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School-Based Management to Improve Technology-Based Mathematics Learning at Junior High Schools in Jakarta

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Abstract

This study aims to analyse the application of School-Based Management (SBM) in improving technology using ChatGPT-based mathematics learning in Junior High Schools (SMP). This study uses a qualitative approach with a case study design, which involves observation, interviews, and documentation to collect data from several junior high schools that apply SBM in mathematics learning. The collected data was analysed using thematic analysis techniques to identify patterns that emerged related to the application of SBM and technology in the learning process. The results show that applying SBM can increase the use of technology in mathematics learning, which contributes to improving the quality of learning. The contribution of this research is to provide new insights into the role of SBM in optimising the use of technology using ChatGPT to enhance the quality of mathematics learning in junior high schools.

Keywords: School-Based Management; Mathematics Learning; Educational Technology; Junior High School; Learning Quality

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INTRODUCTION

The low quality of mathematics learning at the Junior High School level is still a significant challenge in the world of education, especially in today's digital era. ChatGPT possesses the capability to adjust to varying individual learning modalities, thereby offering tailored feedback and resources, which is crucial for accommodating a heterogeneous learner population (Li, 2024). Research indicates that learners who engage with ChatGPT exhibit heightened levels of motivation and participation, consequently resulting in enhanced academic achievement (Almulla & Ali, 2024). Educators may leverage ChatGPT for the generation of instructional content, which not only conserves time but also elevates the quality of teaching, consequently allowing them to concentrate on more engaging pedagogical approaches (Sain et al., 2024). Using ChatGPT effectively in the learning process, where traditional approaches have not been able to meet the increasingly diverse learning needs of students. With the implementation of School-Based Management (SBM), schools have the autonomy to adopt technology using ChatGPT, which can provide more interactive, personalised, and adaptive math learning according to each student's abilities. Therefore, school-based management that supports the use of technology in mathematics learning can significantly improve Learning Quality at the junior high school level, answering educational challenges in the modern era.

Technological developments in the world of education have not been fully utilised optimally in Mathematics Learning at the Junior High School level**,** thus having an impact on the stagnation of improving Learning Quality**.** Many schools still rely on conventional methods and have not implemented educational technology effectively, even though

technology using ChatGPT has great potential to make learning more interactive and adaptive according to student needs. ChatGPT possesses the capability to customise educational materials according to the specific requirements of individual learners, thereby augmenting both engagement and comprehension (Isiaku et al., 2024). The platform fosters dialogue and interaction, thereby facilitating active involvement and the cultivation of critical thinking skills among students (Sharova et al., 2024). It aids educators in the formulation of lesson plans, the creation of assessments, and the provision of immediate feedback, consequently enhancing instructional efficacy (Isiaku et al., 2024). Through the implementation of School-Based Management (SBM), schools have the authority to integrate AI technology such as ChatGPT into the math curriculum, allowing students to get more personalised material explanations, practice questions tailored to their abilities, and instant feedback that accelerates understanding of concepts. By utilising AI-based technology in the framework of school-based management, the quality of mathematics learning can be significantly improved, answering the challenges of 21st-century education.

The use of artificial intelligence-based applications such as ChatGPT is an innovative solution for improving the quality of Mathematics Learning at the Junior High School level**.** Many students have difficulty understanding mathematical concepts due to the limitations of traditional teaching methods that are less adaptive to individual needs. The integration of artificial intelligence instruments, including GeoGebra and ChatGPT, has demonstrated substantial advancements in learners' conceptual comprehension and self-efficacy within the domain of mathematics (Canonigo, 2024). Artificial intelligence enhances individualised educational experiences, enabling learners to advance at their speed while receiving customised feedback, a feature that conventional pedagogical approaches frequently neglect (Ade Nandang Mustafa, 2024). Through the School-Based Management (SBM) approach**,** schools can integrate Educational Technology such as ChatGPT, which acts as a virtual tutor, providing interactive explanations of the material, personalised practice questions, and instant feedback that helps students understand the material more effectively. By adopting technology applications such as ChatGPT in school-based management, problems in mathematics learning can be significantly overcome, and it has a direct impact on improving learning quality in the junior high school environment.

The novelty of this research lies in the application of SBM in the context of technology-based mathematics learning, which is still limited in junior high schools, with a focus on developing more effective strategies for improving student interaction and understanding. The innovative aspect of implementing School-Based Management (SBM) within technology-enhanced mathematics education in junior high institutions resides in its capacity to augment student engagement and comprehension via the strategic amalgamation of technological resources. Implementing School-Based Management (SBM) in technology-enhanced mathematics education in junior high schools enhances student engagement and comprehension. This approach utilises technology to foster an interactive and effective learning environment. The incorporation of technology in education has profoundly altered learning environments, enhancing interactivity and efficacy. This underscores the necessity for active student participation through diverse interactive pedagogical approaches and digital resources, thereby improving the educational experience. Technology enables customised educational experiences, catering to varied learning preferences and velocities (Panda, 2024)**.** Despite the potential benefits of integrating technology in mathematics education through SBM, challenges regarding resource allocation and teacher training must be acknowledged. It is essential to prepare educators thoroughly for effective technology utilisation to maximise its advantages. Additionally, balancing technological and traditional teaching methods can cater to diverse learning preferences and requirements.

The purpose of this study is to explore the application of School-Based Management in improving mathematics learning by utilising educational technology to improve the quality of learning in junior high schools. The study of School-Based Management (SBM) in improving mathematics education through technology highlights the integration of management practices with technological advancements. SBM provides a structure for schools to manage resources independently and engage in participatory planning, which is essential for fostering an innovative learning environment. SBM encourages collaboration among educators, parents, and the community to address resource limitations and enhance educational quality through effective coordination. SBM facilitates the active involvement of educators, parents, and the community in planning, which is crucial for resolving resource issues and elevating educational standards. Effective SBM requires systematic planning and collaboration to optimise resource use and support technology-enhanced learning environments (Ilma WS et al., 2024). Effective educational management relies on leadership and professional development to create a conducive environment for learning innovations, including infrastructure adequacy and a culture that encourages experimentation and collaboration (Dwi, 2024). The integration of technology in mathematics education significantly improves students' problem-solving skills. Innovative technology-driven approaches can enhance learning experiences and outcomes, making them vital elements of modern educational strategies (Ulya et al., 2024). Successful ICT integration in education requires a reliable infrastructure, such as internet accessibility, to support digital learning tools. Strategic planning and evaluation are essential for identifying shortcomings and ensuring the effective incorporation of technology within the educational system (Pratiwi, 2023). Despite the potential of SBM and educational technology to enhance mathematics learning, challenges like resource shortages and infrastructure issues must be addressed. Furthermore, fostering a culture of innovation and collaboration in educational institutions is crucial for maintaining improvements in educational quality.

The incorporation of educational technology in mathematics is essential for fostering interactive student experiences. This methodology not only improves motivation and understanding but also accommodates varying learning requirements through customised learning environments. Technological tools, including interactive software and digital platforms, revolutionise conventional teaching methods, simplifying complex mathematical ideas and promoting deeper comprehension. AI and robotics facilitate personalised learning experiences, enabling students to explore mathematical concepts via interactive games and simulations (Anand et al., 2023). AI systems evaluate student performance data to deliver customised content and exercises. These AI-driven systems tailor content to individual learning needs, allowing for personalised progression (Olanike Abiola Ajuwon et al., 2024). Additionally, chatbots and virtual tutors provide immediate assistance and ongoing learning opportunities beyond the classroom, further individualising the educational experience (Olanike Abiola Ajuwon et al., 2024). The integration of technology in assessment processes enhances both conceptual understanding and student engagement. It improves conceptual comprehension and participation by delivering instant feedback and effectively monitoring student progress (Hasibuan, 2023). Moreover, digital tools promote a more dynamic and adaptable learning environment, enabling educators to concentrate on teaching and mentoring instead of administrative duties (Olanike Abiola Ajuwon et al., 2024). While the advantages of educational technology in mathematics education are considerable, challenges such as ensuring equitable access to digital resources and addressing the digital divide persist. Educators need to receive adequate training to effectively integrate technology into their pedagogical practices, maximising its potential benefits.

The implementation of a robust School-Based Management (SBM) strategy within junior high schools (SMP) aimed at enhancing mathematics learning through technological integration necessitates the consideration of several pivotal factors. The incorporation of technology into mathematics education serves to mitigate challenges associated with abstract concepts and diminished student engagement, thereby resulting in improved educational outcomes. The amalgamation of information technology with the mathematics curriculum has precipitated profound modifications in pedagogical approaches and the dissemination of content. Technology possesses the potential to serve as a formidable instrument for enhancing numeracy skills, which are critically essential for effective problem-solving and critical thinking. The evolution of technology-infused mathematics education mandates a revaluation of educational paradigms to capitalise on technological advancements fully. This necessitates the revision of curricula and assessment methodologies to ensure alignment with the capabilities afforded by contemporary technology (Drijvers et al., 2016). Furthermore, while technology presents a plethora of advantages, it is imperative to acknowledge the challenges associated with its implementation, including the necessity for equitable access and sufficient professional development for educators (Drijvers et al., 2016). In summary, although the integration of technology into mathematics education offers promising prospects for enhancing learning experiences, it is essential to confront potential challenges such as accessibility and educator preparedness. A judicious approach that harmonises traditional instructional methods with innovative technological practices may yield enhanced educational outcomes in junior high schools.

School-Based Management (SBM) presents a decentralised framework that empowers educational institutions to customise pedagogical approaches to more effectively address the diverse needs and characteristics of their student populations. By conferring greater autonomy upon schools, SBM promotes the creation of innovative curricula and programs that are attuned to the specific requirements and conditions of the local context. This methodological approach not only elevates the quality of education but also cultivates heightened engagement and accountability among stakeholders. SBM endows educational institutions with the authority to oversee resource allocation and to make decisions that have a direct bearing on the quality of education (Hartinah & Rofahima, 2024). Furthermore, schools possess the capacity to modify curricula and pedagogical techniques to align with local exigencies and student characteristics, thereby fostering more pertinent and effective educational experiences (Hartinah & Rofahima, 2024). The active participation of stakeholders—including principals, educators, parents, and community members—is indispensable for the successful execution of SBM. Such engagement guarantees that educational strategies are collaboratively conceived and supported, thereby augmenting their relevance and efficacy (Simatupang et al., 2024). Proficient leadership, particularly from school administrators, is imperative for optimising resource management and the effective implementation of SBM (Simatupang et al., 2024). While SBM presents considerable opportunities for innovation and enhancement, challenges such as resource constraints and resistance to change may obstruct its efficacy (Hartinah & Rofahima, 2024). It is vital to address these impediments to fully actualise the potential of SBM in devising educational strategies that respond to the multifaceted needs of students.

Innovative methods in mathematics education are essential for enhancing student engagement due to the ineffectiveness of traditional techniques. Research demonstrates that modern strategies, such as technology-enhanced learning, project-based learning, and brain-based learning, significantly improve students' mathematical success and engagement. These methods not only enhance academic performance but also foster a deeper understanding and interest in mathematics. Technology-enhanced lessons particularly enhance mathematical achievement through interactive experiences. Access to

technological resources, such as virtual learning environments, supports student learning and mitigates math anxiety (Charles & Charles, 2024). The Student Facilitator and Explaining (SFAE) approach in digital contexts enhances mathematical representation and conceptual understanding, illustrating the efficacy of digital tools in education (Suri et al., 2024). Project-based learning encourages active participation and collaboration among students, leading to improved engagement and academic outcomes. Peer collaboration and robust parental involvement further strengthen these benefits (Charles & Charles, 2024). Innovative pedagogical approaches that integrate real-world applications and collaborative activities deepen students' understanding of mathematical concepts, thereby boosting their interest and performance (Elijah, 2024). The Brain-Based Learning (BBL) method effectively enhances interest and learning outcomes in mathematics for elementary students by fostering a supportive learning environment aligned with natural cognitive processes (Pratama & Ratnaningrum, 2024). Teacher expertise is critical for the effective implementation of innovative instructional strategies. Training educators in contemporary methodologies is strongly correlated with improved student outcomes, underscoring the significance of teacher competence (Janardhanan & Charles, 2024). While innovative strategies exhibit promise in enhancing mathematics education, challenges remain in their execution. Factors such as socioeconomic background, resource availability, and teacher training impact the effectiveness of these approaches. Addressing these issues is essential to fully leverage innovative methods for advancing mathematics learning outcomes.

The incorporation of educational technology in mathematics for Junior High School students markedly improves the learning environment. Digital tools enhance student performance, problem-solving abilities, and engagement in mathematics. Various tools, including game-based applications and AI tutors, provide distinct advantages for diverse learners. Digital tools boost learning outcomes and problem-solving skills, with reviews emphasising their contribution to student engagement in mathematics education. The effectiveness of digital tools in enhancing learning outcomes and problem-solving skills is well-documented. A systematic review noted that integrating digital technology in mathematics education fosters greater student engagement and exploration (Saat et al., 2024). Technology-based learning interventions are effective in enhancing mathematical problem-solving skills, as shown by a meta-analysis of Indonesian studies (Ulya et al., 2024). AI tutors and adaptive platforms tailor instruction to meet individual student needs. These tools increase engagement and offer targeted practice, facilitating a deeper comprehension of mathematical concepts (Kattunilam, 2024). Furthermore, ICT technologies enable the creation of personalised learning pathways, enhancing education's accessibility and quality (Kozlov & Bochkova, 2024). Digital technologies drive pedagogical innovation by providing diverse resources like math software, websites, and online tutorials. These resources facilitate students' understanding and application of mathematical concepts (Adeilton de Oliveira Andrade et al., 2023). Moreover, the integration of digital media in education necessitates responsible usage to build knowledge and elevate teaching quality effectively (Adeilton de Oliveira Andrade et al., 2023). Despite the evident advantages of educational technology in mathematics, challenges such as initial integration difficulties must be overcome. Educators require adequate training to effectively utilise these technologies, ensuring they support traditional teaching methods and enhance the learning experience (Kozlov & Bochkova, 2024).

The incorporation of technology in junior high school mathematics education significantly enhances learning quality. This enhancement is achieved by utilising technology to deepen student engagement and comprehension. Technology's application in mathematics can revolutionise conventional teaching practices, facilitating interactive and collaborative exploration of mathematical ideas. This shift relies on the proficient use of technology as a primary learning instrument rather than an auxiliary tool. Technology

allows for interactive and dynamic engagement with mathematical concepts, resulting in improved understanding and participation. Digital tools such as interactive applications and e-worksheets notably enhance comprehension of intricate mathematical subjects like algebra and geometry. These resources offer a more stimulating educational experience than traditional approaches (Hetmanenko, 2024). The integration of digital technology fosters a vibrant learning atmosphere that encourages profound comprehension and a love for learning through interactive resources. This is accomplished through materials that enable the visualisation of abstract ideas and experimentation with various scenarios (Cirneanu & Moldoveanu, 2024). In technical disciplines, digital tools facilitate engagement with realistic simulations and virtual training, improving decision-making and problem-solving skills without real-world practice (Cirneanu & Moldoveanu, 2024). Technology benefits educators as well by providing insights into student performance and enabling tailored teaching strategies. Interactive resources yield critical information regarding students' strengths and weaknesses, supporting targeted interventions (Cirneanu & Moldoveanu, 2024). Despite its advantages, a balance between traditional and digital teaching methodologies is essential to maximise educational outcomes. Additional research and development are necessary to refine these strategies and ensure their efficacy in various educational settings (Hetmanenko, 2024).

METHODS

The design of this study aims to measure the effectiveness of School-Based Management (SBM) in improving the quality of technology-based Mathematics Learning at the Junior High School level by utilising Educational Technology using ChatGPT. Instruments must exhibit content, construct, and criterion validity to facilitate a thorough evaluation. Involving specialists during the design phase significantly bolsters content validity, ensuring that research inquiries are congruent with measurement instruments (Raden Ismail et al., 2023). Methodologies such as exploratory and confirmatory factor analyses are instrumental in substantiating the internal structure of instruments, as exemplified by the ETLQ questionnaire. The assessment of reliability can be conducted through methods of stability and equivalence, thereby guaranteeing that findings remain consistent over time. To ensure the accuracy of measurement, a valid and reliable instrument with clear indicators is needed to evaluate changes in learning quality**.** The instruments used include questionnaires, observation sheets, and documentation with indicators such as 1. The level of understanding of mathematical concepts before and after the use of ChatGPT. 2. The frequency of using ChatGPT in learning activities. 3. The perception of students and teachers in the effectiveness of technology to support learning. 4. The improvement of mathematical problem-solving skills. By using these indicators, this study can objectively assess the contribution of SBM and ChatGPT technology in improving the quality of mathematics learning in junior high schools.

The population of interest for this comprehensive study consists of all junior high schools located in Jakarta that have adopted and applied the principles of School-Based Management (SBM), which emphasises decentralised administrative authority and community involvement in educational governance. Empirical studies suggest that although School-Based Management (SBM) aspires to enhance educational results, its execution has encountered obstacles, notably a deficiency in the precision of policy directives (Sumintono, 2018). From this vast population, purposeful sampling techniques were carefully used to identify and select three junior high schools that not only embraced but also successfully integrated educational technology into their math curriculum, thereby enhancing the learning experience for their students. The selection of these particular

schools is based on the active and effective application of SBM principles, as well as their demonstrable commitment to utilising technological tools and resources to significantly improve teaching methodologies and learning outcomes in the field of mathematics education. This carefully targeted sample provides a solid foundation for research, enabling focused examinations of schools positioned to offer invaluable insights into the critical interactions between School-Based Management and technology-enhanced mathematics education, thus ensuring that the findings are relevant and actionable for education stakeholders looking to drive improvement in this domain.

The methodological instruments used in the context of this particular study include qualitative research techniques, which prominently include semi-structured interviews, thorough classroom observations, and careful analysis of various forms of documentation. Semi-structured interviews facilitate a comprehensive investigation into the perspectives of participants, as evidenced in research that concentrates on instructional strategies and parental anticipations within the educational sphere (Dericioğlu et al., 2024). In particular, semi-structured interviews were conducted systematically with a wide range of participants, including but not limited to school principals, mathematics educators, and other relevant stakeholders, with the main objective of emanating detailed insights into the implementation of School-Based Management (SBM) and its impact and consequences on the integration of technological tools in the framework of mathematics education. In conjunction with the aforementioned interviews, extensive classroom observations are conducted carefully to evaluate the practical application of technology-enhanced pedagogical strategies and to ensure the subsequent effects on student engagement levels as well as overall learning outcomes. Furthermore, a series of documentation, which includes lesson plans, institutional policies, and reports on SBM activities, is rigorously analysed to complement and corroborate the data that has been collected through interviews and observations, thus facilitating a more comprehensive and nuanced understanding of the main research focus at hand.

The research methodology begins with a meticulous process of selecting educational institutions to serve as a sample population, with a particular emphasis on identifying schools that have successfully implemented School-Based Management (SBM) practices while simultaneously integrating various technological tools into their mathematical pedagogy. Educational institutions ought to implement an array of technological instruments within their instructional methodologies, especially in the domain of mathematics, thereby augmenting the experiences of both teaching and learning (Ruearluang & Sonpo, 2024; Suebkha & Boonthom, 2024). After the identification of these associated schools, a thorough data collection process is then conducted, which involves conducting semi-structured interviews with key stakeholders, including principals, math educators, and students, to gain a rich and nuanced understanding of their perspectives regarding the application of SBM and the use of technology in educational settings. This method is further supplemented by direct observational studies of the mathematics learning environment, which aims to examine how technology is seamlessly woven into instructional practice and assess its consequential effects on students' level of engagement as well as their understanding of mathematical concepts. Collectively, these methodological strategies ensure a holistic and comprehensive approach to the exploration of well-rounded research objectives.

The data carefully collected during the research process were subjected to a thorough analysis using thematic analysis techniques designed to uncover the underlying patterns and themes associated with the significant influence exerted by School-Based Management (SBM) on improving the quality of technology-based mathematics learning experiences in the context of secondary school education. This particular methodological approach entails systematic coding of diverse forms of data collected from a variety of

sources, including comprehensive interviews, detailed observations, and extensive documentation, intending to identify not only recurring ideas but also the complex relationships that exist between them. The analytical process primarily centres on a comprehensive understanding of how the basic principles of SBM, which include important elements such as active stakeholder engagement, effective resource management, and strategic planning, collectively contribute to the successful integration of technological tools and resources in the realm of mathematics education. Furthermore, the findings obtained from this rigorous analysis were synthesised to provide valuable insights into the identification of effective practices as well as potential challenges that may arise when trying to utilise SBM as a means to improve learning outcomes through the strategic application of technology.

RESULTS & DISCUSSION

Results

The application of *school-based management in improving technology-based mathematics learning at the junior high school (SMP) level has* a significant impact on the quality of student learning. This phenomenon occurs as a direct consequence of the fact that School-Based Management, a governance framework designed to improve educational effectiveness, empowers individual educational institutions with the autonomy necessary to effectively incorporate and utilise a variety of advanced technologies, including but not limited to innovative tools such as ChatGPT, in a pedagogical process aimed at enriching the overall learning experience for students. For example, in this study, the use of ChatGPT helped teachers design learning materials that were more interactive and relevant to students' needs, making it easier to understand mathematical concepts. Thus, this approach not only increases the effectiveness of teaching but also encourages active participation of students in the learning process.

The level of students' understanding of mathematical concepts increased significantly after the use of ChatGPT. This phenomenon can be attributed to the incredible ability of this advanced technology to not only present educational materials in a way that can be adapted to the varied learning styles of each student but also to provide them with explanations that significantly improve comprehension and facilitate a deeper understanding of complex concepts. For example, before the use of ChatGPT, many students had difficulty understanding algebraic concepts. However, after utilising this technology, they were able to master the material better, as seen from the results of teacher interviews and documentation. Therefore, the use of ChatGPT-based educational technology has proven to be effective in increasing understanding of mathematical concepts among junior high school students.

The frequency of using ChatGPT in learning activities has also increased significantly after this technology has been integrated into the curriculum. Increased student engagement and enthusiasm for the learning process occur as a direct consequence of their increased intrinsic interest and motivation, which is significantly fostered through the utilisation of interactive and responsive technological tools that facilitate a more engaging educational experience. For example, observations show that before integration, most students only accessed the technology once a week. At the same time, afterwards, they used it almost every day to practice problems and understand difficult concepts. This fact shows that the high frequency of technology use is correlated with improved quality of mathematics learning.

The perception of students and teachers on the effectiveness of using ChatGPT in mathematics learning is very positive. Educators often experience significant improvements in their ability to effectively communicate complex material to their students, which in turn facilitates a more productive learning environment. Simultaneously, learners find that they can understand and internalise concepts that were previously considered challenging or beyond their understanding with greater ease and efficiency. Based on the results of questionnaires and interviews, 85% of students stated that the use of ChatGPT made them more confident in dealing with math problems. In comparison, 80% of teachers assessed that this technology made their teaching process easier. With positive perceptions from both sides, it can be concluded that educational technology such as ChatGPT can support more effective and efficient mathematics learning.

Table 1. Summary of the Research Results Based on Five Main Indicators

Indicator	Before the Use of ChatGPT	After the Use of ChatGPT
Level of Understanding of Mathematical Concepts	Low (50%), Medium (40%), High (10%)	Low (10%), Medium (35%), High (55%)
Frequency of Use of ChatGPT in Learning Activities	once/week (65%)	4-5 times/week (70%)
Student and Teacher Perceptions of Technology Effectiveness	Positive (40%), Neutral (45%), Negative (15%)	Positive (85%), Neutral (10%), Negative (5%)
Improving Mathematical Problem-Solving Skills	Average score of 60	Average score 85
Student Involvement in the Teaching and Learning Process	Low participation (55%)	High participation (75%)

The research findings reveal significant improvements in mathematical learning outcomes following the use of ChatGPT, as evidenced by five key indicators. Before using ChatGPT, students demonstrated a low understanding of mathematical concepts, with only 10% reaching a high comprehension level, while 50% remained at a low level. After integrating ChatGPT into learning, high comprehension soared to 55%, and low comprehension dropped to just 10%. The frequency of ChatGPT usage also increased, from 65% of students using it once a week to 70% engaging with it 4-5 times weekly. Perceptions of technology's effectiveness shifted dramatically, with positive perceptions rising from 40% to 85% and negative views declining from 15% to 5%. Furthermore, mathematical problem-solving skills improved as the average student score climbed from 60 to 85. Lastly, student involvement in learning activities heightened, with high participation rates increasing from 45% to 75%. These results underscore ChatGPT's pivotal role in enhancing mathematical comprehension, engagement, and problem-solving abilities among students.

Discussion

The application of *school-based management in technology-based mathematics learning at the junior high school level has been proven* to significantly increase students' understanding of mathematical concepts. The autonomy given to schools to integrate *Educational Technology* such as ChatGPT allows for more adaptive teaching according to the needs of students. ChatGPT significantly empowers students in their educational

journey by providing them with invaluable opportunities to ask diverse questions and receive carefully tailored responses that meet their unique learning needs, thus fostering an environment conducive to independent learning and promoting autonomy in their academic pursuits (Rashed Ibraheam Almohesh, 2024). This application has been shown empirically to have a beneficial impact on student's perception of their sense of autonomy and independence in the context of online classes, ultimately leading to increased engagement and satisfaction with their learning experience (Rashed Ibraheam Almohesh, 2024). Additionally, ChatGPT proficiently facilitates a personalised learning experience by providing a large number of hands-on activities accompanied by direct and constructive feedback, which collectively serves to significantly improve students' comprehension and overall performance in their respective subjects of study (Heathen & Lin, 2024). Based on the data, before the use of ChatGPT, students' understanding of mathematical concepts was mostly at a low (50%) and medium (40%) level, with only 10% being at a high level. However, after the integration of ChatGPT, there was a significant increase, with 55% of students achieving a high level of comprehension, while those at a low level dropped drastically to 10%. This shows that *School-Based Management* can improve *Learning Quality* by utilising technology effectively.

The frequency of use of ChatGPT in mathematics learning activities has increased significantly since this technology was integrated into the school-based management-based curriculum. This increase is due to ChatGPT's ease of access and flexibility in helping students understand the material independently. ChatGPT provides carefully tailored feedback and personalised adaptive learning paths that are specifically designed to meet each student's unique educational requirements, thus ensuring a more effective and engaging learning experience (Kotsis, 2024). In the context of programming courses, these advanced AI tools play a crucial role in facilitating code correction, correcting syntax errors, and handling a variety of technical questions, all of which significantly contribute to improving students' comprehension abilities and their overall problem-solving skills (Mekthanavanh, 2024). Artificial intelligence not only fosters an interactive learning environment but also actively promotes and encourages students to engage more participative with existing educational materials, thereby deepening their understanding and retention of subject matter (Kotsis, 2024). The findings of the study show that students who use ChatGPT consistently report experiencing greater levels of satisfaction and high appreciation for the abilities offered by this innovative tool, which indicates a noteworthy and beneficial transformation in their overall learning experience (Jalon et al., 2024). Before the use of this technology, the majority of students only used ChatGPT once a week (65%), but after integration, 70% of students used it 4-5 times a week. This increase in frequency shows that students feel that the technology is effective in supporting *Mathematics Learning*,

The perception of students and teachers towards the effectiveness of technology in supporting math learning also shows significant changes after the implementation of ChatGPT. This is because technology like ChatGPT provides a more interactive and responsive learning experience, making it easier to understand complex concepts. ChatGPT encourages active engagement in educational efforts, resulting in an increased level of knowledge activation among learners (Liu, 2024). Its interactive characteristics motivate students to grapple with complex concepts, thereby promoting a deeper understanding through an inquiry-driven pedagogical approach (Kotsis, 2024). The adaptive dialogue system used by AI provides tailored feedback, effectively addressing specific learning deficiencies and improving student engagement (Kotsis, 2024). ChatGPT accommodates a wide range of applications, from language acquisition to programming support, providing personalised guidance that aligns with the individual needs of students (Baek & Yi, 2024). Based on the questionnaire, before the use of ChatGPT, only 40% of respondents had a

positive perception of technology in learning, while 45% were neutral and 15% were negative. After the integration of ChatGPT, the positive perception increased sharply to 85%, with only 5% still having a negative perception. These findings show that the use of *Educational Technology* can increase students' and teachers' confidence in the effectiveness of technology in *Mathematics Learning* in *Junior High School*.

Students' mathematical problem-solving abilities improved significantly after the use of ChatGPT in the learning process. This increase occurs because ChatGPT allows students to practice independently by getting live feedback, which speeds up the understanding and application of mathematical concepts. ChatGPT customises its approach to accommodate the diverse learning velocities of individual students, thereby facilitating a concentrated focus on specific areas necessitating additional support, which subsequently enhances their self-efficacy and ease in mastering mathematical concepts (Auna & Hamzah, 2024). Empirical evidence suggests that students who engage with questions generated by ChatGPT demonstrate notable enhancements in performance in contrast to their counterparts who do not utilise this tool, thereby underscoring its efficacy in addressing a variety of learning modalities (Prathigadapa et al., 2024). The artificial intelligence system offers immediate assistance on-demand, permitting students to obtain prompt responses to their inquiries, an essential factor for the comprehension of intricate mathematical principles (Sandu et al., 2024). The constant accessibility of ChatGPT guarantees that students can interact with educational content at their discretion, thereby fostering ongoing learning beyond conventional classroom settings (Listyaningrum et al., 2024). The average score of students' problem-solving abilities increased from 60 before the use of ChatGPT to 85 after the integration of this technology. This increase in scores shows that *School-Based Management* that utilises *Educational Technology* can effectively improve students' analytical and problem-solving skills, which are an important part of *Learning Quality*.

CONCLUSION

The purpose of this study is to explore the application of School-Based Management (SBM) in improving technology-based mathematics learning in Junior High Schools (SMP). This study also aims to analyse the influence of educational technology using ChatGPT on the quality of mathematics learning in junior high schools that apply SBM. Using a qualitative approach, this study identifies how SBM can improve the use of technology in mathematics learning to achieve better results. In addition, this study explores the challenges and opportunities faced by schools in integrating educational technology into mathematics learning. The contribution of this research lies in the development of insights on the importance of SBM in supporting more technology using ChatGPT-based mathematics learning. This research also provides recommendations for schools to optimise the use of educational technology to improve the quality of mathematics learning. While this study provides useful insights, the limitations of this study lie in the limited number of samples, which only include a few junior high schools that have implemented SBM. In addition, this study does not cover all external factors that may affect the quality of mathematics learning, such as government policies or parental support. Another limitation is the limited time to make in-depth observations of the learning process in the selected junior high schools.

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