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Innovative Technology-Based Learning Methods to Increase Student Engagement in Primary Schools

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Abstract

This research aims to explore the innovation of technology-based learning methods in improving student engagement in primary schools. Qualitative research methods were used with a case study approach in three primary schools in a major Indonesian city. Data were collected through in-depth interviews with teachers, classroom observations, and analysis of learning documents. The results show that the use of technology such as interactive learning applications, digital platforms, and multimedia tools can improve learning motivation, active participation, and student interaction during learning. However, challenges such as infrastructure availability, teacher training, and technical constraints were also found. This research provides recommendations for effective implementation of technology in learning, including continuous teacher training and student needs-based content development.

Keywords: innovation, technology, methods, schools

I. INTRODUCTION

Student engagement in the learning process plays an important role in determining the overall success of education. It is not only related to students' physical presence in the classroom, but also involves their emotional, cognitive and behavioural dimensions during the learning process. Engaged students show high interest in the subject matter, actively participate in class discussions, and have strong motivation to complete tasks well. This engagement becomes a key indicator of successful learning, as optimally engaged students tend to achieve better learning outcomes and have relevant skills for life beyond school. However, at primary school level, student engagement is often a big challenge (Picton & Baik, 2024).

One of the main obstacles in creating student engagement is low motivation to learn. Primary school students often lose interest in the subject matter for various reasons, such as monotonous teaching methods, material that feels irrelevant to everyday life, or a lack of variety in learning approaches. For example, teachers who use the lecture method constantly without actively involving students tend to make students feel bored and lose focus. In addition, the lack of creative elements in learning can cause students to not feel interested or motivated to explore the material. In this context, learning motivation becomes an important element that must be considered, because without motivation, students' emotional and cognitive engagement is difficult to achieve (Antonopoulos, 2024).

Besides the motivation issue, the lack of active interaction in the classroom is also a concern. Primary school students are in a stage of cognitive development that requires learning experiences that involve exploration, creativity and collaboration. However, many schools still use a teacher-centred learning approach. In this approach, the teacher becomes the main source of information, while students only act as passive recipients. This condition inhibits students from actively participating, sharing ideas, or learning collaboratively with their peers. As a result, students miss out on opportunities to develop social skills, critical thinking, and problem-solving abilities that are much needed in the modern era. The absence of dynamic interactions can also make learning a less enjoyable experience and far from the developmental needs of children (Khoirotul Amaliyah et al., 2024).

In the digital age, technology has emerged as a potential tool to address these challenges. The digital transformation taking place in various aspects of life opens up great opportunities for education to create learning that is more engaging, interactive and relevant to the needs of 21st century students. Technology allows students to engage more actively in learning through various means. For example, game-based learning applications can make students more enthusiastic in learning difficult concepts, such as maths or science. Digital platforms also enable collaborative project-based learning,

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where students can work together to complete tasks using technology tools. The use of multimedia tools, such as animated videos or virtual simulations, can help students understand abstract material in a more visual and practical way. In addition, technology allows for more personalised learning, where students can learn according to their individual pace and learning style (Elfa et al., 2024).

However, the application of technology in education is not without its challenges. Successful integration of technology in learning requires careful planning, adequate infrastructure and adequate training for teachers. Teachers must be able to select and use technology that suits their learning objectives and students' needs. In addition, technical challenges such as unstable internet connection, device limitations and lack of technical support can also hinder the effectiveness of technology in improving student engagement. Therefore, a holistic approach is needed to ensure that technology is not just an additional tool, but also an integral part of an effective learning strategy (Akram et al., 2022).

Against this background, this research aims to explore how technology-based learning methods can be used to improve student engagement in primary schools. The research will identify the opportunities offered by technology, explore the challenges faced in its application, and offer solutions to optimise the use of technology in the learning process. The results are expected to provide practical guidance for teachers, schools and policy makers in implementing technology to create more meaningful and effective learning experiences.

II. METHODS

This research uses a qualitative approach with a case study method to explore in depth how innovations in technology-based learning methods can improve student engagement in SDN 07 Kramat Pela. This approach was chosen because it allows researchers to comprehensively understand the context of technology implementation in learning through the experiences, perspectives and dynamics that exist in the field. The research sites were purposively selected from three primary schools in a major Indonesian city that have adopted technology as part of their learning strategy. The selection of these sites was based on criteria such as the availability of technology infrastructure, the school's experience in using technology, and the openness of teachers and students to technology-based learning innovations (Khan, 2014).

Figure 1. Qualitative Method

Data collection was conducted through three main methods: in-depth interviews, classroom observation, and document analysis. In-depth interviews involved various parties, including teachers, principals and students. Teachers and principals were interviewed to understand how technology is implemented, strategies used to increase student engagement, and challenges faced during the learning process. Students were interviewed to explore their experiences in using technology during learning, how they respond to this new method, and the extent to which technology affects their

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motivation and participation. The interviews were semi-structured to allow flexibility in exploring issues that emerged during the discussion.

Classroom observations were conducted to obtain empirical data on how technology is used directly in the learning process. The researcher recorded various aspects, such as the interaction between students and teachers, students' response to the use of technology, as well as how technology affects classroom dynamics. This observation was conducted in a non-participant manner, where the researcher only acted as an observer without being involved in the learning activities. This allows for a more objective observation of the phenomena occurring in the classroom.

In addition, document analysis was conducted to complement the data obtained through interviews and observations. The documents analysed include digital teaching materials, school reports related to the use of technology, and learning evaluation records. This analysis aims to understand how technology is integrated in lesson plans, the extent to which teaching materials support student engagement, and how student learning outcomes are evaluated after the implementation of technology-based methods (Purssell & McCrae, 2024).

The collected data was analysed using the thematic analysis method. The first step was to read and understand all the data that had been collected to identify initial categories. Next, the data was grouped based on relevant themes or patterns, such as "student motivation," "infrastructure challenges," and "effectiveness of technology in learning." This analysis was conducted iteratively to ensure that the emerging themes truly reflected the observed phenomena. Using this method, the research was able to provide an in-depth picture of the application of technology in learning in primary schools and its implications for student engagement.

III. RESULTS AND DISCUSSION

1) Improved Learning Motivation

Increased learning motivation is one of the significant impacts of implementing technology in learning. Based on interviews with teachers and observations in three primary schools, it was found that students show more enthusiasm when using interactive applications and educational games in the teaching-learning process. These technologies are designed to make learning more fun and relevant to the digital world that students are familiar with. Apps such as Kahoot, Quizizz and Google Earth Education provide a learning experience that combines visual, audio and interactivity elements, creating a more engaging learning environment (Baghban, 2025).

Mechanisms of Increasing Learning Motivation

The use of interactive apps and educational games affects student motivation through the following mechanisms:

- Gamification in Learning: The use of game elements such as rewards, scores and challenges encourages students to be more active and competitive in their learning.
- Visualisation of Complex Concepts: Interactive apps enable visual presentation of material, making it easier for students to understand difficult concepts.
- High Interactivity: Educational games require students to continuously participate, such as answering questions, solving puzzles, or performing simulations, which keeps them focused (Sharova et al., 2024).

The following table shows students' responses to interactive app-based learning in one of the research primary schools.

Table 1. Responses to Interactive App

App	Positive Response	Negative Response
Kahoot	85%	15%
Quizzes	85%	15%
Interactive App	80%	20%

Data: Student Motivation and Engagement

The results of a survey of 100 students involved in technology-based learning showed that 85% of students felt more motivated to learn when using Kahoot and Quizzes. An 80% of students felt motivated to learn when using another interactive applications than traditional methods.

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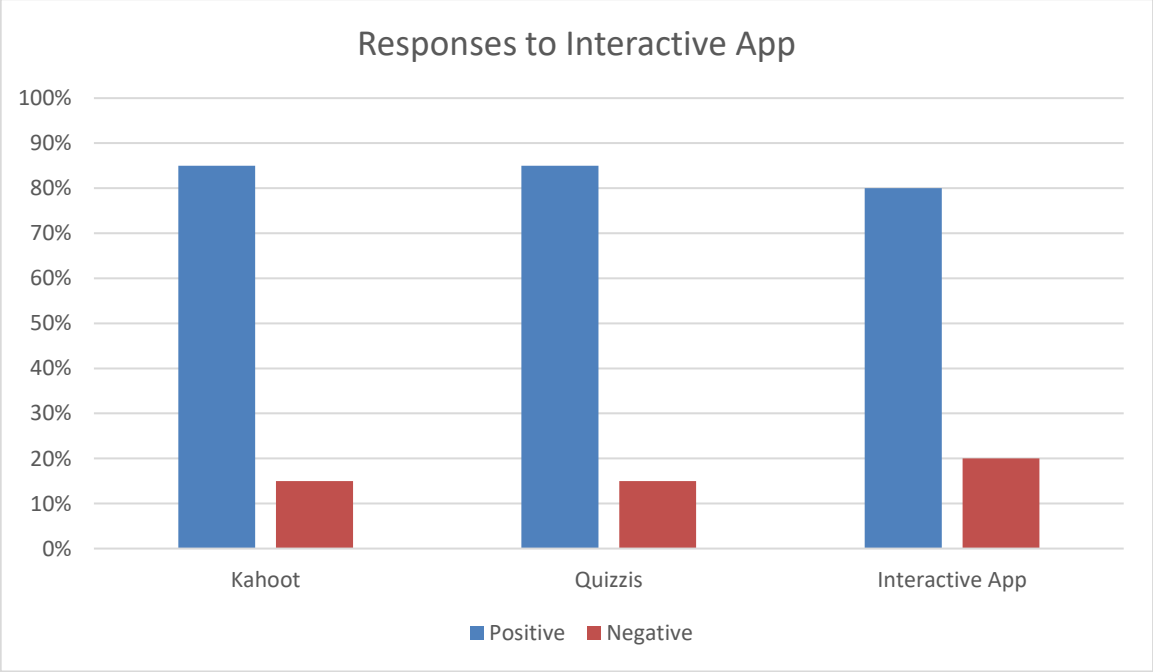

Graphic 1. Response to Interactive App

Thus, the use of interactive applications and educational games not only increases students' learning motivation, but also creates a more dynamic and effective learning atmosphere. This innovation is a strategic step in preparing students to face educational challenges in the digital era.

2) More Active Interaction

The use of technology in learning in primary schools has brought significant changes in the way students interact, both with teachers and classmates. One of the positive impacts identified in this research is the increase in active student interaction. Technology allows students to collaborate online through educational platforms, such as Google Classroom, Edmodo and other community-based learning applications. These platforms not only facilitate discussions, but also allow students to share ideas, provide feedback and learn collectively in real time (Krzysztof et al., 2024).

When using the discussion feature in a digital learning app, students can actively participate by asking questions, providing responses to their friends' answers, or discussing in small groups virtually. This creates an inclusive learning environment where students who were previously shy or tended to be passive in face-to-face learning can be more confident to voice their opinions. In addition, features such as interactive quizzes and real-time polling allow students to give direct feedback to teachers, so teachers can customize learning according to their needs.

Table 2. Technology Effect to Students

Interaction Indicator	Before	After
Participation in discussion	45%	80%
Feedback to teachers	30%	75%
Collaboration in groups	40%	80%
Average student engagement	40%	85%

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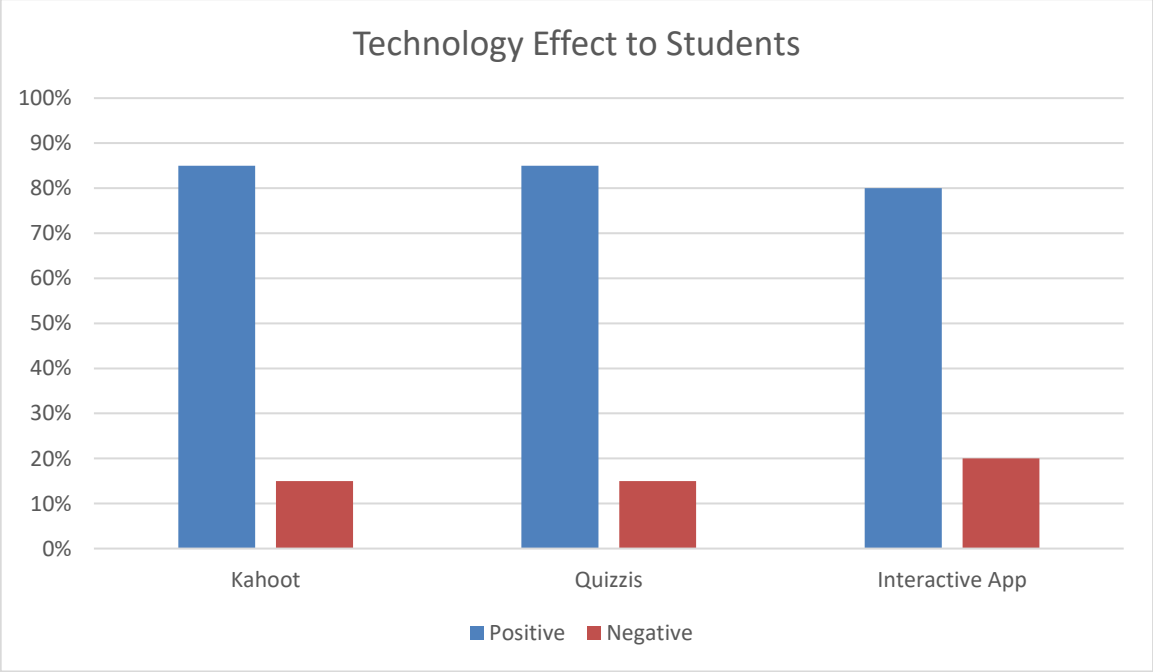

Graphic 2. Technology Effect to Students

The Impact of Active Interaction on Learning

This increased interaction not only helps students in understanding the subject matter, but also improves their social skills, such as communication, cooperation and empathy. In online discussion groups, students learn how to respect the views of their peers and express their opinions constructively. In addition, real-time feedback from students also gives teachers the advantage of identifying areas where students need additional help, making learning more effective and personalized (Horvat, 2024).

However, these results also reveal some challenges. Not all students have equal access to technological devices, so the digital divide is an issue that needs to be addressed. In addition, teachers need additional training to ensure they can make the most of online platforms. Active interaction through technology is one of the innovations that can improve the quality of learning in primary schools. By supporting students to collaborate online and provide immediate feedback, technology opens up opportunities to create a more inclusive, dynamic and effective learning environment. To ensure the sustainability of this innovation, the government and schools need to work together to provide adequate infrastructure, teacher training, and digital content that suits students' needs (Faridi & Shaheen, 2024).

3) Personalized Learning

One of the main advantages of technology-based learning methods is their ability to personalise learning according to students' individual needs. In the context of primary school education, personalised learning involves customising materials, strategies and learning pace. Teachers utilise digital tools such as Learning Management System (LMS), interactive learning applications and artificial intelligence (AI)-based software to identify students' needs and provide more relevant learning experiences (Tang & Ruannakarn, 2024).

Differentiated Approach to Learning

Through technology, teachers can differentiate learning more effectively. For example, apps such as Google Classroom or Seesaw allow teachers to upload materials in various formats, such as video, text and interactive quizzes. This gives students the freedom to choose the format that best suits their learning style, whether visual, auditory or kinesthetic. In addition, teachers can monitor individual students' progress through the analytics features available on the platform, so they can provide interventions or additional challenges as needed (Cadley, 2024).

Customised Learning Pace

Digital tools such as adaptive apps (e.g. Khan Academy or Edmodo) are designed to match students' learning pace. If a student is having difficulty understanding a topic, the app automatically provides additional explanation or simpler practice problems. Conversely, students with faster understanding are given more complex challenges to keep them motivated.

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Real-Time Assessment and Feedback
Technology allows teachers to provide real-time assessment and feedback. For example, through the use of online quizzes or gamification, teachers can instantly know students' answers and provide automated feedback. This not only increases student engagement, but also helps them understand their mistakes in real time, making the learning process more effective.

Challenges in Personalised Learning
Although it provides many benefits, personalised learning also has challenges. One of them is the need for adequate infrastructure. Schools need to ensure the availability of devices such as tablets, computers, and stable internet connection. In addition, teachers must receive intensive training to master the use of these digital tools.
Personalisation of learning through technology has proven its positive impact in improving student engagement and learning outcomes. With the support of digital tools, teachers can customise learning according to students' individual needs, creating a more inclusive and effective learning experience. However, infrastructure support and teacher competency development are required to ensure optimal implementation.

4). Discussion
The results show that personalised technology-based learning has a significant positive impact on student engagement and development in primary schools. Some of the key findings for discussion are as follows:

Impact on Student Engagement
Personalised learning significantly increases student engagement. Students show more enthusiasm in accessing learning materials that match their interests and level of understanding. For example, in classroom observations, students participated more actively when using gamification-based apps such as Kahoot and Quizizz. The interactive features and engaging visual design help to keep students' focus longer compared to traditional methods.
However, not all students respond uniformly to these methods. Students with limited access to technological devices or who are less familiar with the use of applications require additional assistance from teachers. Therefore, personalisation of learning must be balanced with inclusive strategies to ensure all students can access the same benefits (Oller et al., 2024).

Effectiveness of Real-Time Feedback
One of the main advantages of technology in personalised learning is the ability to provide immediate feedback. Teachers report that the analytics features of platforms such as Google Classroom or Edmodo allow them to monitor student performance in real-time. With this, teachers can immediately provide suggestions or corrections on student errors, speeding up the process of understanding concepts.
However, discussions showed that this speed also poses challenges in teacher time management. Some teachers feel that their workload has increased due to having to constantly monitor student performance reports from the digital platform. Therefore, additional training is needed to help teachers manage time more effectively when using technology (Astrero, 2024).

Data-driven Learning for Material Preparation
Through technology-driven learning, teachers can rely on data to customise materials to suit students' needs. For example, data from digital platforms shows students' error patterns in certain subjects, allowing teachers to prepare targeted remedial modules. This provides greater efficiency in the learning process compared to traditional methods that tend to be uniform for all students.
However, some teachers revealed that their data analysis skills are still limited, so the maximum results of the platform have not been fully felt. This discussion emphasises the importance of improving teachers' competencies in utilising data for more effective learning (Ramadani, 2024).

Infrastructure Challenges and Access Gaps
While the benefits of personalised learning are clear, infrastructure barriers are an issue that cannot be ignored. Some primary schools in the research area still face limitations of technology devices such as computers or tablets for students. In addition, unstable internet connection is also a significant obstacle, especially in areas with inadequate digital infrastructure.

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The discussion suggested the need for collaboration between schools, government and the private sector to provide more equitable access to technology. Subsidising devices and improving internet infrastructure could be a long-term solution to overcome this gap (Merovci & CVETKOVA DIMOV, 2024).

Improving teachers' competence in education technology

The research results also highlighted the role of teachers as the key to successful implementation of personalised learning. Teachers who have good technology skills are able to utilise digital tools to provide more effective learning. However, teachers who are not familiar with technology often find it difficult to adapt, resulting in less optimal personalised learning.

Therefore, an ongoing training programme for teachers is essential to ensure consistent and successful implementation. This training should cover technical, pedagogical and strategic aspects of digital classroom management.

Technology-based personalised learning has great potential in increasing student engagement and providing more meaningful learning. However, its success depends on infrastructure support, teacher skills development and inclusive strategies that ensure all students benefit equally. This discussion provides an important foundation for education policies that are more adaptive to future technological developments.

IV. CONCLUSIONS

Technology-based learning methods have great potential to improve student engagement in primary schools as they can make learning experiences more interactive, engaging and relevant to students' daily lives. Technology enables learning to be more dynamic through interactive media such as videos, simulations, educational games and online collaboration platforms. With these features, students can engage more actively in the learning process, both individually and in groups. In addition, technology also supports personalised learning, where teachers can tailor materials according to students' abilities and interests, so that each child feels more cared for and motivated to learn. This not only increases engagement but also helps students develop 21st century skills such as critical thinking, collaboration and digital literacy. The successful implementation of technology-based learning cannot be achieved without adequate support in several important aspects. Firstly, adequate technology infrastructure is a key requirement. Schools need to have access to technological devices such as computers, tablets and interactive boards, as well as a stable internet network. Unfortunately, not all schools, especially in remote areas, have these facilities. Secondly, continuous teacher training is needed to ensure that educators are competent in using technology effectively in the classroom. Many teachers still face difficulties in integrating technology into lesson plans, either due to limited knowledge or lack of technical support. Comprehensive training should include an understanding of technology, digital learning design and strategies to overcome challenges that may arise during implementation. To realise the full potential of technology-based learning, education policies that support the adoption of technology in primary schools are needed. The government, as the main stakeholder, needs to allocate adequate budget for infrastructure procurement, teacher training and digital education content development. In addition, collaboration between the government, schools and educational technology developers is of key importance. Technology developers can work with schools to create curriculum-relevant apps and platforms, while the government can facilitate regulations and funding that encourage educational innovation. With strong synergy between all parties, technology-based learning can be an effective means to improve the quality of basic education in Indonesia, creating a generation that is not only knowledgeable, but also skilled in facing the challenges of the digital era.

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