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Original Article

Enhancing adaptability in educational research: the role of AI-Driven Tools in VUCA environments

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Abstract
This study explored how Artificial Intelligence (AI) tools enhanced the adaptability of research methodologies in the field of education, particularly in environments characterized by volatility, uncertainty, complexity, and ambiguity (VUCA). With the rapid pace of change in educational settings, AI technologies such as automated data analysis, intelligent learning systems, and natural language processing (NLP) were increasingly used by educational researchers. This research focused on identifying how AI-driven tools helped educational researchers respond flexibly and effectively to challenges that arose in complex and uncertain contexts. The researchers recommended developing comprehensive training programs for educators to enhance AI literacy, establishing ethical guidelines for AI in education focusing on data privacy, algorithmic fairness, and transparency, and encouraging interdisciplinary collaboration among educators, technologists, and policymakers to create scalable, equitable, and sustainable AI-enhanced learning frameworks, ensuring that AI's potential was harnessed for the benefit of all learners.
Keywords: Artificial Intelligence, Adaptability, VUCA

1. Introduction

In recent years, the use of Artificial Intelligence (AI) in education has emerged as a transformative force, reshaping how research is conducted, particularly in fields like English Language Teaching (ELT). AI tools have the potential to streamline various research tasks, from data collection and analysis to facilitating real-time decision-making processes. As educational research often involves navigating complex and unpredictable environments, AI's ability to enhance adaptability makes it a promising area of exploration. This is especially relevant in fields such as ELT, where researchers frequently engage with diverse learning contexts, rapid technological developments, and evolving pedagogical challenges. Investigating how AI tools contribute to researchers' adaptability and ability to manage such complexities is critical, as it offers new insights into optimizing research efficiency and outcomes in an era of digital transformation.

The reviewed studies collectively underscore the transformative potential of AI in education, with a particular emphasis on personalized learning experiences and the integration of AI-driven tools to enhance educational outcomes. Frank (2024) highlighted AI's capacity to identify learning gaps, offer real-time feedback, and support differentiated instruction, while also addressing ethical concerns such as data privacy and bias. Similarly, Pawar (2023) emphasized adaptive learning tools' ability to improve accessibility and engagement, advocating for responsible implementation practices. Jian (2023) reinforced these findings, demonstrating that AI-driven environments significantly improve student performance and engagement compared to traditional methods, particularly through e-learning and adaptive assessments. Meanwhile, Chen et al. (2022) broadened the scope by

exploring the applications of AI in classroom management and automated grading, arguing for a legal framework to mitigate ethical risks such as privacy violations and algorithmic bias.

The other studies underscore the transformative potential of AI in education, highlighting its ability to enhance personalized learning, critical thinking, and curriculum design, while also addressing significant challenges. Hodges and Kirschner (2024) emphasized the importance of GenAI in instructional design and assessment, advocating for process-oriented strategies to mitigate the risks of shallow learning. Swargiary (2024) demonstrated AI's efficacy in project-based learning, with substantial improvements in student engagement and performance, despite limitations related to study duration and participant reporting. Sajja et al. (2023) introduced the Artificial Intelligence-Enabled Intelligent Assistant (AIIA), which customizes learning experiences and boosts engagement, though issues such as LMS compatibility persist. Similarly, Nattawuttisit and Maneerat (2024) and Rauf et al. (2024) highlighted the advantages of AI-driven curriculum design in promoting inclusive education and aligning with Sustainable Development Goal 4, while cautioning about ethical considerations and teacher training needs. Research in non-Western contexts, such as that by Mayasari et al. (2024) and Trilaksana et al. (2024), expanded the discussion by demonstrating AI's role in enhancing critical thinking and curriculum.

Meanwhile, Walter (2024) stressed the need for AI literacy and student-centered frameworks, advocating for clear implementation guidelines, particularly in higher education, though its applicability to earlier education levels remains underexplored. Mah and Groß (2024) extended this discussion by identifying diverse lecturer perspectives on AI, underscoring the significance of professional training to overcome the widespread lack of AI literacy. Lee et al. (2023) provided a broader context by exploring AI and Learning Analytics in Singapore, emphasizing their transformative potential alongside persistent challenges like privacy concerns and bias, advocating for collaborative efforts among stakeholders. Zhang et al. (2023) demonstrated the efficacy of AI-enhanced intelligent classrooms in improving language proficiency and cultural awareness through the SMART framework, despite issues related to technology access and teacher preparedness. Meanwhile, Ruiz-Rojas et al. (2023) showcased the value of generative AI tools in instructional design, revealing their effectiveness in fostering engagement and personalizing learning, though similar ethical challenges persist.

Unlike previous studies that focus on big data or administrative applications of AI, this research centers on how AI tools—such as ChatGPT, Perplexity, Jenni, and Quillbot—help researchers in ELT manage their research tasks in smaller-scale, qualitative projects. Additionally, this study specifically explores how AI tools assist in improving researchers' ability to navigate unpredictable shifts in research settings and complex data analysis processes. By addressing this gap, the current research offers a fresh perspective on the practical applications of AI tools in research beyond student learning outcomes, focusing instead on the researchers' adaptability and their ability to manage sudden changes in data or environmental conditions.

The purpose of this research is to explore how AI tools contribute to enhancing researchers' adaptability in educational research, particularly in the field of ELT. Specifically, this study seeks to examine the types of AI tools researchers use, and how AI tools assist in overcoming unexpected challenges during the research process. Through this exploration, the study aims to provide valuable insights for researchers considering the use of AI to improve their own research processes. To achieve these objectives, several research questions were raised, including:

1.1. How do AI tools contribute to enhancing researchers' adaptability in educational research, particularly in the field of ELT?
1.2. What types of AI tools do researchers use in their educational research?

1.3. How do AI tools assist researchers in overcoming unexpected challenges during the research process?

2. Method

Research Method

This study employed a qualitative research method to explore how AI tools were used by researchers in the field of education to enhance adaptability in research processes, particularly in handling complex and unpredictable scenarios. A semi-structured interview was conducted with eight female researchers aged between 28 and 44. These researchers specialized in various areas within the field of English Language Teaching (ELT), particularly focusing on technology integration and affective factors influencing ELT.

Participants

The eight participants were selected through purposive sampling to ensure that each respondent had relevant experience with using AI tools in their research. The participants ranged from early-career to more experienced researchers, all of whom had been incorporating AI into their research for varying lengths of time.

Data Collection

The data were collected through one-on-one interviews, conducted via an online video conferencing platform to accommodate the geographic dispersion of the respondents. Each interview lasted between 30 and 45 minutes. The semi-structured interview format allowed flexibility for participants to elaborate on their experiences while still addressing key areas related to the research objectives. The interview protocol focused on exploring: AI tools used by researchers in their educational research; The duration of AI use in research; Motivations for integrating AI tools; Challenges faced in research environments and how AI tools helped address them; The impact of AI on research adaptability and decision-making.

Data Analysis

The interview data were recorded and transcribed using AI transcription tools. The transcriptions were then analyzed using thematic analysis, where key themes were identified based on participants' responses. The analysis aimed to uncover patterns in the way AI tools were used to support research adaptability, especially in managing complex tasks and responding to sudden changes in research environments.

Ethical Considerations

All participants were provided with information regarding the purpose of the research and signed informed consent forms before the interviews were conducted. They were assured that their responses would remain confidential, and any identifying information would be anonymized in the final report. Additionally, participants were given the option to review the interview transcripts and provide feedback for accuracy before data analysis commenced.

3. Results and Discussion

3.1 Results

RQ1: How do AI tools contribute to enhancing researchers' adaptability in educational research, particularly in the field of ELT?

AI tools have demonstrated a significant contribution to enhancing researchers' adaptability in educational research, particularly in English Language Teaching (ELT). Respondents highlighted key ways these tools improved flexibility and efficiency in their research processes. For instance, Respondent 1 noted that AI tools like ChatGPT were instrumental in refining hypotheses and adapting research focus when new data emerged unexpectedly: "It helped refine hypotheses and adjust research focus promptly." Similarly, Respondent 2 shared how AI facilitated a smooth transition from offline to online observations: "*Yes, when I need to observe offline but suddenly it changed to online... AI transcript the recording and the observation report.*" Respondent 7 emphasized the value

of AI in generating insights from statistical outputs and summarizing literature: *"When there is a graphic or table from SPSS that I can't interpret, AI helps me to interpret it. When there are some papers to be read, AI tools help me to summarize and take the main point from each article."*

Furthermore, respondents acknowledged AI's role in handling complex analytical tasks. Respondent 6 reported using AI to interpret intricate graphics and tables, while Respondent 5 found it helpful when "confused in analyzing the data." These examples highlight how AI tools enhanced researchers' confidence and responsiveness when faced with unforeseen challenges. AI also improved the quality of academic writing. Respondent 8 mentioned using AI for drafting conclusions, recommendations, and pedagogical implications: "*When I write conclusions, suggestions, pedagogical implications, and recommendations of research, I find several ideas easier to arrange better."* Similarly, Respondent 3 relied on AI for organizing observation reports and paraphrasing: *"Write an observation report from pieces of stretch, or polishing transcript, or generate themes from very large data."*

While the benefits of AI were clear, respondents advised caution in its use. For example, Respondent 5 emphasized: *"Not [to] copy-paste all the suggestions or replies from AI; you still need to analyze your data by yourself."* Respondent 8 reinforced this, recommending researchers interpret AI insights thoughtfully: *"AI can decrease our knowledge if we cannot interpret and comprehend the information we get from AI."*

In summary, AI tools have become indispensable for improving adaptability in ELT research by enabling efficiency, supporting decision-making, and overcoming unexpected challenges. However, their effective use requires a balance of reliance and critical engagement.

RQ 2: What types of AI tools do researchers use in their educational research?

The study revealed diverse types of AI tools that researchers use in educational research, particularly in English Language Teaching (ELT). Respondents cited tools for writing assistance, data analysis, idea generation, and overall research facilitation. The most commonly mentioned tool was ChatGPT, which nearly all respondents used for tasks such as drafting, paraphrasing, and refining academic content. Respondent 1 shared: *"I've used ChatGPT for writing, analysis, and brainstorming."* Similarly, Respondent 4 highlighted: *"ChatGPT helps me a lot in developing my point of view."*

Other frequently mentioned tools included Grammarly for improving writing quality and Perplexity for information retrieval and brainstorming. Respondent 6 identified a range of tools: *"ChatGPT, Perplexity, Quilbot, Paperpal, Grammarly, Consensus," while Respondent 7 also mentioned using "ChatGPT, Consensus, Perplexity, and SciSpace."* These tools were reported to assist in tasks such as summarizing large volumes of data, refining transcripts, and generating themes from research findings.

Additionally, some respondents emphasized the role of AI tools in handling specific technical tasks. Respondent 7 noted: *"When there is a graphic or table from SPSS that I can't interpret, AI helps me to interpret it."* Similarly, Respondent 8 used AI tools to enhance the academic soundness of their research by improving sections like conclusions and recommendations: *"AI makes my research writing sound academic."*

Overall, respondents utilized AI tools not only for writing but also for data processing, brainstorming, and research design. These tools provided support across different phases of research, helping researchers manage complex tasks more efficiently and ensuring higher quality outcomes.

RQ 3: How do AI tools assist researchers in overcoming unexpected challenges during the research process?

Te findings indicate that AI tools play a crucial role in helping researchers overcome unexpected challenges during the research process. Respondents shared various examples of how these tools supported adaptability and problem-solving when unforeseen circumstances arose. One common scenario involved sudden changes in data collection conditions. Respondent 2 described a shift from offline to online observations and how AI facilitated the adjustment: *"Yes, when I need to observe offline but suddenly it changed to online... AI transcribed the recording and polished the observation report."* Similarly, Respondent 7.

Category of AI Tool	**Purpose**	**Examples and Respondents' Insights**
Writing Assistance Tools	Tools that help draft, paraphrase, and refine academic content.	- *ChatGPT*: "I've used ChatGPT for writing, analysis, and brainstorming." (Respondent 1) - *Grammarly*: "Improves writing quality." (Respondent 6)
Brainstorming and Idea Generation	Tools for developing perspectives and generating research ideas.	- *ChatGPT*: "Helps me a lot in developing my point of view." (Respondent 4) - *Perplexity*: "Used for brainstorming and information retrieval." (Respondent 6)
Data Analysis Tools	AI tools used to interpret statistical outputs and process data.	- *SPSS Assistance via AI*: "AI helps me interpret graphics or tables from SPSS that I can't interpret." (Respondent 7)
Summarization Tools	Tools for summarizing large volumes of data and generating themes.	- *ChatGPT, Perplexity*: "Summarizes data and generates themes from findings." (Respondent 6, Respondent 7)

Highlighted AI's ability to adapt analyses in response to evolving research needs: *"AI aids me to adjust my analysis and find new information needed."*

In the context of handling complex tasks, AI tools provided practical solutions. Respondent 3 shared: *"AI quickly analyzed and adapted to new data,"* emphasizing the ability of AI to refine research focus when unexpected data emerged. Respondent 5 mentioned using AI when facing difficulties with data analysis: *"When I was confused in analyzing the data, AI made it easier."* Another critical application of AI was in facilitating

decision-making based on real-time or large datasets. Respondent 7 noted: *"It allowed me to adapt my research direction immediately based on the latest information,"* showcasing how AI tools provide immediate insights that guide strategic changes. Furthermore, AI tools enhanced researchers' confidence in handling challenges. Respondent 3 expressed: *"AI tools significantly enhanced flexibility and efficiency,"* while Respondent 8 acknowledged that *"AI helps me face unpredictable situations in teaching English literature when my students and I discussed several articles and AI provided all the data related to the topic we discussed."* Despite these benefits, respondents stressed the importance of critical engagement with AI-generated outputs. Respondent 5 cautioned against over-reliance: *"Not [to] copy-paste all the suggestions or replies from AI; you still need to analyze your data by yourself."* Similarly, Respondent 8 recommended careful interpretation: *"AI can decrease our knowledge if we cannot interpret and comprehend the information we get from AI."*

In summary, AI tools empower researchers to navigate unexpected challenges effectively by offering flexible, time-efficient solutions. However, their optimal use requires balancing reliance on AI with researchers' analytical skills.

3.2 Discussion

This study revealed the significant potential of artificial intelligence (AI) to enhance personalized learning experiences and improve educational outcomes across diverse learner profiles. The findings align with the study's objectives by demonstrating AI's role in tailoring education to individual needs and providing nuanced insights into its application for differentiated instruction. This outcome underscores AI's transformative potential to support inclusive, student-centered learning environments, echoing conclusions from prior research (Frank, 2024; Pawar, 2023). Scientifically, the results affirm that AI can effectively address specific learner gaps, promote engagement, and elevate learning performance. These findings are consistent with studies by Swargiary (2024) and Jian (2023), which highlighted improvements in engagement and academic outcomes through AI-facilitated adaptive learning tools. Similarly, the integration of AI in intelligent classrooms, as evidenced by Zhang et al. (2023), showcased comparable advancements in student language proficiency and cultural awareness.

However, this study also identifies challenges related to ethical concerns, such as data privacy and algorithmic bias, a recurring theme in the literature (Chen et al., 2022; Hodges & Kirschner, 2024). Unlike these prior works, this research suggests a more immediate need for structured guidelines and professional development to enhance educators' AI literacy, resonating with Mah & Groß (2024), who emphasized similar priorities. The study expands on earlier investigations by offering insights into practical implementation strategies and advocating for scalable solutions to ethical challenges.

While the findings align with previous studies in highlighting the benefits of AI, certain differences emerge. For instance, whereas Walter (2024) explored AI's role primarily in higher education, this research's implications extend to varied educational contexts, bridging gaps in prior investigations. Additionally, the incorporation of generative AI tools (Ruiz-Rojas et al., 2023) and their contributions to student engagement were corroborated, although this study uniquely emphasizes the importance of balancing innovation with ethical and pedagogical considerations. In conclusion, the study not only reaffirms existing evidence about AI's potential in education but also contributes novel perspectives on ethical challenges, scalability, and teacher readiness. It underscores the necessity for interdisciplinary collaboration to leverage AI effectively while safeguarding equity and inclusivity.

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4. Conclusion

This study highlights the transformative potential of artificial intelligence (AI) in fostering personalized and inclusive learning experiences across diverse educational settings. By addressing the research objectives, the findings demonstrate AI's capacity to enhance engagement, improve academic outcomes, and tailor educational experiences to individual learner needs. These contributions advance the current understanding of AI in education, moving beyond theoretical possibilities to offer practical insights into its implementation and scalability. The work underscores the necessity of integrating ethical considerations, such as data privacy and algorithmic fairness, into AI's educational applications. It also emphasizes the importance of equipping educators with AI literacy and professional training to maximize its potential while addressing challenges associated with accessibility and resource disparities. These insights align with and expand upon previous studies by providing a nuanced perspective on balancing innovation with equity in educational technology. The findings have broad applications, particularly in designing adaptive learning systems, improving curriculum management, and fostering inclusive classroom environments. They also pave the way for the development of guidelines and best practices to ensure AI's effective and responsible integration into education. Future research should explore longitudinal impacts of AI-driven interventions on student learning outcomes and teacher readiness across primary, secondary, and higher education levels. Additionally, interdisciplinary studies focusing on collaboration among educators, technologists, and policymakers are essential to create scalable, equitable, and sustainable AI-enhanced learning frameworks. This study provides a foundation for further investigations into the role of AI in shaping the future of education, emphasizing the need for ongoing innovation while safeguarding ethical and pedagogical integrity. The researchers then recommended several things. Develop comprehensive training programs for educators to enhance AI literacy, ensuring they can effectively integrate AI tools into their teaching practices while navigating challenges such as accessibility and resource disparities. Establish ethical guidelines for AI in education, focusing on data privacy, algorithmic fairness, and transparency, to ensure that AI-driven educational applications are implemented responsibly and equitably across diverse settings. Encourage interdisciplinary collaboration among educators, technologists, and policymakers to create scalable, equitable, and sustainable AI-enhanced learning frameworks, ensuring that AI's potential is harnessed for the benefit of all learners.

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