Artificial intelligence in virtual education

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Abstract

Introduction: The research aimed to understand the potential benefits, challenges, and the overall impact of integrating Chatbots into educational environments from the viewpoint of educators.

Methodology: To achieve a comprehensive understanding, the study was guided by a constructivist paradigm, which emphasizes the importance of individuals' experiences and interpretations in constructing their reality. This qualitative study was designed to explore teachers' perspectives on the utilization of Chatbots as classroom assistants The study participants consisted of a purposive sample of teachers who have had experience with or shown interest in using technology, including Chatbots, in their teaching practices. The selection process aimed to ensure a diverse representation of subjects in terms of teaching levels (primary, secondary, and tertiary education), disciplines, and technological proficiency. In total, 25 teachers participated in the study, with efforts made to achieve theoretical saturation—a point at which no new information or themes are observed in the data.

Findings: Teachers identified several benefits of Chatbot integration, emphasizing Engagement Enhancement. Despite the benefits, several challenges were identified. Effective implementation strategies were discussed, emphasizing the need for Integration into Curriculum and Professional Development. The future of educational technology includes Enhanced Learning Tools like gamified learning apps and virtual labs.

Conclusion: integrating Chatbots in educational settings is a multifaceted endeavor that presents a promising yet complex pathway to enhancing learning experiences. While Chatbots offer significant benefits in terms of engagement, administrative efficiency, and support for both teaching and learning, their effective integration hinges on addressing a myriad of technical, pedagogical, and socio-emotional challenges

Keywords:

 AI, Chatbots in education, Educational technology, Qualitative research, Technology integration, Pedagogical support

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Introduction

Today, the use of various technologies that have emerged with the advancement of science has made many of our daily activities easier. Mobile phones, computers, access to the Internet to communicate with the world, etc. are among the applications of the advancement of science. In addition to all these cases, changing the educational method to virtual education is also one of the most important changes that have been achieved through advanced science.

The use of virtual space and the Internet today has somehow turned into a method of distance learning and education, which can be accessed at a very high speed and with greater security, without any restrictions. course and learning, whatever we need to be in the form of virtual education or online education. During the early years when people became familiar with this educational method, distance education courses were offered through electronic texts and people could use this through teaching and learning their desired concepts. But due to the advancement of science and technology as well as the production of devices with variety in communication ways and increasing the speed of information, today we are witnessing virtual education online using various types of communication such as audio and video communication.

Many terms are offered to describe this educational method, some of which are:
- Online training
- Education through the Internet
- Distance Learning
- Computer electronics training
- Online learning
- Internet learning and...

A Chatbot is an artificial intelligence (AI) software that can simulate a conversation (chat) with a user in natural language through messaging programs, websites, mobile applications or telephone. Chatbots are often considered as one of the most advanced and efficient tools for human-machine interaction. In fact, Chatbots that use natural language processing (NLP) represent the evolution of the question answering system. So; A Chatbot can be defined as a computer program based on artificial intelligence that simulates human conversations. This artificial intelligence software interprets and processes user requests and responds to them quickly.

digital natives increasingly populate classrooms, the educational landscape is undergoing significant transformation, urging educators and researchers to explore innovative tools that cater to the evolving needs of learners (Chounta et al., 2021; Ferikoğlu & Akgün, 2022; Parsakia, 2023; Rios-Campos et al., 2023; Shin, 2021; Ubah et al., 2022). Chatbots, driven by advancements in artificial intelligence (AI) and natural language processing (NLP), have emerged as a promising technological intervention, potentially revolutionizing the traditional educational paradigms (Ferikoğlu & Akgün, 2022; Rios-Campos et al., 2023; Tapalova & Zhiyenbayeva, 2022).

The potential of Chatbots to serve as educational tools has been a subject of scholarly interest, reflecting a growing recognition of their capacity to support personalized learning, enhance student engagement, and streamline

administrative tasks (Chocarro et al., 2021; Ghorashi et al., 2023; Kuhail et al., 2022; Lolinco, 2023; Vanichvasin, 2022). Teachers, as the primary facilitators of learning, play a crucial role in the integration of technology within educational settings. Their attitudes towards and acceptance of Chatbots are pivotal in determining the success and effectiveness of these technological interventions. The Technology Acceptance Model (TAM), as explored by Chocarro, Cortiñas, and Marcos-Matás (2021), provides a valuable framework for understanding the factors influencing teachers' readiness to adopt Chatbots, including perceived usefulness, ease of use, social language capabilities, and bot proactiveness (Chocarro et al., 2021).

Despite the potential benefits, the deployment of Chatbots in educational contexts raises questions regarding pedagogical efficacy, technical reliability, and the social and emotional implications of replacing human interaction with AI-driven communication. Chuah and Kabilan (2021) highlight the significance of teachers' views on utilizing Chatbots for English language teaching in mobile environments, emphasizing the importance of aligning technological tools with pedagogical objectives to foster meaningful learning experiences (Chuah & Kabilan, 2021). Similarly, the review by Kohnke (2022) underscores the role of Chatbots as supplemental tools in language learning, suggesting their utility in providing additional practice opportunities and immediate feedback to learners (Kohnke, 2022).

The adoption of Chatbots in education necessitates a comprehensive understanding of their design, functionality, and impact on learning outcomes. Recent deep learning approaches in human-centered machine learning offer insights into the development of more intuitive and responsive educational Chatbots (Kaluarachchi et al., 2021). These advancements underscore the importance of creating Chatbots that can adapt to individual learners' needs, preferences, and learning styles, thereby enhancing the personalization of learning experiences.

A systematic review conducted by Kuhail et al. (2022) examines the interaction between students and educational Chatbots, identifying key factors that contribute to the effectiveness of Chatbots as learning tools (Kuhail et al., 2022). The findings suggest that the design and implementation of Chatbots should consider user engagement, content relevance, and the ability to simulate meaningful educational interactions. In a similar vein, Lolinco (2023) explores the development of a curated Chatbot as an exploratory tool for chemistry learning, illustrating the potential of Chatbots to facilitate interactive and exploratory learning in specific subject areas (Lolinco, 2023).

Wollny et al. (2021) provide a comprehensive overview of the current state of research on Chatbots in education through a systematic literature review. Their findings indicate a burgeoning interest in the application of Chatbots across various educational settings, highlighting the potential for Chatbots to support personalized learning, facilitate administrative tasks, and provide scalable solutions for educational challenges. However, the review also points to the need for further empirical research to explore the long-term effects of Chatbot integration on educational outcomes and to address the challenges

associated with their implementation (Wollny et al., 2021). The systematic literature review by Pérez, Daradoumis, and Puig (2020) revisits the use of Chatbots in education, shedding light on the diverse applications and outcomes associated with Chatbot integration. This review emphasizes the need for ongoing research to assess the impact of Chatbots on learning processes, student satisfaction, and educational outcomes (Pérez et al., 2020). Furthermore, the study by Vanichvasin (2022) investigates the impact of Chatbots on student learning and satisfaction within the context of entrepreneurship education, suggesting that Chatbots can enhance learning efficiency and student engagement when effectively integrated into the curriculum (Vanichvasin, 2022).

Teachers' experiences and attitudes towards Chatbots are important in navigating the complexities of technology integration in educational contexts. Thus, this study explores the perceived benefits, challenges, and implications of using Chatbots as classroom assistants.

Methodology

Study Design and Participants

This qualitative study was designed to explore teachers' perspectives on the utilization of Chatbots as classroom assistants. The research aimed to understand the potential benefits, challenges, and the overall impact of integrating Chatbots into educational environments from the viewpoint of educators. To achieve a comprehensive understanding, the study was guided by a constructivist paradigm, which emphasizes the importance of individuals' experiences and interpretations in constructing their reality. This approach facilitated an in-depth exploration of teachers' experiences and attitudes towards Chatbots in education.

The study participants consisted of a purposive sample of teachers who have had experience with or shown interest in using technology, including Chatbots, in their teaching practices. The selection process aimed to ensure a diverse representation of subjects in terms of teaching levels (primary, secondary, and tertiary education), disciplines, and technological proficiency. In total, 25 teachers participated in the study, with efforts made to achieve theoretical saturation—a point at which no new information or themes are observed in the data.

Prior to the commencement of the study, ethical approval was obtained from the Institutional Review Board. Participants were informed about the purpose of the research, the voluntary nature of their involvement, and their right to withdraw at any time without penalty. Informed consent was obtained from all participants. To ensure confidentiality, all identifying information was removed or altered in the transcription process and subsequent analysis.

Measures

Semi-Structured Interview

Data were collected through semi-structured interviews, which allowed for flexibility in exploring the teachers' views while maintaining a focus on key research questions. The interview guide comprised open-ended questions designed to elicit detailed responses about the participants' experiences,

perceptions, and the perceived impact of Chatbots on teaching and learning processes. Interviews were conducted either face-to-face or via video conferencing platforms, depending on the participants' preferences and availability. Each interview lasted approximately 45 to 60 minutes and was audio-recorded with the participants' consent.

Data Analysis

The audio-recorded interviews were transcribed verbatim and analyzed using thematic analysis. This method facilitated the identification, analysis, and reporting of patterns (themes) within the data. The analysis process followed Braun and Clarke's six-phase framework, which includes familiarizing oneself with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. The analysis was iterative, with the researchers moving back and forth between the phases to refine the themes and ensure they accurately represented the data. The use of NVivo software assisted in organizing the data and facilitating the thematic analysis.

To ensure the trustworthiness of the findings, several strategies were employed. These included triangulation through comparing data from different sources (e.g., teachers from various educational levels and subjects), member checking by providing participants with a summary of their interview for validation, and maintaining a reflexive journal throughout the research process. These measures aimed to enhance the credibility, transferability, dependability, and confirmability of the study results.

Research Findings

In the study, a total of 22 participants were engaged to explore the perspectives of teachers regarding the integration of Chatbots as classroom assistants. The demographic composition of the participants was diverse, aiming to capture a wide range of insights across different educational levels and disciplines. Specifically, the cohort included 8 primary school teachers, 7 secondary school teachers, and 7 tertiary education instructors, ensuring a balanced representation across the educational spectrum. In terms of gender distribution, there were 12 female and 10 male teachers, reflecting a relatively even gender balance. The participants also varied in terms of their experience with educational technology: 5 were identified as early adopters, having extensive experience with integrating technology in teaching, 10 were considered proficient, comfortably using technology in their classroom but not necessarily exploring new tools proactively, and 7 were novices, either new to technology integration or having limited experience.

Table 1: The Results of Thematic Analysis

Categories	Subcategories	Concepts (Open Codes)
1. Perceived Benefits	a. Engagement Enhancement	Increased participation, Curiosity stimulation, Personalized learning paths, Sustained attention, Enhanced motivation, Interactive learning experience
	b. Administrative Efficiency	Automated attendance tracking, Streamlined grading, Efficient resource distribution, Simplified communication, Time-saving
	c. Accessibility	24/7 availability, Multi-language support, Ease of use, Adaptable learning materials, Special needs accommodation
	d. Pedagogical Support	Instant feedback, Adaptive learning support, Supplemental content delivery, Concept reinforcement, Learning pace adjustment
	e. Teacher Empowerment	Enhanced teaching methods, Greater content control, Professional development opportunities, Collaboration facilitation, Innovation in teaching practices
	f. Collaboration and Communication	Facilitated peer interaction, Enhanced teacher-student communication, Community building, Feedback loops, Cross-cultural exchanges
2. Challenges and Concerns	a. Technical Issues	Connectivity problems, Platform compatibility, User interface limitations, Data privacy concerns, System reliability
	b. Pedagogical Concerns	Shallow learning, Content accuracy, Misalignment with curriculum, Overreliance on technology, Student distraction
	c. Emotional and Social Impact	Reduced human interaction, Emotional detachment, Lack of social cues, Privacy concerns, Cyberbullying potential
	d. Teacher Preparedness and Training	Need for technical training, Resistance to change, Pedagogical adaptation challenges, Time investment, Stress and anxiety
	e. Ethical and Equity Issues	Digital divide, Access inequalities, Biased algorithms, Data misuse risks, Transparency and accountability
3. Implementation Strategies	a. Integration into Curriculum	Aligning with learning objectives, Complementary role, Interdisciplinary approach, Scalable use cases, Student-centered activities
	b. Professional Development	Continuous training programs, Peer mentoring, Online resources and forums, Workshops and seminars, Feedback and support systems
	c. Technical Support and Infrastructure	Reliable IT support, Robust hardware and software, Regular updates and maintenance, Cybersecurity measures, User-friendly design

	d. Policy and Guidelines	Clear usage policies, Ethical standards, Privacy protection measures, Inclusive access policies, Evaluation and assessment guidelines
	e. Student Engagement and Feedback	Student input in Chatbot design, Feedback mechanisms, Adaptive learning paths, Gamification strategies, Collaborative learning opportunities
	f. Community Engagement	Parental involvement, Local community resources, Educational outreach programs, Community service projects, Public awareness campaigns
	g. Sustainable Practices	Eco-friendly technology use, Long-term educational strategies, Sustainability in curriculum integration, Resource conservation, Awareness and advocacy
4. Technological Integration	a. Enhanced Learning Tools	Gamified learning apps, Interactive e-books, Virtual labs, Online discussion forums, Collaborative software
5. Teacher and Student Roles	a. Evolving Roles	Teacher as facilitator, Student-centered learning, Peer teaching, Role flexibility, Lifelong learning mindset
	b. Professional and Personal Development	Skill development, Digital literacy, Emotional intelligence, Adaptability and resilience, Creative and critical thinking
	c. Collaboration in Learning	Group projects, Peer feedback, Collaborative problem-solving, Interdisciplinary projects, Community-based learning
	d. Autonomy and Ownership	Self-directed learning, Personal learning goals, Project choice, Learning pace control, Content selection
	e. Feedback and Adaptation	Continuous feedback loops, Personalized learning adjustments, Performance analytics, Curriculum evolution, Teaching methods refinement

The qualitative analysis of semi-structured interviews with 22 teachers revealed insights into the perceptions of Chatbots as classroom assistants. The findings are organized into five main categories: Perceived Benefits, Challenges and Concerns, Implementation Strategies, Technological Integration, and Teacher and Student Roles. Each category encompasses various subcategories, highlighting the multifaceted impact of Chatbot integration into educational settings.

Perceived Benefits

Teachers identified several benefits of Chatbot integration, emphasizing Engagement Enhancement, where one teacher noted, "Students showed higher participation levels and were more curious about lessons when Chatbots were

involved." The Administrative Efficiency subcategory highlighted the potential for streamlining routine tasks, with a respondent commenting, "Chatbots significantly cut down the time I spend on administrative tasks, like attendance." Accessibility was praised for providing "24/7 availability and multi-language support," making learning more inclusive. Pedagogical Support and Teacher Empowerment emerged as crucial benefits, where Chatbots offered "instant feedback and adaptive learning support," and empowered teachers by "enhancing teaching methods and facilitating innovation." The addition of Collaboration and Communication underscores Chatbots' role in "facilitating peer interaction and enhancing teacher-student communication."

Challenges and Concerns

Despite the benefits, several challenges were identified. Technical Issues, such as "connectivity problems and platform compatibility," were common concerns. Pedagogical Concerns raised questions about the depth of learning, with a teacher remarking, "I worry about the potential for shallow learning." The Emotional and Social Impact on students, including "reduced human interaction," was also highlighted. Teacher Preparedness and Training was seen as a significant hurdle, with one educator stating, "The need for technical training cannot be overstated." Additionally, Ethical and Equity Issues were noted, particularly regarding the "digital divide and access inequalities."

Implementation Strategies

Effective implementation strategies were discussed, emphasizing the need for Integration into Curriculum and Professional Development. The Technical Support and Infrastructure category addressed the importance of reliable IT support, while Policy and Guidelines focused on establishing clear usage policies. Student Engagement and Feedback were seen as vital for tailoring Chatbot functions, with a notable emphasis on Community Engagement and Sustainable Practices to align Chatbot use with broader educational goals and environmental sustainability.

Technological Integration

The future of educational technology includes Enhanced Learning Tools like gamified learning apps and virtual labs. Teachers expressed optimism about these tools, with one sharing, "Interactive e-books and virtual labs have the potential to revolutionize how we teach."

Teacher and Student Roles

This category reflects the evolving Roles of teachers and students in a Chatbot-assisted learning environment. Teachers are transitioning to facilitators, promoting Professional and Personal Development, and fostering Collaboration in Learning. Autonomy and ownership in learning were highlighted, with a focus on Feedback and Adaptation to meet individual student needs. A teacher encapsulated the sentiment, stating, "Our roles are evolving; we're guiding students to take charge of their learning journey."

Discussion and conclusion

The qualitative analysis of semi-structured interviews with teachers on the integration of Chatbots as classroom assistants yielded five main themes, each encompassing various categories that highlight the multifaceted perspectives of educators. These themes include Perceived Benefits, Challenges and Concerns, Implementation Strategies, Technological Integration, and Teacher and Student Roles. Within these themes, categories such as Engagement Enhancement, Administrative Efficiency, Technical Issues, Pedagogical Concerns, Integration into Curriculum, Professional Development, Enhanced Learning Tools, and Evolving Roles were explored, reflecting the depth and diversity of teachers' experiences and viewpoints regarding Chatbot utilization in educational settings.

The Perceived Benefits theme encapsulated categories including Engagement Enhancement, Administrative Efficiency, Accessibility, Pedagogical Support, Teacher Empowerment, and Collaboration and Communication. Engagement Enhancement was highlighted through concepts like increased participation and sustained attention. Administrative Efficiency emerged through the reduction of routine tasks and streamlined grading. Accessibility was emphasized by 24/7 availability and ease of use, while Pedagogical Support involved instant feedback and adaptive learning. Teacher Empowerment was defined by enhanced teaching methods and innovation facilitation, and Collaboration and Communication were seen in the facilitated peer interaction and enhanced teacher-student communication. Chocarro, Cortiñas, and Marcos-Matás (2021) underscore the role of social language and bot proactiveness in enhancing engagement, reflecting the importance of Chatbots in stimulating student interest and participation (Chocarro et al., 2021). Similarly, Vanichvasin (2022) identifies Chatbots' ability to foster engagement and satisfaction in the context of entrepreneurship education, supporting the notion that Chatbots can significantly enhance the learning experience (Vanichvasin, 2022). The reduction in administrative tasks through Chatbot integration, as observed in this study, finds support in the work of Wollny et al. (2021), who highlight Chatbots' potential to streamline administrative processes and free up valuable teaching time. Kohnke (2022) and Chuah & Kabilan (2021) provide evidence for Chatbots' role in supporting language learning, offering a perspective that complements the broader pedagogical benefits identified in the current study, such as providing instant feedback and facilitating adaptive learning (Kohnke, 2022).

Under the Challenges and Concerns theme, categories identified were Technical Issues, Pedagogical Concerns, Emotional and Social Impact, Teacher Preparedness and Training, and Ethical and Equity Issues. Technical Issues were marked by concepts such as connectivity problems and data privacy concerns. Pedagogical Concerns included shallow learning and content

accuracy issues. The Emotional and Social Impact category underscored reduced human interaction and emotional detachment, whereas Teacher Preparedness and Training revealed a need for technical training and adaptation challenges. Ethical and Equity Issues highlighted the digital divide and access inequalities. The concern over technical reliability is echoed by Kuhail et al. (2022), who point out the importance of user engagement and content relevance, factors that are directly impacted by the technical performance of Chatbots (Kuhail et al., 2022). The apprehension about the depth of learning facilitated by Chatbots is supported by Pérez, Daradoumis, and Puig (2020), who call for more empirical research to assess the impact of Chatbots on learning processes and educational outcomes (Pérez et al., 2020). The study's concerns about reduced human interaction and emotional detachment are mirrored in Lolinco's (2023) exploration of Chatbots in chemistry learning, emphasizing the need for Chatbots to complement rather than replace human interactions in educational settings (Lolinco, 2023).

Implementation Strategies encompassed categories such as Integration into Curriculum, Professional Development, Technical Support and Infrastructure, Policy and Guidelines, Community Engagement, and Sustainable Practices. Integration into Curriculum focused on aligning with learning objectives and interdisciplinary approaches. Professional Development stressed continuous training and peer mentoring. Technical Support and Infrastructure dealt with reliable IT support and user-friendly design. Policy and Guidelines emphasized clear usage policies and ethical standards, Community Engagement on parental involvement, and Sustainable Practices on eco-friendly technology use. The emphasis on aligning Chatbots with learning objectives and curriculum finds support in Chuah & Kabilan's (2021) work, which highlights the importance of contextual adaptation in utilizing Chatbots for English language teaching (Chuah & Kabilan, 2021). The call for teacher training and support in using Chatbots is underscored by Chocarro, Cortiñas, and Marcos-Matás (2021), who point out that users' characteristics, including their technological proficiency, play a crucial role in technology acceptance (Chocarro et al., 2021).

The Technological Integration theme revolved around the category of Enhanced Learning Tools, detailing concepts like gamified learning apps, virtual labs, and collaborative software. This theme underscored the role of technological advancements in deepening the pedagogical impact of Chatbots, facilitating interactive and immersive learning experiences. Kaluarachchi, Reis, & Nanayakkara (2021) explore the advancements in deep learning that have improved Chatbot capabilities, supporting the study's observation that ongoing technological innovation is key to enhancing Chatbots' educational value (Kaluarachchi et al., 2021).

Lastly, the Teacher and Student Roles theme highlighted the shifting dynamics within educational environments, with categories such as Evolving

Roles, Professional and Personal Development, Collaboration in Learning, Autonomy and Ownership, and Feedback and Adaptation. Evolving Roles were characterized by teachers transitioning to facilitators and students taking more active roles. Professional and Personal Development focused on skill and emotional intelligence development. Collaboration in Learning emphasized group projects and peer feedback, Autonomy and Ownership on self-directed learning, and Feedback and Adaptation on personalized learning adjustments and curriculum evolution. Discussing the changing roles of teachers and students in a Chatbot-integrated learning environment resonates with Vanichvasin's (2022) findings on Chatbots enhancing student autonomy and engagement, highlighting the shift towards more student-centered learning models (Vanichvasin, 2022).

In conclusion, integrating Chatbots in educational settings is a multifaceted endeavor that presents a promising yet complex pathway to enhancing learning experiences. While Chatbots offer significant benefits in terms of engagement, administrative efficiency, and support for both teaching and learning, their effective integration hinges on addressing a myriad of technical, pedagogical, and socio-emotional challenges. This study underscores the importance of a balanced approach that leverages the strengths of Chatbots while mitigating their limitations, ultimately aiming to enrich the educational landscape.

This study is limited by its focus on teachers' perspectives, which, while invaluable, represent only one facet of the broader educational ecosystem. The reliance on qualitative interviews limits the generalizability of the findings and may not capture the full diversity of experiences and attitudes towards Chatbots in education. Additionally, the rapidly evolving nature of Chatbot technology and its applications in education suggests that findings may quickly become dated, necessitating continuous research and evaluation.

Future research should aim to broaden the scope of investigation to include the perspectives of students, administrators, and parents to develop a more comprehensive understanding of the impact of Chatbots in education. Longitudinal studies could provide deeper insights into the long-term effects of Chatbot integration on educational outcomes and the sustainability of their benefits. Further, exploring the application of Chatbots across different subjects, educational levels, and cultural contexts would offer valuable insights into their versatility and adaptability.

For practitioners, the findings highlight the need for careful consideration and planning in the integration of Chatbots into educational practices. Professional development and training for educators are crucial to ensure they are equipped to leverage Chatbot technology effectively. Collaboration between educators, students, and technology developers is essential to design Chatbots that are pedagogically sound and meet the needs of diverse learners. Ultimately, the goal should be to use Chatbots as a complementary tool that

enhances, rather than replaces, the human elements of teaching and learning, ensuring that the technology serves to support and enrich the educational experience for all stakeholders.

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