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Enhancing Mathematics Instruction through Quizizz: A Systematic Literature Review

Tirivanhu Muchuweni, Zingiswa Jojo*
Rhodes University
Eastern Cape, South Africa

Israel Kariyana
Department of Continuing Professional Teacher Development,
Walter Sisulu University, Eastern Cape, South Africa

Abstract. This systematic review paper examines the pedagogical value of utilizing Quizizz to enhance mathematics instruction within secondary education. Guided by the PRISMA 2020 framework, the review analyzed 25 peer-reviewed studies published between 2015 and 2024, sourced from ERIC, ScienceDirect, and SpringerLink. The database searches employed specific search terms, such as "Quizizz AND mathematics," "formative assessment AND Quizizz," "educational games AND mathematics classroom," and "student motivation OR Quizizz," to ensure comprehensive coverage of relevant literature. A thematic synthesis approach was utilized, involving coding, the grouping of descriptive themes, and the generation of analytical themes to analyze the findings. The review particularly focused on Quizizz's effects on student engagement, motivation, academic performance, formative feedback, and differentiated instruction, with Self-Determination Theory (SDT) serving as the guiding framework. The results indicated that Quizizz consistently promotes active participation and motivation, with multiple studies reporting higher test scores and improved attitudes toward mathematics compared to traditional instructional methods. Quizizz facilitates real-time formative assessment, provides instant feedback, and enables educators to adjust their instructional strategies accordingly. Its gamified features, including avatars, leaderboards, and self-paced learning, create an interactive environment that supports autonomy, competence, and relatedness, as articulated by SDT. Furthermore, Quizizz allows for differentiation, accommodating students with varying skill levels to engage at their individual pace. These findings underscore the tool's potential to render mathematics classrooms more inclusive and effective. The review concludes with recommendations for integrating Quizizz with other pedagogical approaches and emphasizes the necessity for

*Corresponding author: Zingiswa Jojo; *Zingiswa.Jojo@ru.ac.za*

further research in rural and under-resourced contexts to ensure equitable access.

Keywords: Quizizz; mathematics instruction; gamification; student engagement; formative assessment

1. Introduction

Gamification is becoming a popular strategy in education because it helps make learning more engaging and enjoyable (Hamari, Koivisto, & Sarsa, 2014; Lee & Hammer, 2011). Adding game-like elements such as points, rewards, and leaderboards to lessons enables teachers can boost student motivation and support better learning outcomes (Qudsi, 2024; Deterding et al., 2011). As noted by Shumba (2024), "…gamification plays a significant role in the teaching and learning process, emphasizing the need to integrate gamification in both online and offline platforms to enhance student engagement" (p. 123).

Jong, Zhai, and Chen (2024) highlight that such platforms promote active, student-centered learning across mathematics and STEM subjects. Triantafyllou, Georgiadis, and Sapounidis (2025) found that gamification improves learning outcomes when game elements are applied meaningfully. Various categories of gamification platforms offer a wide range of features. In this context, this study specifically focuses on the role of Quizizz in mathematics instruction.

Many secondary school students struggle with mathematics due to feelings of anxiety or disconnection from the subject. Mathematics anxiety, which refers to stress or fear while doing math, can lead students to avoid participating in problem-solving activities (Ramirez et al., 2013; Carey et al., 2016). This often negatively affects their performance and confidence, creating a cycle where they continue to fall behind and lose interest in the subject (Ashcraft, 2002; Suárez-Pellicioni et al., 2016).

Gamified digital tools like Quizizz provide a way to improve this experience by making learning more interactive and student-friendly (Poondej & Lerdpornkulrat, 2016; Hidayat et al., 2024). With features such as points, leaderboards, and instant feedback, Quizizz brings energy and enjoyment into the classroom (Ismail & Mohammad, 2017). These elements help keep students motivated and reduce the fear often associated with mathematics lessons (Basuki & Hidayati, 2019).

Quizizz is one of the most widely used gamified platforms in classrooms today (Ismail & Mohammad, 2017; Capuno, 2023). Students generally find Quizizz easy to use and enjoyable (Basuki & Hidayati, 2019). Features like real-time feedback, avatars, and competitive elements create an interactive environment that encourages participation in learning activities. This is especially beneficial in mathematics, where many students struggle with anxiety and may lose interest in lessons (Maulana et al., 2023). Lampropoulos and Kinshuk (2024) explain that tools like Quizizz are part of a growing trend to make learning more active and hands-on through technology.

While several studies have explored the use of gamified platforms in education, most focus on general engagement or compare different tools without a clear emphasis on specific subjects. To date, there is limited consolidated evidence demonstrating how Quizizz supports mathematics instruction in secondary schools. Existing research tends to report isolated outcomes, and few reviews have examined its overall pedagogical value in mathematics learning. This review addresses that gap by analyzing 25 peer-reviewed studies from 2015 to 2024. Quizizz has been selected because it combines real-time feedback, performance tracking, and flexible pacing, making it suitable for both in-class and self-directed learning. With these features, teachers can adjust their teaching methods and provide students with more independence in how they learn.

In addition to addressing this gap, the findings contribute to curriculum design by illustrating how gamified platforms can support lesson planning, inform policy decisions that encourage the integration of digital tools, and promote quality mathematics education. They also offer guidance for future researchers to explore implementation in different contexts, especially in rural and under-resourced schools. The review specifically examines how Quizizz influences student engagement, motivation, academic performance, formative assessment, and differentiated instruction in secondary mathematics classrooms.

1.1 Research Problem

There are several benefits to engaging in gamification, including enhanced preparedness, improved participation, collaborative learning, teamwork, and added value to teaching and learning (Shumba, 2024, p. 123). Although Quizizz is now a common tool in mathematics classrooms, research on its impact remains fragmented. Most available studies examine individual classrooms or specific contexts (Sitompul et al., 2024; Maulana et al., 2023; Capuno, 2023) without integrating their insights. Broader reviews of gamification (Triantafyllou et al., 2025; Hidayat et al., 2024) highlight potential benefits but do not focus on Quizizz in secondary mathematics. If this gap is not addressed through a systematic synthesis, teachers and researchers may continue to rely on isolated evidence, leading to inconsistent practices and missed opportunities to use Quizizz effectively in mathematics classrooms.

1.2 Research Objectives and Questions

The purpose of this review is to explore how Quizizz has been utilized in secondary school mathematics classrooms. Specifically, the study examines the influence of Quizizz on student engagement and motivation, as well as its role in supporting formative assessment and enabling differentiated instruction.

From these objectives, the following research questions were formulated:

- How does the use of Quizizz influence student engagement, motivation, and achievement in secondary school mathematics classrooms?
- In what ways does Quizizz support formative assessment and differentiated instruction in secondary school mathematics?

1.3 Theoretical Framework

Self-Determination Theory (SDT) provides the framework for this study. According to SDT, students are more motivated when their learning environment supports three basic psychological needs: autonomy, competence, and relatedness (Ryan & Deci, 2000). Autonomy refers to students having control over their learning activities. Competence is the belief that students can succeed when provided with clear goals and timely feedback. Relatedness involves feeling connected and supported by teachers and peers (Leon, Núñez, & Liew, 2015).

Quizizz aligns with these principles by allowing students to work at their own pace, granting them autonomy over timing and participation. Its instant feedback and progress tracking enhance competence as students see their results immediately and can identify areas for improvement. Multiplayer modes, leaderboards, and collaborative features foster relatedness by creating a shared and interactive classroom experience. These elements work together to create an environment where students are more likely to be engaged and motivated to learn. The study proposes a structured framework (Figure 1) that links the features of Quizizz to the three SDT needs, illustrating how these elements contribute to engagement, motivation, learning outcomes, and differentiated instruction in mathematics classrooms.

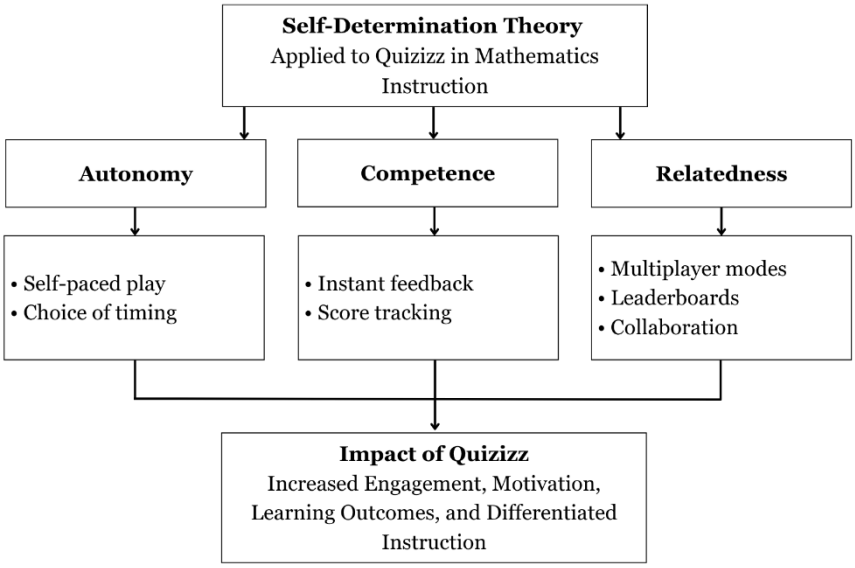

Figure 1: Self-Determination Theory applied to Quizizz in mathematics instruction

2. Literature Review

Gamification is increasingly being used in educational settings. Deterding et al. (2011) describe it as the inclusion of game-like elements in tasks that are typically not designed as games. In mathematics classrooms, this method has been linked to higher student interest and better learning outcomes (Hamari et al., 2014). Quizizz is widely utilized as a gamification tool that enhances student engagement and supports formative assessment in mathematics instruction (Basuki & Hidayati, 2019; Capuno, 2023). Studies by Alt (2023) and Sáez-López et al. (2024) confirm that gamified tools like Quizizz improve motivation and focus,

especially in mathematics, by creating a more engaging and supportive environment. The first researcher's classroom experiences suggest that game-based elements, such as timers, leaderboards, and points, have increased student focus, participation, and enthusiasm.

Several studies have found that tools like Quizizz promote active learning. For instance, Sitompul, Sayekti, Saragih, and Salminawati (2024) discovered that using Quizizz in higher education improved student motivation and led to more positive attitudes toward learning. Students reported enjoying the interactive format and feeling more engaged during lessons. The instant feedback provided by Quizizz helps students understand their performance and supports their thinking and reflection skills (Wang, 2015).

Lee and Lai (2023) also found that gamified group tasks helped students articulate their thinking and improved collaboration, suggesting that tools like Quizizz facilitate deeper learning in mathematics. The researchers' experiences indicate that students become more engaged when they receive immediate feedback and often request to retake quizzes, demonstrating reflective thinking and a desire to improve.

Quizizz also functions as an effective tool for formative assessment by offering real-time feedback and performance analytics (Black & Wiliam, 2009; Maulana et al., 2023). It provides quick feedback and allows students to correct their answers during the activity. Teachers can use the Quizizz dashboard to track student progress and adjust their teaching based on student responses (Black & Wiliam, 2009; Basuki & Hidayati, 2019). Olsher, Yerushalmy, and Chazan (2016) emphasize that technology-based formative assessment tools like Quizizz help teachers tailor their instruction and give students greater control over their learning. Analyzing Quizizz results can help teachers identify struggling students and highlight topics that require additional review. These insights assist teachers in planning review activities and providing extra support to the learners who need it most.

Quizizz also aids in differentiation by allowing educators to design quizzes that align with individual student needs and learning levels (Maruanaya & Brahmasakha, 2024). A study by Maruanaya and Brahmasakha (2024) compared students using Quizizz with those employing traditional worksheets for vocabulary learning. The Quizizz group not only scored higher but also exhibited a more positive attitude toward learning, indicating that this tool can enhance learning outcomes and boost student confidence (Capuno, 2023). During mathematics instruction in US-based classrooms, the first researcher created multiple versions of the same quiz to accommodate varying student ability levels. Differentiation achieved through Quizizz has enabled more learners to engage at their own pace and experience success.

Comparative research has also demonstrated that Quizizz is more effective than traditional paper-based quizzes (Maulana et al., 2023). For example, Ismail and Mohammad (2017) found that students using Quizizz performed better in algebra

and geometry compared to those receiving regular instruction. This finding aligns with Ortiz-Rojas et al. (2024), who reported enhanced learning and motivation in STEM subjects through gamification strategies similar to those employed in Quizizz. Researchers noted that students using Quizizz regularly displayed stronger performance in unit assessments. Additionally, Quizizz seemed to alleviate test anxiety and encourage more frequent practice. However, despite the promising research, some limitations must be considered. Quizizz relies heavily on extrinsic motivators like points and leaderboards, and it remains unclear whether it fosters long-term intrinsic motivation (Ryan & Deci, 2000).

The success of Quizizz also hinges on teachers' comfort with technology, the level of support provided by their schools, and the availability of reliable internet access (Kaoropthai & Boonmoh, 2023). Furthermore, conducting more comparisons across different school types and subjects would strengthen the findings, and organizing additional peer-reviewed studies around clear themes such as engagement, assessment, and differentiation would enhance the quality of the analysis.

Overall, existing research indicates that Quizizz has strong potential as a teaching tool in mathematics classrooms. At the same time, it underscores the importance of teacher training, adapting the tool to local conditions, and ensuring alignment with instructional goals. Drawing from both teaching and research experiences, the researchers regard Quizizz as a practical and effective tool. It is most effective when educators are confident in its use and when its features are purposefully aligned with specific learning objectives.

3. Methodology

The study employed a structured literature review approach, following the PRISMA 2020 standards (Page et al., 2021). These guidelines outline clear steps for transparently and systematically reporting how studies are identified, selected, and analyzed. The PRISMA 2020 framework includes a 27-item checklist and detailed instructions to assist researchers in explaining the review's purpose, the study selection process, and the key findings. This approach ensured that the review was organized, objective, and thorough.

3.1 Inclusion and Exclusion Criteria

Before starting the literature review, clear rules were established to determine which studies would be included or excluded. This process helped maintain fairness and consistency while reducing potential bias. Figure 2 summarizes the specific inclusion and exclusion criteria that guided the selection of studies for this review. These criteria were based on standard guidelines for systematic reviews and considered whether the studies clearly described their research design, methodology, while focusing on outcomes related to student engagement, motivation, academic performance, formative assessment, and instructional practices.

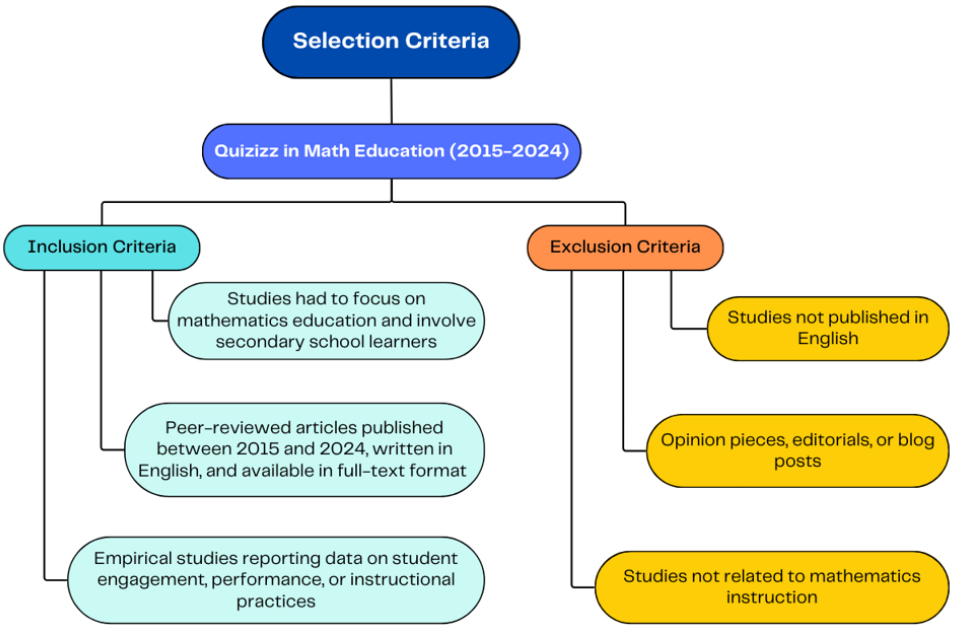

Figure 2: Inclusion and Exclusion Criteria for the Systematic Review of Quizizz in Mathematics Instruction

3.2 Search Strategy

To identify studies related to the use of Quizizz in mathematics instruction, a structured search process was followed. Searches were conducted across three major databases: ERIC, ScienceDirect, and SpringerLink. These databases were chosen for their extensive and high-quality coverage of educational research and technology-enhanced learning, ensuring relevance to the review objectives. A wide range of studies was gathered using specific keywords along with search connectors such as "AND" and "OR." The main search terms included: "Quizizz AND mathematics," "Educational games AND mathematics classroom," "Formative assessment AND Quizizz," "Student motivation OR Quizizz," "Performance AND Quizizz," and "Instructional practices AND Quizizz."

These search terms were selected to capture studies on engagement, motivation, formative assessment, and differentiated instruction. They were refined through trial searches and an initial scan of related studies. Only peer-reviewed articles from 2015 to 2024 were included to maintain focus on recent findings. References from selected studies were also examined (backward and forward citation tracking) to identify additional relevant sources not captured during the initial search. The entire search process was documented according to PRISMA 2020 (Figure 3) to support transparency and reproducibility.

3.3 Selection Process

The initial database search identified 1,069 studies across ERIC (553), ScienceDirect (303), and SpringerLink (213). After removing 47 duplicates, a total of 1,022 unique records remained. A title and abstract screening process narrowed the list to 334 studies, while 688 were excluded due to irrelevance. Subsequently, 42 full-text articles were assessed for eligibility based on the title and abstract screening. Two articles were not accessible in full, and 15 were excluded for not

meeting the inclusion criteria. This resulted in 25 studies included in the final synthesis. To ensure the quality and credibility of the included studies, two reviewers independently assessed the research design, clarity of methodology, and relevance of findings to the review objectives. Disagreements were resolved through discussion until a consensus was reached.

For each included study, data were extracted into a structured table that recorded: (a) author(s) and year, (b) study location or context, (c) participant population, (d) research design and methodology, (e) focus on Quizizz and gamification, and (f) key findings related to engagement, motivation, academic performance, formative assessment, and instructional practices. This process ensured that all relevant information was collected systematically and consistently. The selection process is illustrated in Figure 3.

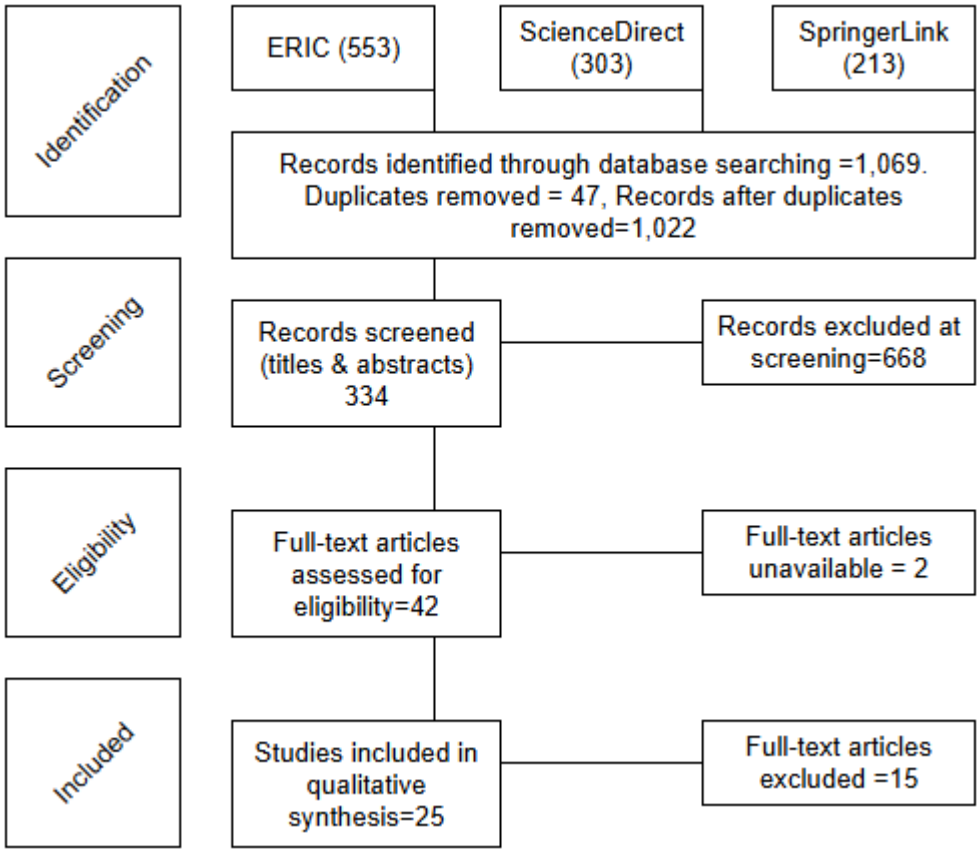

Figure 3: Study Selection Steps Illustrated Using the PRISMA 2020 Flow Framework

3.4 Data Analysis

To analyze these studies, a thematic synthesis approach was adopted. This method allows for a meaningful integration of qualitative findings and supports deeper interpretation in educational research. Kiger and Varpio (2020) posit that thematic analysis is a widely used yet often misunderstood method of qualitative data analysis. Many teachers lack research skills (Sahan & Tarhan, 2015), making it difficult for them to analyze their classroom data (Dawadi, 2020). Saunders et al. (2023) argue for the need to ensure that all themes are salient, meaning they are supported by data relevant to the study objectives. Since the first author is

currently a practicing high school teacher, we found it fascinating to adopt this analysis method.

The analysis followed three key stages, as outlined by Kiger and Varpio (2020):

- *Line-by-line coding*: Each study was read carefully, and key findings were coded line by line to identify meaningful patterns.
- *Development of descriptive themes*: Similar codes were grouped to form broader descriptive themes that captured the main ideas across the studies.
- *Generation of analytical themes*: The descriptive themes were interpreted to generate analytical themes, which were used to address the research objectives and provide deeper insights.

4. Results

The thematic synthesis generated three major themes aligned with the study objectives: (1) student engagement, motivation, and academic achievement; (2) formative assessment and feedback; and (3) differentiated instruction. While the review focused on secondary mathematics classrooms, relevant studies from elementary and higher education contexts were also included to highlight broader patterns and strengthen the synthesis.

4.1 Engagement, Motivation and Academic Achievement

Findings from the 25 reviewed studies indicate that Quizizz is consistently associated with increased student engagement and motivation in mathematics classrooms. Although the primary focus of this review was on secondary mathematics, a small number of studies from elementary and higher education contexts were included when their findings were relevant to understanding broader trends in how Quizizz supports these outcomes.

Many of the studies reported that students felt more enthusiastic about participating in learning activities when Quizizz was used, primarily due to its interactive features and gamified design elements. For example, Ling, Jumaat, Mohamad Ashari, and Abu Samah (2022) examined Year 3 students in Johor, Malaysia, and found that 83% believed Quizizz inspired and motivated them to learn mathematics. The same study reported improved participation and higher test scores following the use of Quizizz as a gamified assessment tool.

Gamified features such as avatars, leaderboards, and instant feedback were frequently cited across the reviewed studies as key contributors to a stimulating and enjoyable learning environment. These elements helped students stay alert, increased participation, and enhanced their enjoyment of lessons. This is consistent with Huang and Hew (2018), who found that gamification positively influences motivation and engagement in diverse educational contexts. Additional studies reinforced these patterns. For instance, Sitompul et al. (2024) found that undergraduate students experienced improved focus, motivation, and self-confidence through the use of Quizizz. Similarly, Capuno (2023) observed that Grade 8 students in the experimental group developed stronger self-regulated learning skills compared to those in the control group.

Academic achievement was also consistently supported by findings from reviewed studies such as Maulana et al. (2023), Capuno (2023), and Maruanaya and Brahmasakha (2024), which reported improved student performance when using Quizizz in mathematics instruction. Quizizz was found to help students achieve better results by offering features like instant feedback, enjoyable quiz formats, and self-paced learning, which aided their understanding of the content and maintained their engagement. In the study by Maulana et al. (2023), tenth-grade students in Indonesia who used Quizizz showed significant improvement, with their scores rising more than those of the group that used traditional teaching. The researchers attributed this to Quizizz providing students with quick feedback and opportunities to practice, which enhanced their learning.

Capuno (2023) also found similar results with Grade 8 students. Those who used Quizizz performed better and became more independent in their learning. The game features kept them interested and focused, making it easier to understand the lessons. Another study by Maruanaya and Brahmasakha (2024) worked with fifth-grade students and combined Quizizz with a group learning method called Teams Games Tournament. This approach helped students learn collaboratively, stay active, and enjoy the lessons.

Across these studies, a consistent pattern emerged: students who used Quizizz had higher achievement scores, participated more actively, and showed greater confidence in their work. These findings suggest that Quizizz is an effective tool for fostering student engagement, motivation, and academic achievement across a range of educational contexts, with 16 of the 25 reviewed studies showing measurable gains in participation or test scores and 9 providing qualitative evidence. Table 1 provides a summary of selected studies that contributed to these themes.

Table 1: Summary of Selected Studies Supporting Engagement and Motivation, and Academic Achievement Themes

Authors (Year)	Sample Size	Educational Context	Measured Outcomes	Main Findings
Yusoff et al. (2020)	30	Year 3 students in Johor, Malaysia	Engagement, Motivation	83% of participants reported increased motivation; significant improvement in engagement and achievement with gamified assessments.
Capuno (2023)	48	Grade 8 students	Self-Regulated Learning, Academic Performance	Quizizz enhanced self-regulated learning; students using Quizizz outperformed those who did not.
Maulana et al. (2023)	40	Tenth-grade students	Academic Achievement	Experimental group using Quizizz improved from 60 to 85 in post-test scores; the control group improved from 58 to 72.

Maruanaya & Brahmasakha (2024)	50	Fifth-grade students	Vocabulary Acquisition, Language Usage	Quizizz combined with cooperative learning strategies led to significant improvements in vocabulary acquisition and language usage.
Sitompul et al. (2024)	272	Undergraduate students, Indonesia	Engagement, Motivation, Self-Regulation	Quizizz improved motivation, focus, and enjoyment. Students reported increased self-confidence and independent learning.

4.2 Formative Assessment, Feedback, and Differentiated Instruction

The thematic synthesis of the 25 reviewed studies revealed that Quizizz strongly supports formative assessment and differentiated instruction, both of which were key objectives of this review. A consistent strength identified across the studies is that Quizizz provides instant feedback that students and teachers use to improve learning (Wang, 2015). As soon as a student answers a question, they receive immediate confirmation of whether the answer was correct, helping them quickly understand their mistakes (Black & Wiliam, 2009). Teachers also use the dashboard to monitor individual and class progress, identify struggling students, highlight topics that require attention, and adjust instruction accordingly (Basuki & Hidayati, 2019; Maulana et al., 2023).

In Maulana et al. (2023), students who used Quizizz scored higher and reported feeling more confident because the feedback helped them focus on areas needing improvement. Similarly, Sitompul et al. (2024) found that students valued the ability to retake quizzes and reflect on their learning, which boosted their confidence and persistence. Feedback also gave students a sense of control over their learning (Capuno, 2023). Many learners reported that they could understand their mistakes immediately, enjoyed tracking their progress, and were motivated to try again.

These findings emphasize how Quizizz contributes to the broader concept of assessment for learning by combining formative feedback with opportunities for reflection. These perceptions were echoed across several studies, where students described Quizizz as a tool that supported self-awareness and helped teachers make timely instructional adjustments. Figure 4 presents a summary of how formative feedback and assessment-for-learning processes were experienced by students across the studies.

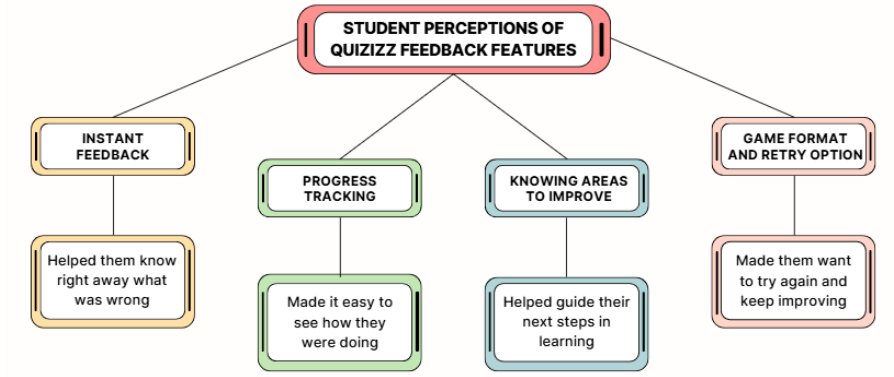

Figure 4: Student Perceptions of Quizizz Feedback Features Based on Reviewed Studies

Differentiated instruction also emerged as a distinct pattern in the reviewed studies. Quizizz enables teachers to modify quizzes to meet diverse learning needs, including varying skill levels, learning preferences, and student interests. This flexibility allows teachers to design more inclusive lessons. For example, Maruanaya and Brahmasakha (2024) demonstrated that when Quizizz was combined with cooperative learning, fifth-grade students received content at the appropriate level of challenge, which increased both participation and achievement. Similarly, Sitompul et al. (2024) reported that undergraduate students benefited from the ability to work at their own pace and appreciated the tool's adaptability to their learning preferences.

Teachers also reported using multiple versions of the same quiz to accommodate different ability levels. The dashboard allowed them to track performance and adjust lesson pacing for individual students. Moreover, studies highlighted that Quizizz's ability to incorporate various question types, images, videos, and audio enhanced accessibility and engagement for diverse learners. These findings demonstrate that Quizizz helps teachers manage classroom diversity effectively. Figure 5 illustrates how the reviewed studies underscore Quizizz's role in enabling differentiated instruction.

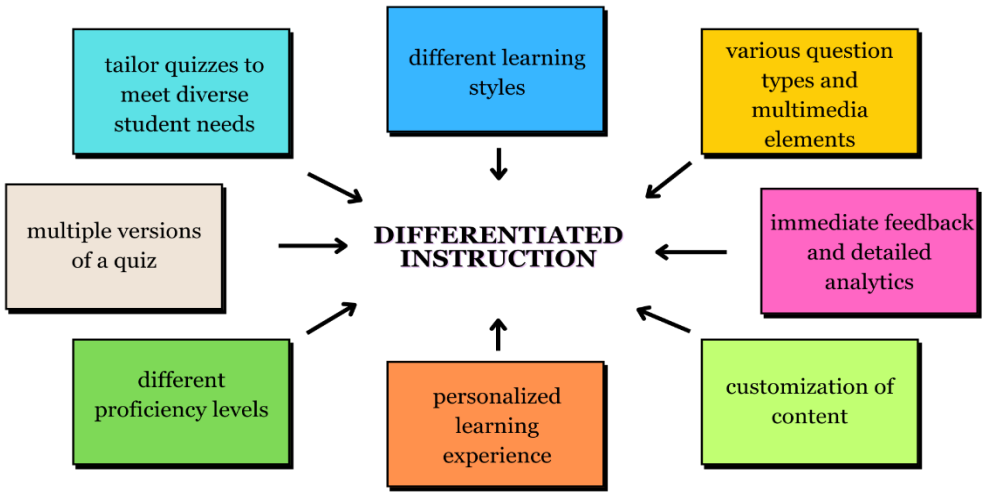

Figure 5: Instructional Benefits of Quizizz for Differentiated Mathematics Instruction

5. Discussion

This systematic review confirms that Quizizz is a valuable teaching tool in mathematics education, particularly in supporting student engagement, motivation, academic achievement, formative assessment, feedback, and differentiated instruction. Its game-like features, such as avatars, leaderboards, and instant feedback, help create an interactive classroom environment. These elements encourage participation, reduce mathematics anxiety, and improve conceptual understanding, even in independent learning settings (Basuki & Hidayati, 2019; Sitompul et al., 2024; Maulana et al., 2023).

The positive outcomes reported in the reviewed studies align closely with Self-Determination Theory (SDT), which highlights the importance of autonomy, competence, and relatedness for motivation (Ryan & Deci, 2000). Quizizz supports autonomy through self-paced learning, builds competence with instant feedback, and encourages relatedness through multiplayer modes and classroom interaction. As shown in the results, these features not only strengthen engagement and motivation but also lead to gains in academic performance when used regularly. This suggests that Quizizz does more than just make lessons enjoyable; it can support deeper learning and long-term motivation when integrated with intentional planning and effective pedagogy (Leon et al., 2015; Capuno, 2023).

Quizizz also enhances effective teaching practices. Its feedback tools and performance reports help teachers identify learning gaps, track student progress, and adapt instruction. Findings showed that these formative assessment tools provide teachers with real-time insights that allow for timely interventions and planning of subsequent lessons. These features are particularly helpful in classrooms where students have varying levels of understanding (Wang, 2015; Black & Wiliam, 2009). The studies indicated that teachers utilized these insights to plan lessons more effectively and provide timely support (Basuki & Hidayati, 2019). This supports Boaler and Staples (2008), who emphasized that equitable practices that adjust to student needs are essential for creating inclusive mathematics classrooms where all learners can progress.

Differentiated instruction also emerged as a consistent benefit of using Quizizz. Teachers were able to tailor quiz content, adjust pacing, and offer different versions of tasks for students with varying abilities. These strategies encouraged active participation from students who might otherwise struggle in a traditional, uniform teaching approach. However, even though the tool is promising, there are important considerations. Quizizz depends on a strong internet connection, which can be a challenge in under-resourced or rural schools where connectivity is limited. Studies such as Kaoropthai and Boonmoh (2023) note that these infrastructure challenges reduce the impact of digital tools in such contexts. Addressing this may require improved digital access or choosing platforms that can also work offline.

Another challenge is that Quizizz relies on external rewards such as points and rankings. While these rewards can boost short-term engagement, they may not

always foster deeper understanding. Past research cautions that focusing too much on rewards can diminish intrinsic motivation over time (Ryan & Deci, 2000; Bicen & Kocakoyun, 2018). For this reason, teachers are encouraged to use Quizizz alongside strategies such as inquiry-based learning, peer discussion, and reflective activities that promote critical thinking.

The effectiveness of Quizizz also depends on teachers' confidence with technology. Some may need support to use it effectively. Ongoing professional development can help teachers connect Quizizz activities to specific learning goals and make effective use of the data it provides (Shumba, 2024; Capuno, 2023). Overall, the evidence demonstrates that when Quizizz is used intentionally, it promotes engagement, improves motivation, raises academic achievement, enables meaningful formative assessment, and supports differentiated instruction. It is most effective when paired with strong teaching strategies. To maximize these benefits, schools should support teachers in integrating Quizizz in ways that meet the needs of all students.

6. Conclusion

This systematic review shows that Quizizz is an effective tool for mathematics instruction, particularly in secondary school settings. Evidence demonstrates that Quizizz enhances student engagement, strengthens motivation, improves academic performance, and supports formative assessment. Quizizz game-like features, such as avatars, leaderboards, and instant feedback to classroom activities, create a dynamic environment that helps students stay involved and understand mathematical concepts more deeply. A key contribution of this review is the synthesis of scattered findings to clarify how Quizizz promotes learning through self-paced tasks, instant feedback, and differentiated instruction.

The review also highlights how Quizizz aligns with Self-Determination Theory: autonomy is supported through self-paced play and flexible timing, competence is built through instant feedback and score tracking, and relatedness is encouraged through multiplayer modes, leaderboards, and collaboration. These connections help explain why Quizizz improves engagement, motivation, and learning outcomes in mathematics classrooms.

The study further concludes that for Quizizz to be effective, it must be integrated purposefully, aligned with learning goals, and supported with strategies such as group discussions and inquiry-based learning. Barriers like limited internet access and an overemphasis on rewards need to be addressed. Lastly, when used thoughtfully and combined with sound teaching practices, Quizizz emerges as a flexible tool that supports inclusive, engaging, and data-informed mathematics instruction.

7. Implications and Recommendations

The findings from this review highlight Quizizz as a valuable digital tool for enhancing mathematics instruction. To maximize its effectiveness, educators, school leaders, and policymakers should consider the following recommendations.

7.1 Integrating Quizizz into Teaching Practice

Teachers are encouraged to incorporate Quizizz into a broader teaching approach rather than limiting it to assessment. It can be utilized to reinforce concepts, provide practice, and keep students engaged. For example, a short Quizizz activity can be employed at the start of a lesson to review prior knowledge or at the end to consolidate new learning. Studies such as Capuno (2023) and Maulana et al. (2023) demonstrate that regular use of Quizizz enhances student motivation and achievement, particularly when paired with immediate feedback and opportunities for practice.

In well-resourced schools, these features can be augmented by integrating Quizizz with group discussions, peer feedback, and collaborative tasks. In schools with fewer resources, careful planning, the use of shared devices, smaller quiz sessions, and consistent scheduling can help mitigate the effects of connectivity challenges (Kaoropthai & Boonmoh, 2023).

Combining Quizizz with strategies such as partner work, group discussions, and problem-solving makes lessons more interactive. Teachers benefit from seeing examples of how their colleagues use Quizizz, including sample lesson plans and activities. Professional development and peer support can assist teachers in linking Quizizz activities to lesson goals, designing assessments that foster understanding rather than memorization, and utilizing dashboard data to identify learning gaps. Training that incorporates classroom examples and hands-on practice can build teacher confidence and illustrate how Quizizz fits alongside other teaching strategies.

7.2 Overview of Quizizz Tools and Educational Value

Quizizz provides a wide range of tools to meet various teaching and learning needs. These tools include interactive lessons, quizzes, AI-generated content, and flashcards that can be used for real-time or self-paced learning. The platform also allows for the integration of videos and reading passages to keep students active and engaged. Teachers can import worksheets or auto-generate content, which saves preparation time and adds flexibility.

Gamified features such as avatars, leaderboards, and power-ups help maintain motivation, while tools like Voyage Math adjust practice tasks to match a learner's skill level. As shown in Figure 6, these features directly support the key outcomes of this review: improved engagement, better formative assessment, and effective differentiation. Considering that school contexts differ, evidence suggests adapting Quizizz to fit local conditions. In classrooms with good internet access, teachers can utilize interactive game modes and varied question types. In settings with limited connectivity, smaller quizzes, printable resources, and structured follow-up discussions may be more practical.

With this flexibility, Quizizz can support lessons that are engaging, adaptable, and focused on student growth. Future planning should include teacher training and strategies to combine Quizizz with inquiry-based and reflective practices so that its benefits reach all students, regardless of their learning context.

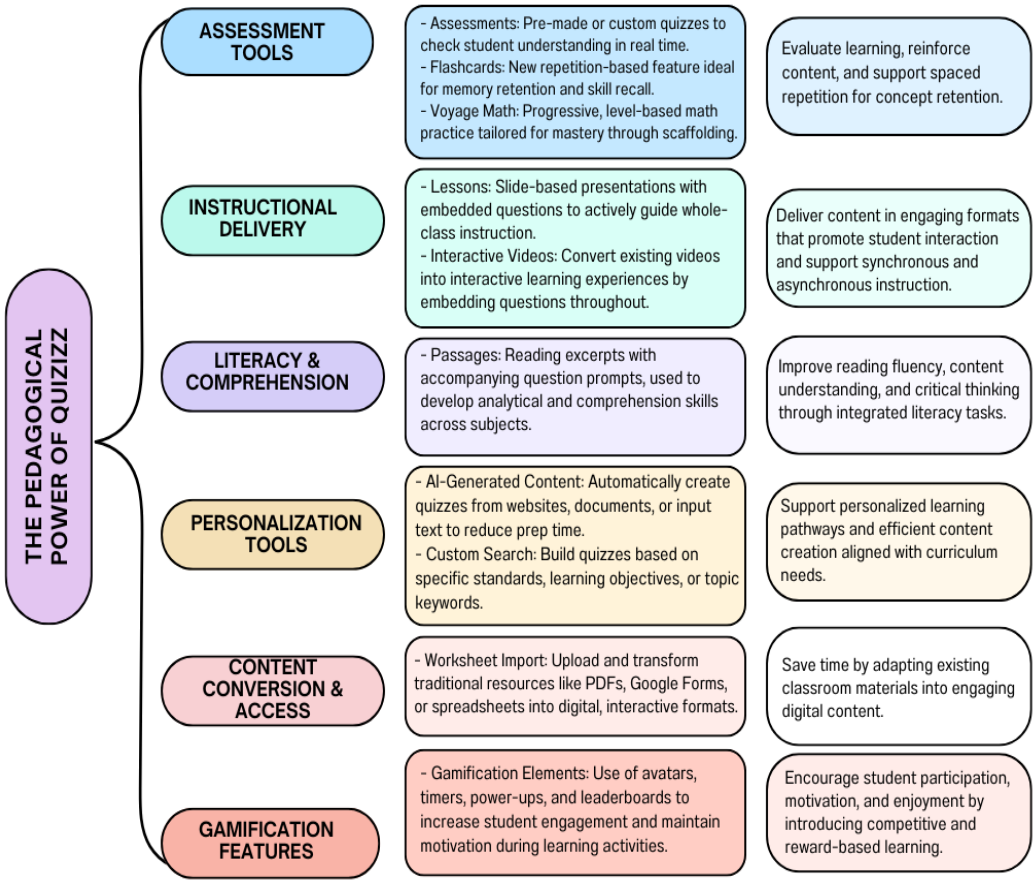

Figure 6: Key Quizizz Features and Their Instructional Benefits

8. Limitations and Future Research

This review provides valuable insights into how Quizizz supports mathematics teaching and learning. However, several limitations should be considered. First, the review includes only studies published between 2015 and 2024, which means earlier relevant research may have been excluded. Second, many of the studies utilized cross-sectional designs, limiting the ability to evaluate the long-term impact of Quizizz on student outcomes. Third, most studies were conducted in urban or well-resourced school settings, so the findings may not fully represent experiences in rural or under-resourced environments.

Future research should include longitudinal studies that track the extended impact of Quizizz on student engagement, motivation, and achievement over time. Additionally, there is a need for more research in low-resource and rural schools to explore implementation challenges and identify possible adjustments needed to improve the platform's effectiveness in those settings. Researchers should also aim to use consistent evaluation tools and metrics. This would support more accurate comparisons across studies and could contribute to future meta-analyses.

Furthermore, recent developments in Quizizz have introduced AI-enhanced features, such as automated question generation, adaptive learning pathways, and performance-based suggestions. These tools offer promising possibilities for

personalized instruction but remain underexplored in the literature. Future studies should examine the effectiveness and classroom impact of these AI-driven features to better understand their potential role in supporting differentiated teaching and equitable access to learning support.

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