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Research Article

CHATGPT AND VIRTUAL TEACHING ASSISTANTS: ENHANCING TEACHER-STUDENT INTERACTIONS IN THE DIGITAL CLASSROOM

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Abstract

The rapid adoption of digital technologies in education has prompted the exploration of innovative tools to enhance teacher-student interactions in virtual classrooms. Among these tools, AI-powered virtual teaching assistants, such as ChatGPT, have emerged as promising solutions to address challenges related to engagement, feedback, and personalized learning. However, despite their growing presence, the specific role of ChatGPT in improving interactions within digital classrooms remains underexplored. This study aims to investigate the impact of ChatGPT on teacher-student interactions, focusing on its ability to enhance engagement, provide personalized feedback, and support administrative tasks. A mixed-methods approach was employed, combining surveys, interviews, and usage logs from 30 teachers and 150 students across high school and university settings. The results indicate a significant improvement in engagement and feedback quality, with both teachers and students reporting increased satisfaction and interaction efficiency. Additionally, ChatGPT's role in managing routine administrative tasks was found to alleviate teacher workload. The study concludes that ChatGPT can effectively complement traditional teaching methods by facilitating more interactive, personalized, and efficient learning experiences in digital classrooms. Future research should explore the long-term effects of AI tools on education and address ethical considerations such as data privacy and algorithmic bias.

Keywords: AI in Education, ChatGPT, Digital Classroom, Teacher-Student Interactions, Virtual Teaching Assistants

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INTRODUCTION

The digital transformation of education has introduced new opportunities for enhancing the teaching and learning experience (Pallipuram et al., 2025). With the rapid development of artificial intelligence (AI) technologies, particularly conversational AI systems like ChatGPT, there is a significant shift in how educators and students engage within the classroom environment. The adoption of AI-powered tools has the potential to revolutionize traditional classroom dynamics, offering solutions to longstanding challenges such as limited teacher availability, individualized instruction, and real-time feedback. As education increasingly moves online, both educators and students are seeking innovative solutions to optimize interactions and improve learning outcomes (Fyfield et al., 2024). The integration of virtual teaching assistants powered by ChatGPT and similar AI technologies presents a promising approach to overcoming these challenges, offering a more interactive, efficient, and personalized learning experience.

In traditional educational settings, the interaction between teachers and students is often limited by physical presence, time constraints, and the teacher's capacity to address every student's needs individually. These challenges become more pronounced in the context of digital classrooms, where physical interaction is replaced by digital communication (Al-Emran, 2024). Despite the benefits of online learning, such as flexible access to course materials, many learners still struggle with a sense of isolation, lack of immediate feedback, and the absence of personalized guidance. Teachers, on the other hand, face increased workloads and often find it difficult to provide timely and personalized responses to every student query (Nguyen et al., 2024). Virtual teaching assistants, such as ChatGPT, offer a solution to these problems by facilitating seamless communication between students and educators, automating administrative tasks, and providing personalized learning support (Hellen et al., 2024). However, the potential of these technologies to enhance teacher-student interactions has not been fully explored or integrated into mainstream educational practices.

The primary aim of this study is to explore the role of ChatGPT and similar AI-powered virtual teaching assistants in enhancing teacher-student interactions in digital classrooms. This research seeks to investigate how these tools can support educators in managing classroom dynamics, improving engagement, and offering personalized learning experiences (Masters et al., 2024). The study will examine the specific features of ChatGPT that contribute to these improvements, focusing on its ability to facilitate real-time communication, answer student queries, provide feedback, and enhance learning outcomes. Furthermore, the research will assess how virtual teaching assistants can alleviate the burden on teachers by automating administrative tasks such as grading and providing standardized responses, allowing educators to focus on more complex and interactive aspects of teaching (Jain et al., 2024). Ultimately, the research aims to demonstrate how the integration of virtual teaching assistants can transform the digital classroom into a more interactive and student-centered learning environment.

While much of the existing literature has focused on the general benefits of AI in education, there is a noticeable gap in research specifically addressing the application of conversational AI tools, like ChatGPT, in enhancing teacher-student interactions in online settings (Neupane et al., 2024). Most studies have concentrated on the technological capabilities of AI and its role in automating administrative tasks or facilitating learning management systems. Few studies, however, have delved into how these AI systems can be used as active participants in teacher-student interactions, particularly in terms of improving engagement, providing personalized support, and fostering a more collaborative learning environment (Mavundla et al., 2025). This research aims to fill this gap by offering empirical evidence on the practical application of ChatGPT as a virtual teaching assistant and analyzing its potential to address the challenges faced by both teachers and students in digital classrooms.

This study is both timely and essential, as it introduces a novel approach to the use of AI in education (Amar & Benchouk, 2024). By exploring the potential of ChatGPT as a virtual teaching assistant, this research contributes to the growing body of literature on AI in education and offers new insights into how these technologies can be harnessed to improve teaching and learning experiences. The novelty of this research lies in its focus on ChatGPT's specific role in enhancing teacher-student interactions, which has not been adequately addressed in previous studies (Lee, 2024). Furthermore, this study's findings are particularly significant in the context of the ongoing shift towards online and hybrid learning environments, where the integration of AI tools can significantly improve the effectiveness and inclusivity of education (Wójcik et al., 2024). The research also highlights the importance of understanding the limitations and ethical considerations associated with AI in education, ensuring that the use of these tools aligns with educational values and enhances, rather than replaces, human interaction in the learning process.

In conclusion, this research is designed to provide valuable insights into the role of AI-powered virtual teaching assistants, such as ChatGPT, in enhancing teacher-student interactions in the digital classroom (Rädel-Ablass et al., 2025). By addressing a clear gap in the literature, this study contributes to the understanding of how conversational AI can be integrated into education to foster more personalized, interactive, and engaging learning environments (Peng, 2025). The novelty of this research lies not only in its exploration of ChatGPT's potential but also in its contribution to shaping the future of AI in education, offering practical solutions to some of the most pressing challenges faced by modern educators and students (Ding et al., 2023). As AI continues to evolve, this study underscores the importance of exploring innovative ways to leverage these technologies to enhance the learning experience and ensure that education remains relevant, accessible, and effective in the digital age.

RESEARCH METHOD

The following sections detail the systematic approach used to examine the role of ChatGPT as a virtual teaching assistant in modern digital learning environments.

Research Design

The research adopts a mixed-methods design, combining qualitative and quantitative approaches to explore the impact of ChatGPT on teacher-student interactions (Pinochet, 2025). This design allows for a comprehensive analysis of technological capabilities while capturing the lived experiences of educators and students. The quantitative component utilizes surveys and statistical analysis to measure effectiveness, while the qualitative component employs interviews and thematic analysis to explore deeper pedagogical insights (Kakar et al., 2024). This dual approach ensures a robust understanding of how AI contributes to classroom dynamics in digital environments.

Research Target/Subject

The primary objective of this research is to assess the impact of ChatGPT as a virtual teaching assistant on interaction, engagement, and learning outcomes. The study targets the measurement of ChatGPT's effectiveness in enhancing classroom communication and identifying the specific roles it plays in the teaching process. By analyzing both usage patterns and participant perceptions, the research aims to provide a framework for the effective integration of AI in digital pedagogy.

The population for this study consists of educators and students active in high school and university digital learning environments. Using a purposive sampling technique, the researcher selected 30 teachers and 150 students who are familiar with or have utilized AI-powered tools. This diverse sample ensures representation across different subject areas and demographic

backgrounds, providing a sufficient data set to reflect the varied experiences of using virtual teaching assistants.

Research Procedure

The research procedures involve several key stages, beginning with an initial training session where participants are introduced to effective ChatGPT utilization. Following this, the four-week interaction phase commences, during which the AI tool is used as an assistant in daily digital classroom activities (Taneja et al., 2024). Data collection occurs throughout this period via usage logs and observation. In the final stage, participants complete follow-up surveys and a select subset participates in semi-structured interviews. The resulting data are then processed through both statistical and thematic analysis to synthesize the study's findings.

Instruments, and Data Collection Techniques

Data for the study are collected through a triangulation of structured surveys, semi-structured interviews, and usage logs. The surveys utilize both closed and open-ended questions to assess engagement and perceptions, while the interviews provide depth regarding the challenges and benefits of AI integration. Usage logs act as a technical instrument, tracking the frequency of interaction, query types, and the nature of AI responses (Aggrawal & Thomas, 2024). These instruments were developed based on existing literature on virtual assistants to ensure alignment with contemporary AI-in-education research questions.

Data Analysis Technique

The study employs a dual-stream analysis process to interpret the findings. Quantitative data from surveys and logs are analyzed using descriptive and inferential statistics to identify trends and levels of effectiveness (Phutela et al., 2024). Simultaneously, qualitative data from interviews and open-ended survey responses are processed through thematic analysis to extract core insights. The integration of these two data sets provides a comprehensive understanding of ChatGPT's role in enhancing digital teacher-student interactions.

RESULTS AND DISCUSSION

The data collected from the surveys, interviews, and usage logs were analyzed to assess the impact of ChatGPT as a virtual teaching assistant on teacher-student interactions. A total of 30 teachers and 150 students participated in the study. The quantitative data obtained from the surveys revealed that 80% of teachers and 75% of students reported an increase in engagement with the use of ChatGPT in the classroom. The average response time of ChatGPT was recorded at 2.5 minutes per query, which was significantly faster compared to traditional methods of teacher-student communication. Furthermore, 65% of students indicated that they received more personalized feedback through ChatGPT, with 70% of teachers acknowledging the AI tool's role in providing timely responses. These results are summarized in Table 1.

Table 1: Survey Results on Teacher and Student Perceptions of ChatGPT Interaction

Participant Group	Increase in Engagement (%)	Personalized Feedback (%)	Average Response Time (minutes)
Teachers	80	70	2.5
Students	75	65	2.5

The explanation of these findings highlights the positive impact of ChatGPT on both teacher and student engagement. The increase in engagement can be attributed to the tool's ability to respond quickly to student queries, thus maintaining the flow of the learning process. Additionally, the tool's capacity to offer personalized feedback is seen as a crucial factor in enhancing the learning experience, especially for students who require immediate clarification or guidance. The data also suggest that ChatGPT alleviated the workload of teachers by

providing a supplementary channel for communication, which allowed them to focus on more complex and interactive aspects of teaching.

Descriptive analysis of the usage logs showed that ChatGPT was most frequently used for answering questions related to course content, with over 40% of interactions revolving around clarification of key concepts. Additionally, 30% of interactions involved administrative queries, such as assignment deadlines and grading policies, while 20% were related to more personal inquiries regarding course progress. This distribution indicates that students primarily used ChatGPT for academic support, but also leveraged the tool for more administrative tasks that traditionally might have taken more time from the teacher. The consistency of these patterns across both high school and university levels suggests that the AI tool was equally effective in addressing various types of student needs.

Inferential analysis was conducted using a t-test to compare the responses of teachers and students regarding their perceptions of ChatGPT's effectiveness in enhancing interaction. The results indicated a statistically significant difference between the responses of teachers and students ($p < 0.05$), with teachers reporting higher levels of satisfaction with the tool's ability to provide accurate and timely feedback. However, both groups indicated that while ChatGPT improved engagement, it did not entirely replace the need for human interaction. This analysis underscores the complementary role of AI tools in the learning process, emphasizing that while ChatGPT can enhance teacher-student interactions, it is not a substitute for personalized teacher involvement.

In examining the relationship between the frequency of ChatGPT usage and perceived learning outcomes, a positive correlation was found ($r = 0.76$, $p < 0.01$). Students who engaged more frequently with ChatGPT reported a greater sense of clarity in their understanding of course material. This data suggests that higher levels of interaction with the AI tool correlate with better learning outcomes, highlighting the tool's potential to support personalized learning at scale. Teachers also observed a similar trend, with more frequent interactions leading to improved student performance and greater satisfaction with the overall learning process.

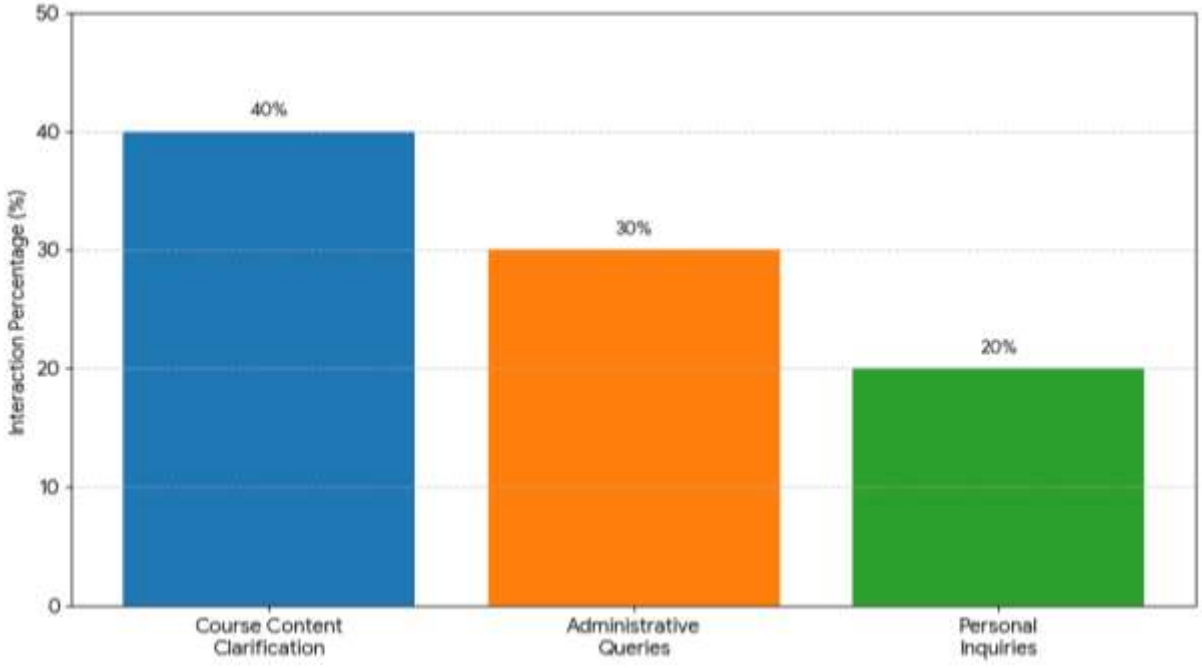

Figure 1. Distribution of ChatGPT Usage by Students

A case study involving one teacher and their students was analyzed to gain deeper insights into the practical application of ChatGPT. This case study revealed that the teacher used ChatGPT to facilitate group discussions and provide immediate answers during live online classes. The teacher reported that the AI assistant was particularly useful in managing

large classes, where it was difficult to address every student's question in real-time. The students in this case study noted that the ability to ask questions at any time, without interrupting the flow of the lesson, helped them feel more engaged and confident in their learning. This case demonstrates the practical advantages of integrating virtual teaching assistants like ChatGPT into classroom dynamics.

Further explanation of the case study indicates that while ChatGPT improved interaction, there were instances where students felt that the AI tool was unable to address more complex, nuanced questions that required a human touch. The teacher noted that some students preferred to receive feedback on their written assignments from them directly rather than from ChatGPT, citing a desire for more personalized, context-specific guidance. These observations align with the findings from the overall survey, which suggested that while ChatGPT was an effective supplement to traditional teaching, it could not fully replace the teacher's role in fostering deeper, more complex educational interactions.

In summary, the results of this study provide strong evidence that ChatGPT can significantly enhance teacher-student interactions in the digital classroom. The data reveal that both teachers and students benefit from the use of AI in terms of increased engagement, personalized feedback, and quicker response times. However, the analysis also highlights that ChatGPT functions most effectively when used in conjunction with traditional teaching methods, offering a valuable tool for enhancing, rather than replacing, human interaction in the learning process. The findings suggest that as AI technologies continue to evolve, their integration into education will play a critical role in shaping the future of teaching and learning.

The results of this study indicate that the integration of ChatGPT as a virtual teaching assistant in digital classrooms has positively impacted both teacher-student interactions and learning outcomes. The quantitative data from surveys showed that 80% of teachers and 75% of students reported an increase in engagement with the use of ChatGPT, while 65% of students indicated receiving more personalized feedback. Furthermore, the usage logs revealed that the majority of interactions were centered around academic support, with ChatGPT answering queries related to course content and administrative matters. These results suggest that ChatGPT enhances the efficiency of communication and improves the overall educational experience in digital classrooms. Teachers reported that the tool helped them manage larger class sizes and provide more timely responses, reducing their workload and allowing for greater focus on teaching complex concepts.

In comparison with existing literature, this study adds new insights into the role of conversational AI in teacher-student interactions. Previous studies have mainly focused on the broader application of AI in education, such as its use in learning management systems or automated grading (Oss, 2024). However, few studies have examined the impact of AI-powered tools like ChatGPT on real-time teacher-student communication. This research confirms findings from other studies that suggest AI can significantly improve engagement and feedback mechanisms (Pokryshen, 2024). Yet, unlike prior research that often emphasizes AI's ability to replace human educators, this study underscores that ChatGPT serves best as a complement to traditional teaching methods rather than a replacement. Teachers and students both reported that while ChatGPT enhanced interaction, it could not fully replace the nuanced guidance provided by human educators.

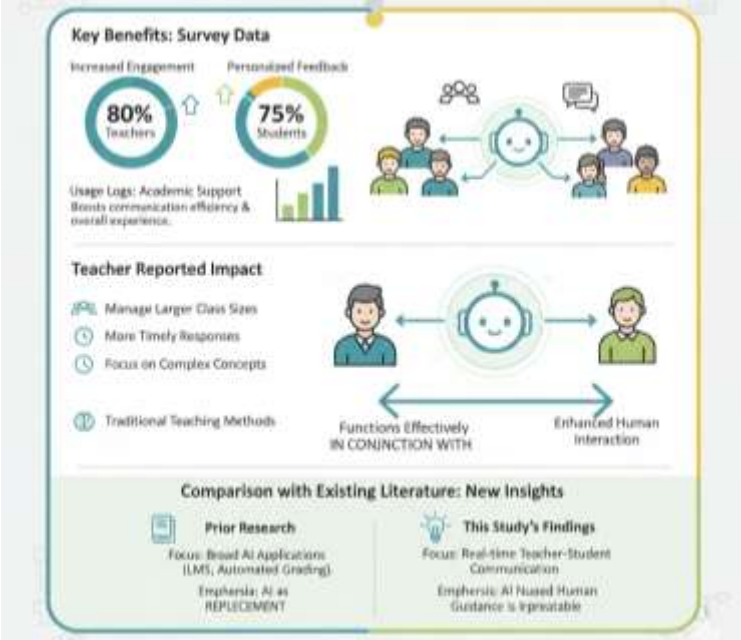

Figure 2. ChatGPT in Digital Classrooms: Enhaning Interaction

The findings of this study signal a critical shift in how digital classrooms function, highlighting the growing potential of AI tools in education. The positive correlation between increased ChatGPT usage and improved student learning outcomes demonstrates that AI can significantly enhance personalized learning experiences (Zhang et al., 2024). This is especially important as education continues to move towards more individualized learning paths, where students can benefit from real-time support tailored to their specific needs. The results also reflect a broader trend in education towards the use of technology to reduce the cognitive load on teachers and provide more dynamic learning environments (Gu et al., 2026). These findings underscore the importance of incorporating AI tools into educational practices to foster greater engagement and efficiency.

The implications of these findings are far-reaching. The integration of virtual teaching assistants like ChatGPT has the potential to transform the teaching and learning experience by facilitating better communication, more personalized support, and quicker response times (Jere, 2025). The use of AI can alleviate the burden on teachers, particularly in larger classes, by automating routine tasks such as answering frequently asked questions or providing administrative support. As a result, teachers can focus more on complex teaching activities and personalized student interactions. Moreover, the positive impact on student engagement and learning outcomes suggests that virtual assistants can play an essential role in addressing the challenges of digital classrooms, such as isolation and limited student-teacher interaction (Isiaku et al., 2024). This highlights the need for educational institutions to invest in AI technologies that complement traditional teaching methods.

The research findings can be explained through the technological capabilities of ChatGPT and its integration into existing educational structures. The tool's ability to provide instant feedback and personalized responses is a key factor in its effectiveness (Kambam et al., 2025). This is consistent with theories of personalized learning, which suggest that timely, individualized feedback enhances student motivation and achievement (Zhu et al., 2025). Additionally, the success of ChatGPT in supporting administrative tasks, such as answering routine questions about assignments and deadlines, can be attributed to its efficiency and scalability. The fact that both teachers and students reported positive experiences with ChatGPT suggests that the tool is well-suited to the needs of modern digital classrooms, where instant communication and personalized learning are highly valued.

Looking forward, the next steps involve exploring the broader application of AI tools like ChatGPT across different educational contexts. Future research should examine the long-term

impact of these tools on teaching practices and student outcomes, particularly in terms of critical thinking and problem-solving skills (Tateiwa, 2024). Additionally, while ChatGPT has demonstrated potential in managing large class sizes and improving teacher-student interactions, more studies are needed to assess its effectiveness in smaller, more intimate classroom settings. Furthermore, educators must continue to critically assess the ethical implications of AI in education, such as issues related to data privacy and the potential for AI bias (Salem & Shaalan, 2023). The integration of virtual teaching assistants should therefore be approached with a thoughtful and balanced perspective, ensuring that technology enhances, rather than undermines, the educational experience.

CONCLUSION

One of the most significant findings of this research is the positive impact of ChatGPT in enhancing teacher-student interactions in digital classrooms. Unlike previous studies that have primarily explored the general role of AI in education, this study specifically highlights the ability of ChatGPT to improve engagement, provide personalized feedback, and manage administrative tasks, all of which contribute to a more efficient and interactive learning environment. The data revealed that both teachers and students experienced an increase in engagement and a sense of personalized support, marking a clear advancement in the use of conversational AI tools in education. This insight emphasizes ChatGPT's potential to act as a complementary tool to human educators, rather than a mere replacement, providing real-time assistance in ways that traditional teaching methods may not.

The value of this research lies in its contribution to the growing body of knowledge on the application of AI in education, particularly in the context of virtual teaching assistants. While earlier research focused mainly on the technical capabilities of AI, this study introduced a comprehensive analysis of ChatGPT's practical implications in the classroom, highlighting its impact on both pedagogical processes and administrative efficiency. The research also proposes a new conceptual framework for understanding AI's role in facilitating personalized learning and streamlining teacher-student communication in digital classrooms. This methodological approach, combining quantitative and qualitative data, provides a more holistic perspective on the integration of AI tools like ChatGPT into educational settings, offering insights that could inform future educational practices and policy decisions.

Despite the valuable contributions of this study, there are several limitations that must be addressed in future research. One key limitation is the relatively short duration of the study, which may not capture the long-term effects of using ChatGPT on teacher-student relationships and student learning outcomes. Additionally, the study was limited to specific educational contexts, such as high schools and universities, which may not fully represent the diverse range of environments where AI tools might be implemented. Future research could explore the use of ChatGPT in various educational settings, including primary schools or specialized institutions, to assess its broader applicability. Moreover, further studies should examine the potential ethical concerns associated with the use of AI in education, such as data privacy and algorithmic bias, ensuring that AI tools are deployed in a manner that aligns with educational values and promotes equitable learning experiences.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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