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The Role of Interactive Technology in Enhancing Student Engagement in Mathematics

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Abstract: This study aims to analyse the use of interactive technology in mathematics learning to enhance student engagement. A descriptive qualitative approach was employed, involving six tenth-grade students from a senior high school in Surakarta. Data were collected through in-depth interviews, participatory observations, and documentation, and they were analysed using the Miles and Huberman interactive model. The findings indicate that the use of interactive technologies such as Quizizz, smartphones, and projectors contributes to increased student motivation, active participation, and a better understanding of abstract mathematical concepts. Features, including real-time feedback, material visualisation, and gamification, were found to be effective in creating an engaging and interactive learning environment. Furthermore, technology facilitates two-way communication between teachers and students and fosters students' confidence to ask questions. However, the study also identified several challenges, including limited internet access, insufficient availability of devices, and teachers' readiness to manage technological tools. Therefore, the integration of technology in mathematics learning requires adequate infrastructure, proper training for educators, and continuous supervision to ensure its optimal and equitable implementation. This study is expected to contribute to the development of effective, technology-based learning strategies to improve the quality of mathematics education in schools.

Keywords: interactive media; learning technology; math learning; student engagement.

INTRODUCTION

Today's education has undergone significant changes with the integration of digital technology in the teaching and learning process. Various disciplines, especially mathematics and technology, play a valuable role as a valuable means to increase student participation and help their understanding of abstract concepts (Srimuliyani, 2023). The use of technology in mathematics learning allows students to be more interactive, increase participation, and deepen concept understanding more effectively through simulation and visualisation (Fira et al., 2024). Thus, the use of technology in mathematics learning is an alternative solution to facilitate students' understanding of the material. Mathematics is often considered a challenging subject to understand because it requires deep logical understanding and abstract thinking skills (Marliana, Sunaryo & Zamnah, 2022). Many students face challenges in understanding complex mathematical concepts, which often results in low participation in the learning process (Auna & Hamzah, 2024).

To overcome these challenges, a more innovative approach is needed in the learning process, one of which is through the use of technology. The use of technology in mathematics learning can provide a more fun and interactive learning experience (Fauziyah, Sugiman & Munahefi, 2024), making it easier for students to understand abstract concepts more effectively. Although technology offers solutions, student involvement in mathematics learning remains an issue that needs attention. One of the main problems in mathematics learning is the low student engagement due to conventional teaching methods that are less attractive (Fira et al., 2024). In addition, the lack of understanding of basic mathematical concepts from the beginning also contributes to low student involvement in learning (Putri, Febriana & Malini, 2024). Many students have difficulty understanding the material due to the lack of a problem-solving-based approach and a lack of application in daily life (Matondang, Saragih & Sari, 2023). In addition, the high level of mathematics anxiety among

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students is also an obstacle in increasing their interest in this subject (Prasetyo & Dasari, 2023). The use of aids such as Quizizz, mobile phones, and projectors in learning has been shown to be effective in increasing student engagement, motivation, and understanding of mathematical concepts (Nababan et al., 2021).

Quizizz is a game-based learning platform that allows students to learn in an interactive way through quizzes (Secha, Setyowati & Darmanto, 2024). This application has been applied at various levels of education and has been proven to be effective in increasing students' motivation in learning mathematics (Tiana, Krissandi & Sarwi, 2021). With features such as real-time ranking and competition mode, students are motivated to be more active in answering questions and understanding the material provided (Rohmah, 2024). Studies reveal that the use of Quizizz can increase student comprehension by up to 85% compared to traditional learning methods (Wahyuni & Tranggono, 2023). In addition to Quizizz, the use of other devices such as mobile phones also provides flexibility in the learning process and allows students to develop learning independence.

The use of mobile phones allows students to access subject matter flexibly, anytime and anywhere (Rifai, Sulton & Sulthoni, 2020). Various supporting applications, such as graphing calculators, interactive simulations, and mathematical visualisation tools, are able to make it easier for students to understand concepts more effectively (Aini, Yuliyani & Pratama, 2024). The results revealed that students who used mobile phones in mathematics learning were more effective at solving concept-based problems compared to those who relied solely on textbooks (Monika, Prabowo & Jami, 2024). Not only mobile phones, but projectors also play an important role in helping teachers present material in a more visual and engaging way for students. Projectors are one of the tools that can increase student participation in mathematics learning by presenting material in a more visual and interesting way (Sartika et al., 2023). With projectors, teachers can display interactive presentations, educational videos, and graphic simulations that are more interesting for students (Sulastri, Jamim & Agustina, 2021). This helps to increase students' focus on learning and strengthen their understanding of the material.

Several previous studies have proven that the use of technology in mathematics learning makes a positive contribution. A study by (Miladanta & Muharam, 2021) shows that the use of Quizizz significantly increases students' enthusiasm for learning in solving math problems. Another study by (Monika, Prabowo & Jami, 2024) shows that students who use cellphones as a learning tool have a more effective understanding of concepts than conventional methods. In addition, research by (Wahyuni & Tranggono, 2023) shows that the use of projectors in learning can increase students' concentration and engagement in the classroom. While the use of technology in maths learning offers many advantages, there are still some hurdles that need to be overcome. One of the main obstacles is the extent to which teachers are ready to make optimal use of technology in the learning process (Saumantri, 2022). In addition, limited access to technology in some areas is also an obstacle to the comprehensive application of this method (Hidayatullah et al., 2023).

As technology integration in education becomes more widespread, teachers and educational institutions need to implement effective strategies to utilise technology to increase student engagement in mathematics learning (Firdaus, Rizal & Rahman, 2025). Most previous studies have focused more on the effectiveness of technology use in general, without examining specifically how its application has the potential to increase students' activeness in mathematics learning. Thus, this research is important to fill these gaps and provide a clearer understanding of the role of technology in encouraging student participation.

The use of technology in mathematics learning has enormous potential in increasing student engagement and teaching effectiveness. Various technological tools, such as Quizizz, mobile phones, and projectors, have been shown to help students master math concepts better.

However, the application of this technology also faces various challenges, such as teacher readiness and limited access to technology. Therefore, cooperation between the government, schools, and teachers is needed to ensure that technology can be optimised for its use in mathematical learning (Juntak et al., 2023). Taking into account the various advantages and challenges in the application of technology, this study aims to analyse how the use of technology in mathematics learning can increase student engagement.

METHODS

This study uses a qualitative descriptive method to explore what has happened in the field. The sample in this study was six tenth-grade students from a senior high school in Surakarta. The reason for the selection of these 6 students is because they have become accustomed to using technology in mathematics learning, either through digital learning media such as Quizizz or other technology-based applications.

The data collection techniques used in this study include in-depth interviews, participatory observations, and documentation. Interviews with students focused on the use of the Quizizz platform and other technology applications by examining two factors, namely internal factors and external factors. Internal factors refer to students' attention and interest in using technology, while external factors are related to the influence of the environment and the effectiveness of technology-based learning media. In the data analysis phase, this study employs the qualitative data analysis technique based on the Miles and Huberman model, which consists of three steps: Data Reduction (data reduction), Data Display (data presentation), and Conclusion Drawing/Verification (drawing conclusions).

RESULTS AND DISCUSSION

Based on interviews and observations involving six tenth-grade students from a high school in Surakarta, this study revealed various findings related to the application of digital learning applications and technological tools in mathematics learning. These students, who were selected through purposive sampling, actively shared their experiences using platforms like Quizizz as well as devices like mobile phones and projectors.

Most participants reported increased motivation and engagement when learning with digital tools. They assessed the learning process to be more dynamic, interesting, and easy to understand due to the visual and interactive nature of the material presented. For example, one student stated, "I prefer to learn math using Quizizz because it's more exciting, there are challenges, and I can know the correct answer firsthand. So, I can immediately correct my mistakes." This reflects the advantages of instant feedback in improving self-assessment and concept understanding, as supported by (Wahyuni & Tranggono, 2023) who found that game-based learning tools improve concept understanding by up to 85% compared to traditional methods.

To ensure the validity of the data, interview transcripts from the two subjects were compared. When asked about their involvement during maths learning using Quizizz, the researchers asked the same question to two students. Student 1 replied, "I feel more motivated because I can immediately see the score and compare it with my friends. It makes me even more excited to try again." Student 2 also explained, "It felt fun and motivating, because I could immediately tell if my answer was right or wrong, so I didn't feel bored." From these answers, it can be concluded that both subjects consistently felt increased motivation and pleasure through Quizizz, thus strengthening the triangulation and reliability of the data.

In addition to motivation, technology has also been found to be able to encourage communication between students and teachers. One student explained, "Usually when studying without technology, I am embarrassed to ask questions. But if it's through an app or

a mobile phone, I dare to try and ask the teacher." This is in line with (Aini, Yuliyani & Pratama, 2024) who emphasise that digital platforms encourage two-way communication, allowing students to overcome psychological barriers such as shame and participate more actively in the learning process.

To reinforce these findings, researchers also compared the answers of two students regarding their experiences communicating with teachers through the app. Student 1 stated, "I became more courageous to ask questions through the application, because there is no need to be embarrassed if the question is simple, and the teacher can answer immediately." Meanwhile, Student 2 said, "If I use my cell phone, I feel more confident to send questions. Occasionally I'm afraid I'll make a mistake if I talk to them directly, but through the app it feels easier." Based on these two answers, it can be concluded that technology facilitates student-teacher interaction and encourages two-way communication, thereby strengthening data triangulation and increasing the reliability of findings.

In addition, teachers were also observed adopting various learning strategies using technology to meet diverse learning needs. Two students said that mathematical concepts became clearer when explained with the help of projectors and educational videos. One student commented, “When I see numbers on the blackboard, I sometimes get confused. But when I see videos or images on the screen, it's easier for me to understand.” These findings are consistent with the research by (Sulastri, Jamin & Agustina, 2021), which concluded that visual presentations significantly support students' understanding of abstract concepts in mathematics.

The interactive features of the digital application also keep students focused and enthusiastic. One student stated, "If I just listen to the teacher explain, sometimes I get sleepy. But if I am asked to do a question in the application, I am more excited because there is a score and time." This supports the findings of (Secha, Setyowati & Darmanto, 2024) which show that gamification elements such as the scoring system and time limit have a positive effect on intrinsic motivation and learning discipline.

However, some challenges were also identified. One student reported internet access issues and device limitations, which indicated infrastructure inequality. This challenge is also seen during learning, where some students are less active due to technical constraints. In line with (Hidayatullah et al., 2023), uneven infrastructure and the digital divide remain the main obstacles to the equitable implementation of educational technology, especially in schools with limited resources.

The limitations of the device mean that some students have to share, thus reducing their active participation. This condition emphasises the importance of policy interventions to improve connectivity and provide equitable access to technology. Furthermore, the impact of increased engagement is also reflected in student learning outcomes. Some students reported that after using Quizizz and projector-assisted learning, their scores on math exercises improved. This shows that interactive technology increases motivation and participation and contributes to better academic achievement. To reinforce these findings, documentation in the form of screenshots of Quizizz activities and photos of students using projectors and mobile phones was also collected. The visual data supports the interview transcript, thus ensuring continuity between the qualitative narrative and the observed practice.

Overall, these findings reinforce the existing literature. (Srimuliyani, 2023; Fira et al., 2024) emphasise that interactive digital tools increase student engagement and participation. (Wahyuni & Tranggono, 2023) confirmed the value of game-based learning for improving understanding, while (Aini, Yuliyani, & Pratama, 2024; Sulastri & Agustina, 2021) validated the role of communication and visualisation in improving student performance. Therefore, while interactive technology has enormous potential to increase motivation, engagement, and conceptual understanding in mathematics learning, its impact on learning outcomes is highly

dependent on the availability of adequate infrastructure, teacher readiness, and ongoing learning support. To ensure that the use of technology in mathematics learning takes place optimally and evenly, adequate infrastructure support, training for teachers, and appropriate supervision strategies are needed. With competent management, technology integration has enormous potential in improving the quality of mathematics learning in the future.

CONCLUSION

Based on the results of the study, it can be concluded that the application of interactive technology such as Quizizz, mobile phones, and projectors in mathematics learning is able to increase student engagement, motivation, and understanding. Most students feel more enthusiastic and active and are helped in understanding abstract concepts through the use of technology-based media. Features such as live feedback, material visualisation, and gamification elements (such as scores and time limits) have proven effective in encouraging active student participation in the classroom. The findings also reinforce previous research that shows that technology plays a role in creating a more engaging and communicative learning experience. The presence of technology helps reduce emotional barriers, such as the embarrassment of asking questions, as well as make it easier to understand difficult material through interactive visual presentations. However, the use of technology in mathematics learning still faces challenges, including limited internet access, the availability of devices, and the readiness of teachers to manage the use of technology effectively. In addition, the potential for distraction and student dependence on technology needs to be a concern so as not to interfere with the effectiveness of learning.

REFERENCES

Aini, P. R., Yuliyani, & Pratama, R. (2024). Penggunaan Media Smartboard dalam Meningkatkan Pemahaman Siswa pada Pelajaran PAI di SD Prestige Bilingual School. *Permata : Jurnal Pendidikan Agama Islam*, *5*(2), 330–340.

Auna, H. S. A., & Hamzah, N. (2024). Studi Perspektif Siswa Terhadap Efektivitas Pembelajaran Matematika Dengan Penerapan Chatgpt. *HINEF : Jurnal Rumpun Ilmu Pendidikan*, *3*(1), 13–25. https://doi.org/10.37792/hinef.v3i1.1160

Fauziyah, Sugiman, & Munahefi. (2024). Transformasi Pembelajaran Matematika melalui Media Augmented Reality: Keterlibatan Siswa dan Pemahaman Konseptual. *PRISMA, Prosiding Seminar Nasional Matematika*, *7*, 936–943.

Fira, Ilham, Rahmania, R., Irwandi, & Hudri, M. (2024). Meningkatkan Keterlibatan Siswa melalui Teknologi Pendidikan : Tinjauan Sistematis. *Prosiding Seminar Nasional Paedagoria*, *4*, 1–13.

Firdaus, A. T. B., Rizal, M. A., & Rahman, T. (2025). Pemanfaatan Teknologi dalam Pendidikan : Meningkatkan Interaktivitas Pembelajaran. *Pragmatik : Jurnal Rumpun Ilmu Bahasa Dan Pendidikan,* *3*(1), 256–265. https://doi.org/10.61132/pragmatik.v3i1.1347

Juntak, J. N. S., Rynaldi, A., Sukmawati, E., Arafah, M., & Sukomardojo, T. (2023). Mewujudkan Pendidikan Untuk Semua: Studi Implementasi Pendidikan Inklusif di Indonesia. *Ministrate: Jurnal Birokrasi Dan Pemerintahan Daerah*, *5*(2), 205–214. https://doi.org/10.15575/jbpd.v5i2.26904

Marliana, P., Sunaryo, Y., & Zamnah, L. N. (2022). Pengaruh Model Pembelajaran Terhadap Kemampuan Pemahaman Konsep Matematis Siswa. *Prosiding Galuh Mathematics*

National Conference (GAMMA NC), 2(1), 28–32.

Matondang, K., Saragih, R. M. B., & Sari, R. (2023). Penerapan Pendekatan Open Ended Dalam Pembelajaran Matematika. *OMEGA: Jurnal Keilmuan Pendidikan Matematika*, *2*(2), 32–38. https://doi.org/10.47662/jkpm.v2i2.469

Miladanta, A. N., & Muharam, A. A. S. (2021). Efektivitas Pembelajaran Tatap Muka Berbasis Quizizz dalam Meningkatkan Hasil Belajar Siswa MTs Darul Fikri Materi Gerak. *Proceedings UIN Sunan Gunung Djati Bandung*, *27*(1), 25–37.

Monika, L., Prabowo, F., & Jami, F. Y. (2024). Pemanfaatan Aplikasi Quizizz sebagai Media Pembelajaran Matematika di Sekolah Dasar Islam di Karawang. *Jurnal Syntax Admiration*, *5*(1), 194–205. https://doi.org/10.46799/jsa.v5i1.975

Nababan, G., Extin, J., Purba, L., & Aji, K. A. (2021). Mengukur Keterlibatan Siswa Dalam Pembelajaran Online Siswa Kelas VII Di Sekolah Abc Pada Pembelajaran Matematika Measuring Student Engagement in Online Learning of Class VII Students At Sekolah Abc in. Jurnal *Magister Pendidikan Matematika (JUMADIKA)*, *3*(2)*,* 100-109.

Prasetyo, F., & Dasari, D. (2023). Studi Literatur: Identifikasi Kecemasan Matematika dan Motivasi Belajar Terhadap Hasil Belajar Matematika Siswa. *RANGE: Jurnal Pendidikan Matematika*, *4*(2), 240–253. https://doi.org/10.32938/jpm.v4i2.3649

Putri, P. O., Febriana, R., & Malini, H. (2024). Implementasi Model Pembelajaran Contextual Teaching And Learning Berbantuan Media Mind Mapping Untuk Meningkatkan Pemahaman Konsep Matematika. *Wacana Akademika*, *8*(2), 142–150.

Rifai, A., Sulton, S., & Sulthoni, S. (2020). Pengembangan Media Mobile Learning Sebagai Pendukung Sumber Belajar Biologi Siswa SMA. *JKTP: Jurnal Kajian Teknologi Pendidikan*, *3*(1), 10–17. https://doi.org/10.17977/um038v3i12019p010

Rohmah, N. (2024). Upaya Meningkatkan Motivasi Belajar Siswa Melalui Implementasi Media Quizizz. *Tarbiyatuna: Jurnal Pendidikan Ilmiah*, *9*(1), 53–68. https://doi.org/10.55187/tarjpi.v9i1.5647

Sartika, N. S., Munawaroh, T., Susanti, E. N., Meika, I., Mauladaniyati, R., Sujana, A., Sahrudin, A., Yunitasari, I., Rosdianwinata, E., Rifai, R., Pratidiana, D., Permatasari, P., Uniah, D., & Cahyati, K. (2023). Pelatihan Penyusunan Bahan Ajar Berbasis Web Bagi Guru SMP Kabupaten Pandeglang. *Jurnal Pengabdian Pada Masyarakat*, *8*(4), 934–945. https://doi.org/10.30653/jppm.v8i4.621

Saumantri, T. (2022). Kesiapan Guru dalam Pembelajaran Jarak Jauh di Era New Normal. *Edukatif : Jurnal Ilmu Pendidikan, 4*(3), 4145 - 4153.

Secha, M. N., Setyowati, & Darmanto, E. (2024). Implementasi Quizizz Dalam Pembelajaran. *Jurnal Ilmiah Wahana Pendidikan, 10*(18), 637-643. https://doi.org/10.5281/zenodo.13937824.

Sulastri, S. N. A., Jamin, H., & Agustina, M. (2021). Optimalisasi Penggunaan Proyektor dalam Pembelajaran pada Mata Pelajaran I.P.A. *Al-Ihtirafiah: Jurnal Ilmiah Pendidikan Guru Madrasah Ibtidaiyah*, *1*(1), 67–77.

Srimuliyani. (2023). Menggunakan Teknik Gamifikasi untuk Meningkatkan Pembelajaran dan Keterlibatan Siswa di Kelas. *EDUCARE : Jurnal Pendidikan Dan Kesehatan*, *1*(1), 29-35. https://doi.org/10.70437/jedu.v1i1.2

Tiana, A., Krissandi , A. D. S., & Sarwi , M. . (2021). Peningkatan Motivasi dan Hasil Belajar Siswa Melalui Media Game Quizizz pada Mata Pelajaran Matematika. *Jurnal Pendidikan Indonesia, 2*(6), 943–952. https://doi.org/10.59141/japendi.v2i06.189

Hidayatullah, M. T., Asbari, M., Ibrahim, M. I., & Faidz, A. H. H. (2023). Urgensi Aplikasi Teknologi dalam Pendidikan di Indonesia. *Journal of Information Systems and Management (JISMA)*, *2*(6), 70–73. https://doi.org/10.4444/jisma.v2i6.785

Wahyuni, F. P. N., & Tranggono, D. (2023). Upaya dalam Meningkatkan Literasi, Numerasi, dan Adaptasi Teknologi Siswa melalui Program Kampus Mengajar 4 di SMP Widya Gama Mojosari. *Jurnal Pengabdian Nasional (JPN) Indonesia*, *4*(1), 125–133. https://doi.org/10.35870/jpni.v4i1.128