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Management of AI Chatbots to Improve Student Achievement in an Indonesian Senior High School

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Abstract

The integration of artificial intelligence (AI) in education has increasingly been adopted to support digital learning environments; however, the effectiveness of AI chatbot implementation largely depends on how it is managed within schools. This study aims to analyze the management of AI chatbots in enhancing student academic achievement at SMAN 1 Cikarang Pusat. The research employs a descriptive qualitative case study approach. Data were collected through observations, semi-structured interviews, and documentation involving the school principal, teachers, IT staff, and students. The findings show that the school has implemented AI chatbots as part of its digital learning innovation through several management stages: (1) planning, including needs analysis, infrastructure preparation, and teacher training; (2) implementation in learning activities such as practice exercises, enrichment materials, and academic consultations; and (3) monitoring and evaluation conducted by teachers and IT personnel. The results indicate that the use of AI chatbots contributes to increased student learning motivation, more flexible access to learning resources, and improved independent learning habits. Nevertheless, several challenges remain, including differences in teacher digital literacy, the lack of standardized operational procedures, and unequal access to digital devices and internet connectivity among students. This study contributes to the development of AI-based learning management practices by providing practical insights for schools in managing chatbot technology effectively to support student academic performance in the digital era.

Keywords: Artificial Intelligence, AI Chatbot, Education Management, Student Achievement, Learning Support System, School Performance

Introduction

The rapid development of technology in the era of the Industrial Revolution 4.0 has brought significant changes in various sectors, including education. One technological innovation increasingly utilized in the learning process is Artificial Intelligence (AI), particularly in the form of chatbots. Chatbots are automated communication systems capable of interacting with users through natural language processing. In education, this technology has begun to function as a learning medium and academic support tool because it can provide quick access to information, deliver learning exercises, and assist students in understanding learning materials independently. However, in practice, many schools have not yet maximized the potential of this technology to improve students' academic achievement. This situation often occurs because the use of chatbots is not systematically managed and has not been fully integrated into school learning processes.

Previous studies indicate that AI chatbots have considerable potential to support the learning process. This technology can provide adaptive learning materials, deliver immediate feedback to students, and create opportunities for flexible and independent learning. Several

studies also report that chatbots can increase students' learning motivation, enhance engagement in learning activities, and assist teachers in reinforcing instructional materials and monitoring students' learning progress. Furthermore, research emphasizes that the successful integration of technology in education depends not only on the sophistication of the technology itself but also on effective educational management, including human resource readiness, clear institutional policies, adequate infrastructure, and continuous evaluation mechanisms. Nevertheless, most existing studies still focus on the technical effectiveness or pedagogical benefits of chatbots, while studies examining how chatbot implementation is managed within school organizations remain limited.

Although numerous studies have demonstrated the educational benefits of AI chatbots, empirical research that analyzes their implementation from a management perspective in schools is still scarce. In particular, studies that examine how planning, implementation, and evaluation processes influence the effectiveness of chatbot utilization in improving student achievement remain limited. Moreover, research conducted in the context of secondary education in Indonesia is still relatively rare. This condition indicates a gap between the theoretical potential of AI technology in education and its practical management within school environments.

To address this gap, this study adopts a qualitative approach with a case study design. The qualitative approach was selected because the research aims to explore in depth the processes, experiences, and perspectives of school stakeholders regarding the management of AI chatbot implementation. Through qualitative inquiry, the study can capture detailed information about how planning, implementation, and evaluation processes are carried out within the school context. Meanwhile, the case study design was chosen because the research focuses on a specific institutional setting, namely SMAN 1 Cikarang Pusat, allowing for a comprehensive and contextual understanding of how chatbot technology is managed within a particular school environment.

Based on this perspective, the novelty of this study lies in positioning the use of AI chatbots within the framework of educational management, particularly in relation to institutional decision-making and technology governance in schools. Unlike previous studies that mainly emphasize technological effectiveness, this research highlights how chatbot technology is systematically planned, implemented, and evaluated to support improvements in student academic achievement.

Therefore, this study aims to analyze the management of AI chatbot utilization in improving student achievement at SMAN 1 Cikarang Pusat. More specifically, the research examines the processes of planning, implementation, and evaluation of chatbot use in learning activities and identifies the challenges encountered during its implementation in the school environment.

Method

The selection of a qualitative approach in this study is directly aligned with the research objective, which is to analyze the management processes involved in the utilization of AI chatbots to improve student achievement at SMAN 1 Cikarang Pusat. Since the study focuses on understanding managerial processes, such as planning, implementation, and evaluation within a specific educational context, a qualitative approach is considered appropriate because it allows the researcher to explore experiences, perceptions, and practices of stakeholders involved in the management of chatbot technology. Through qualitative inquiry, the researcher is able to obtain rich and contextual data that explain how decisions are made, how strategies are implemented, and how the technology is integrated into daily learning activities.

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This research employs a case study design because the investigation concentrates on a single institutional setting, namely SMAN 1 Cikarang Pusat, where AI chatbot technology has begun to be implemented as part of digital learning innovation. The case study design enables an in-depth examination of the phenomenon within its real-life context and allows the researcher to understand how the management of AI chatbot utilization operates in a particular school environment. By focusing on one case, the study can provide a detailed and contextualized understanding of the management practices, the actors involved, and the institutional factors that influence the effectiveness of chatbot implementation in supporting student academic achievement.

The combination of a qualitative approach and a case study design is therefore relevant to the research focus because the study does not aim to measure the effectiveness of technology quantitatively, but rather to understand how the technology is managed and integrated within the school's organizational and learning processes. This methodological approach enables the researcher to examine the managerial aspects of technology adoption, including decision-making processes, coordination among school stakeholders, and the evaluation of chatbot use in learning activities.

Participants in this study were selected using purposive sampling to ensure that the informants possessed direct knowledge and experience related to the implementation of AI chatbots in the school. The participants consisted of the school principal, teachers who utilize the chatbot in learning activities, IT personnel responsible for the system, and students who interact with the chatbot as users.

Data were collected through three main techniques: observation, semi-structured interviews, and documentation analysis. Observations were conducted over a three-month period to examine how AI chatbots were integrated into classroom learning activities and academic support services. Semi-structured interviews were used to explore stakeholders' experiences and perspectives regarding the planning, implementation, challenges, and perceived impact of chatbot use on student achievement. Documentation analysis was carried out by reviewing relevant materials such as school policies, lesson plans, digital learning reports, and other documents related to the implementation of AI chatbots.

Data analysis followed the interactive model proposed by Miles and Huberman, which includes data reduction, data display, and conclusion drawing. To ensure the trustworthiness of the findings, several validation strategies were applied, including source triangulation, technique triangulation, member checking, and prolonged observation. Through these procedures, the study systematically examined how the management of AI chatbot utilization contributes to improving student academic achievement within the school context.

Results

Overview of Findings

The findings of this study were obtained through classroom observations, semi-structured interviews, and document analysis conducted at SMAN 1 Cikarang Pusat. The research examined the management of AI chatbot utilization in improving student achievement, focusing on the management functions of planning, organizing, implementation, and evaluation.

The results indicate that the school has begun integrating AI chatbots as part of its digital learning innovation to support academic activities. Interviews with school leaders revealed that the initiative was introduced to respond to the growing demand for technology-assisted learning. One administrator noted that the chatbot was designed to help students access learning materials and practice exercises outside the classroom. Observational data also show that the

school has gradually adapted its learning environment by providing internet access and digital learning facilities.

Planning and Organization

The planning stage involves identifying learning needs, aligning chatbot use with curriculum objectives, and preparing supporting infrastructure. The planning process includes collaboration among the principal, curriculum coordinators, IT personnel, and teachers. Teachers receive introductory training on integrating chatbot features into learning activities, while students are introduced to the system to support independent learning.

Organizationally, the implementation of the chatbot involves role distribution among stakeholders. The IT team manages the technical system, teachers integrate the chatbot into learning activities, and curriculum coordinators oversee the implementation to ensure alignment with learning objectives. However, the findings indicate that formal operational guidelines and coordination mechanisms still require improvement.

Implementation in Learning Activities

The chatbot is primarily used to provide practice exercises and support independent learning outside classroom hours. Students interact with the chatbot to ask questions and review learning materials. Interview data suggest that students appreciate the flexibility and immediate feedback provided by the system. One student reported that the chatbot helps them review lessons more easily because explanations are available anytime. Despite these positive responses, implementation varies across subjects. Some teachers continue to rely on conventional teaching approaches due to limited digital literacy. In addition, several teachers expressed concerns about potential student overreliance on chatbot responses.

Evaluation and Impact on Student Achievement

Evaluation of chatbot use is conducted through routine digital learning review meetings in which teachers discuss student learning performance and challenges encountered during implementation. Documentation analysis indicates that subjects that actively use the chatbot show improvement in student practice test scores. Teachers also reported increased student motivation and learning independence. However, improvements in learning outcomes are not evenly distributed, as some students face limitations in accessing digital devices or internet connections outside school.

The findings highlight the importance of effective management in integrating AI chatbot technology into educational practices. From the perspective of educational management theory, the school has implemented key management functions including planning, organizing, implementation, and evaluation, although these processes are still developing. In the planning stage, the school demonstrates an awareness of the importance of aligning technological innovation with learning objectives. However, the absence of comprehensive operational procedures indicates that planning processes still require stronger documentation and clearer guidelines for teachers. Similar findings have been reported in previous studies, which emphasize that successful technology integration depends on structured planning and institutional support.

The organizational structure established by the school reflects an effort to distribute responsibilities among relevant stakeholders. Assigning technical responsibilities to the IT team and instructional roles to teachers allows the chatbot system to function effectively. Nevertheless, coordination and monitoring mechanisms remain essential to ensure consistent implementation across different subjects.

In terms of implementation, the findings show that AI chatbots can support student-centered learning by providing flexible access to learning resources and immediate feedback. These features contribute to increased student motivation and independent learning behavior.

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This result is consistent with research in educational technology suggesting that digital learning tools can enhance learner engagement and autonomy.

However, several challenges remain. Differences in teacher digital competence influence the extent to which chatbot technology is integrated into classroom practices. Teachers who are less familiar with digital tools tend to rely more heavily on traditional teaching methods, which limits the potential benefits of AI-assisted learning. The evaluation process also requires improvement. Although the school conducts routine discussions regarding digital learning, the absence of structured evaluation instruments makes it difficult to measure the effectiveness of chatbot use systematically. Developing clear evaluation indicators would allow schools to better assess the contribution of AI chatbot management to student learning outcomes.

Overall, the study suggests that effective management of AI chatbot utilization can positively contribute to student motivation, learning independence, and academic performance. Nevertheless, improving teacher digital literacy, establishing clear operational guidelines, and ensuring equitable access to digital resources remain essential for optimizing the long-term impact of AI chatbot integration in schools.

Table 1. Summary of Research Findings on AI Chatbot Management at SMAN 1 Cikarang Pusat

Aspect	Key Findings	Main Issues Identified
Research Context	AI chatbots have been introduced as part of digital learning innovation to support academic processes.	Implementation is still in the early stage and gradual.
Planning	Chatbot use is planned for practice, enrichment, and academic consultation; involves school leaders, teachers, and IT staff.	Lack of detailed SOPs; limited advanced teacher training.
Organization	Clear role distribution: IT team manages system, teachers integrate chatbot, curriculum coordinators supervise.	Coordination and continuous monitoring need improvement.
Implementation	Chatbots are used for practice and independent learning; students respond positively due to fast feedback and flexibility.	Uneven use across subjects; limited teacher digital literacy; concern over student dependence.
Evaluation	Evaluation conducted informally through meetings, grade monitoring, and feedback.	No structured evaluation instrument for chatbot effectiveness.
Impact on Student Achievement	Increased motivation, learning independence, and improved practice test scores in some subjects.	Unequal outcomes due to limited device and internet access.
Theoretical Perspective	Supports management functions (planning–organizing–actuating–controlling) and educational technology theory.	Documentation, coordination, and infrastructure require strengthening.

Discussion

The findings of this study indicate that the management of AI chatbot utilization at SMAN 1 Cikarang Pusat contributes positively to improving student achievement. However, this improvement does not occur solely because of the presence of the technology itself, but rather because of how the technology is strategically managed and integrated into the learning process. The results show that AI chatbots function effectively as supplementary learning tools when their use is aligned with instructional planning, supported by teacher facilitation, and embedded within a structured management framework.

The improvement in student learning outcomes can be explained through several mechanisms. First, the chatbot system provides immediate feedback and on-demand explanations, which reduce the delay that often occurs when students wait for teacher responses outside classroom hours. This rapid feedback loop enables students to correct misunderstandings more quickly and reinforces their comprehension of learning materials. Second, the chatbot increases learning accessibility by allowing students to review materials and practice exercises at any time, which supports the development of self-directed learning behaviors. Third, the interactive nature of chatbot communication creates a learning environment that is perceived as more responsive and less intimidating for students when asking questions.

However, the findings also show that the effectiveness of chatbot utilization varies across subjects and learning contexts. This variation occurs because the success of AI integration depends heavily on teachers' digital competence and their ability to incorporate chatbot functions into pedagogical activities. In subjects where teachers actively designed learning tasks involving chatbot interaction, students demonstrated stronger engagement and improved understanding of the material. Conversely, in subjects where chatbot use remained optional or minimally integrated, the impact on learning outcomes was less evident. This finding suggests that technology adoption alone is insufficient; effective instructional design and teacher involvement are essential factors determining the success of AI-assisted learning.

Another factor influencing the effectiveness of chatbot implementation is the institutional management system within the school. The absence of standardized evaluation instruments and clear operational guidelines limits the ability of teachers and administrators to systematically assess the effectiveness of chatbot use. As a result, although the technology shows potential to support learning activities, its long-term sustainability depends on the development of structured governance mechanisms within the school.

The findings of this study are generally consistent with previous research highlighting the potential of artificial intelligence to enhance educational processes. Woolf (2015) explains that AI-supported learning environments can provide adaptive feedback that improves students' engagement and facilitates personalized learning experiences. The present study confirms this argument by demonstrating that chatbot systems can strengthen student motivation and independent learning habits through immediate responses and flexible access to learning materials.

Similarly, Rusman (2020) emphasizes that digital learning technologies can encourage learner autonomy when integrated effectively into teaching practices. The results of the present study support this perspective, as students reported that chatbot interaction helped them practice independently and review materials outside classroom hours. However, this study goes further by showing that the benefits of such technologies are not automatically realized. Instead, their effectiveness is strongly influenced by the quality of management practices governing their implementation.

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Research by UNESCO (2021) and Pavlik (2019) also highlights that AI technologies can expand learning opportunities by enabling students to access educational support beyond traditional classroom boundaries. The experiences of students in this study confirm this observation, as they reported that chatbots provided additional academic assistance when teachers were unavailable. Nevertheless, unlike many previous studies that primarily focus on technological effectiveness, the present research reveals that institutional factors—such as teacher readiness, infrastructure availability, and managerial coordination—play a decisive role in determining whether AI technologies actually improve learning outcomes.

In contrast to studies that treat AI adoption mainly as a technological innovation, the findings of this research highlight the importance of organizational management in educational technology integration. This perspective aligns with Fahmi's (2018) argument that technological innovations in education often fail to achieve their intended impact when they are not supported by effective management structures. The present study therefore extends the existing literature by demonstrating that the success of AI chatbot implementation depends not only on technological functionality but also on the strategic management of human resources, institutional policies, and evaluation systems within the school.

From a theoretical perspective, the findings reinforce the relevance of classical educational management theories in the context of digital learning innovation. Specifically, the management functions proposed by George R. Terry—planning, organizing, actuating, and controlling—remain applicable when schools adopt advanced technologies such as artificial intelligence. The planning stage ensures that chatbot implementation aligns with curriculum objectives and instructional strategies. The organizing stage clarifies roles among teachers, IT staff, and administrators. The actuating stage involves the practical integration of chatbots into learning activities, while the controlling stage focuses on monitoring and evaluating the effectiveness of the technology.

Beyond reaffirming classical management theory, this study contributes to the theoretical development of educational technology management by demonstrating that AI-based learning tools should be understood as components of a broader institutional system rather than as isolated technological solutions. The findings suggest that effective digital innovation in education requires a combination of technological capability, managerial coordination, and teacher readiness.

From a practical perspective, the results provide several implications for schools seeking to adopt AI chatbot technology. First, the implementation of AI-based learning tools should be accompanied by strategic planning that clearly defines the objectives, scope, and expected outcomes of the technology. Second, continuous professional development programs are essential to strengthen teachers' digital competence and ensure that educators are capable of integrating chatbot functions into their pedagogical practices. Third, schools need to develop clear operational guidelines and evaluation instruments to monitor the effectiveness of chatbot utilization and ensure its sustainability. Finally, improving technological infrastructure and ensuring equitable access to digital devices and internet connectivity are crucial steps to ensure that AI-assisted learning benefits all students.

This study has several limitations that should be acknowledged. First, the research adopts a single-case qualitative design focusing on one school, which limits the generalizability of the findings to broader educational contexts. While the case study approach provides rich contextual insights, the results may not fully represent the experiences of schools with different institutional characteristics or technological readiness levels.

Second, the evaluation of student achievement in this study relies primarily on qualitative observations, interview responses, and existing academic records rather than controlled

experimental measurements. As a result, it is difficult to isolate the direct causal impact of chatbot utilization on academic performance.

Third, the absence of standardized instruments specifically designed to measure the effectiveness of AI chatbot implementation restricts the precision of the evaluation process. In addition, variations in students' access to digital devices and internet connectivity may have influenced their ability to utilize the chatbot consistently, thereby affecting the overall outcomes observed in this research.

Future research should consider conducting comparative studies involving multiple schools to examine whether the patterns observed in this study are consistent across different institutional contexts. Longitudinal research designs would also be valuable for understanding how the impact of AI chatbot implementation evolves over time.

Quantitative or mixed-method approaches may provide more rigorous measurements of learning outcomes and enable researchers to analyze causal relationships between chatbot utilization and student achievement. Furthermore, future studies could investigate additional variables such as teacher digital competence, institutional leadership, technological infrastructure readiness, and student learning styles.

Another important direction for future research involves the development of standardized instruments for evaluating AI chatbot effectiveness in educational settings. Such instruments would allow researchers and educators to assess the impact of AI-assisted learning more systematically. Finally, further research is needed to explore how AI-supported learning environments can balance technological assistance with the development of students' higher-order thinking skills, including critical thinking, creativity, and problem-solving abilities.

Conclusion

This study concludes that the implementation of AI chatbot technology at SMAN 1 Cikarang Pusat has been carried out through several educational management functions, including planning, organizing, implementation, and evaluation. The findings indicate that AI chatbots are utilized as supplementary learning tools that support practice activities, reinforce learning materials, and facilitate student interaction with academic content outside classroom hours. Their use contributes to increased student motivation and engagement in learning activities, particularly when integrated into structured instructional practices.

However, the effectiveness of chatbot utilization is still constrained by several factors. These include the absence of comprehensive planning documents, variations in teachers' digital competence, uneven access to internet connectivity among students, and the lack of standardized operational procedures and evaluation instruments to measure the effectiveness of chatbot use in learning.

This study also has several limitations. As a single-case qualitative study conducted in one school, the findings are context-specific and cannot be generalized to all educational institutions. In addition, the assessment of student achievement relies primarily on qualitative observations and existing academic records rather than controlled quantitative measurements. Therefore, the results should be interpreted cautiously as insights into the management of AI chatbot implementation within a specific school context rather than as universal evidence of its effectiveness.

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