. Future studies could incorporate objective measures of academic performance, such as standardized test scores or observational assessments, to provide a more comprehensive evaluation of the impact of Wordwall.net on student learning outcomes.

Additionally, this research primarily focused on immediate effects regarding student engagement and performance. Longitudinal studies are needed to assess the sustained impact of Wordwall.net activities over time and their influence on long-term academic achievement. Such investigations could provide deeper insights into how interactive tools contribute to ongoing learning processes.

Finally, further exploration is warranted into the specific features of Wordwall.net that most effectively enhance student engagement and learning outcomes. Qualitative research methods, such as interviews or focus groups with educators and students, could uncover nuanced perspectives on how different platform aspects are utilized in classroom settings.

CONCLUSION

This study provides significant insights into integrating Wordwall.net with interactive whiteboards (IWBs) and its impact on student motivation and academic achievement in a Financial Instruments course. The primary research questions focused on how

Wordwall.net activities on IWBs affect students' learning motivation and academic performance. The findings indicate a substantial increase in quiz scores, with a 31-point improvement from pre to posttest, and 97% of participants achieving passing grades after the intervention. Furthermore, motivation measures demonstrated significant gains across all five dimensions: intrinsic goal orientation, extrinsic goal orientation, task value, control beliefs, and self-efficacy for learning and performance.

The qualitative feedback underscored the effectiveness of the interactive game-based format in fostering enjoyment, promoting social collaboration, and enhancing engagement with digital content. This suggests that the immersive experience provided by IWBs combined with Wordwall.net can create a more dynamic learning environment.

Despite these promising results, gaps still need to be found in understanding the long-term effects of this integration across diverse educational contexts. Future research should explore larger sample sizes and varied subject areas to assess the generalizability of these findings. Additionally, investigating specific features of Wordwall.net that contribute most effectively to student engagement and learning outcomes will further enrich our understanding of its potential in educational settings. This study supports the argument for adopting interactive tools like Wordwall.net in conjunction with IWBs to enhance student learning experiences.

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CONFLICT OF INTEREST STATEMENT
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