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The Role of Artificial Intelligence in Research Methodology

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Abstract

A tedious and intricate procedure, thematic analysis is a part of qualitative research. The potential for improving and partially automating theme analysis has been raised by the development of "generative artificial intelligence (A.I.)", particularly big language models. Review the many studies on the use of artificial intelligence in research technique in this article. This review emphasizes the transformative role of Artificial Intelligence, particularly tools like Chat GPT, in enhancing research methodology. AI streamlines data analysis, fosters deeper insight generation, and supports personalized workflows, especially in qualitative research. However, its effectiveness hinges on user understanding, ethical awareness, and critical engagement. While AI can supplement human expertise, it should not replace it. A synergistic relationship between AI and human judgment is essential for valid outcomes. Future efforts must focus on developing standardized guidelines and fostering transparency to ensure responsible, meaningful, and contextually appropriate integration of AI in global research practices.

Keywords: Qualitative research, ChatGPT, Artificial intelligence (AI), Large language models (LLM), Data analysis, Academic research, etc.

1 Introduction

The paradigm change in research from conventional to artificial intelligence (AI)-driven research has been brought about by recent technological innovations and advancements in machine learning and data mining. The major technology that will shape the future of human civilisation is artificial intelligence (AI), which has the ability to enhance human skills without causing undue expense [1]. In contrast to the rigorous, time-consuming, arduous, and highly technical nature of conventional qualitative and quantitative research, AI-driven research methods are "relaxed, quick, convenient, time-efficient, and sometimes contactless". However, this disparity is unavoidable and has even sparked discussions about its ethical implications [2]. The potential for "Chat GPT, Solab, Ernie Bot, Gemini, Claude, Grok, Llama,

and Copilot", to someday depose human intellect, enable plagiarism, and feed or misinterpret information has frightened many. However, the method academics collect and evaluate data online has been completely transformed by the internet of things [3]. Actually, the vast majority of journals have already begun to accept AI-driven research submissions for potential publication. This indicates that Chat GPT and other forms of artificial intelligence have influenced the field of study. Therefore, given its practical acceptance, mainstreaming AI in research is not far from reality [4].

Data analysis is one area where artificial intelligence is really helpful. It may be quite time-consuming to handle the majority of non-numerical data obtained in qualitative research via focus groups, interviews, stakeholder engagement, Delphi approach, field reconnaissance, field notes, and observations [5]. The ability to interpret and analyse data effectively will be necessary to participate in a meaningful play of codes, themes, and words. One researcher can analyse qualitative data alone, but in certain cases, two or more researchers working together can provide superior themes. On the other side, thematic analysis is required in quantitative research in order to generate themes for exploratory factor theory (EFA) [6]. Even if the statistical software groups the data, the researcher's meaningful analysis is the only factor that will determine the names of the themes or dimensions. This is the point at which artificial intelligence functions effectively and powerfully. By employing the software to statistically organise the thoughts, the AI may be asked about the appropriate codes or topics [7].

A. Artificial intelligence

Artificial intelligence (AI) technologies enable computers to do a broad variety of complex activities, including data analysis, suggestion-making, and the ability to observe, understand, and translate spoken and written language. AI serves as the foundation for innovation in contemporary computing, enabling both consumers and organisations to reap benefits [8]. For instance, "optical character recognition (OCR)" collects text and data from documents and images, converts unstructured content into organised data appropriate for commercial use, and yields useful information [9].

The core of the concept is data, even if the specifics vary throughout AI techniques. Large data sets allow AI systems to learn and develop by identifying connections and patterns that humans might miss. In this learning process, algorithms—which are sets of rules or instructions—are used to direct the AI's decision-making and analysis [10]. In the field of machine learning, which is a popular aspect of artificial intelligence, algorithms are trained on labelled or unlabelled data to generate predictions or classify information. A further specialisation, deep learning employs "multi-layered artificial neural networks" that replicate the organisation and operations of the human brain to process information. As a result of continuous learning and adaptation, AI systems improve their ability to complete specific tasks, including language translation, picture recognition, and beyond [11].

B. Use of AI in research

Acquire research knowledge and literature review: Research tools with AI capabilities for reading, taking notes, and annotating may significantly speed up the learning process. These tools may assist users choose if an item is worth reading by showing them snippets from the literary source with the most

relevant information highlighted. This may assist the user in taking notes on the topic, identifying which paragraphs to read in-depth, and rapidly finding pertinent information in research papers [12]. Users should study the original material rather than only depending on AI-generated summaries and critically evaluate the result without taking it as "the truth" in order to get the most of such an AI-powered tool for research.

Research planning and study design: AI-driven experimental design tools improve parameters using machine learning approaches. Automating experimental design processes may help researchers save more time and effort, freeing up more time for data interpretation and analysis. These AI methods may reduce human error and R&D costs. Researchers must build models that include a large number of variables and factors in order to employ AI technologies for experimental design models in an efficient manner [13]. Researchers may create ideal designs that optimise the efficacy of their studies by feeding certain criteria into these models.

Data analysis: AI-powered data analysis tools have revolutionised the field, as traditional methods of data analysis were reliant on manual processes and had limited computational capabilities. Machine learning algorithms are employed by these tools to interpret, extract, and reveal patterns in extensive datasets. This can increase the efficacy of research output production and reduce the time and cost associated with its production. In order to optimise the utilisation of AI tools for data analysis, researchers must establish explicit project objectives and pinpoint the precise insights and outcomes they intend to achieve through the analysis. Furthermore, it is imperative that they gather germane data and ensure that it is clean, well-organised, and suitable for analysis. Lastly, it is imperative that the researchers identify and determine the AI tools and algorithms that are most appropriate for their objective analysis [14].

Peer review assistance: Submission volumes for peer evaluation are growing steadily. By decreasing the amount of time spent on screening and revising, it is possible to significantly increase academic productivity and save millions of working hours. AI-powered peer review tools have the potential to realise the potential of semi-automated peer review systems. This system could identify potentially low-quality or controversial studies and match reviewers with manuscripts that align with their subject-matter expertise. Although AI is not yet capable of conducting peer review, AI tools can be effectively employed in the peer review process to recommend appropriate journals for an article, conduct initial quality control on submitted manuscripts, and identify reviewers [15].

2 Literature Review

(Bennis & Mouwafaq, 2025) [16] Thematic analysis is a technical and time-consuming component of qualitative research. There is hope that theme analysis will become better and largely automated with the advent of "generative artificial intelligence (A.I.)", especially huge language models. Particularly in complex psychosocial analysis, this study shows how artificial intelligence (AI) may be integrated with qualitative research techniques. As a result, the A.I. deep learning models demonstrated exceptional accuracy and efficiency. The results of this study indicate that "qualitative research methodology" should

prioritise the preservation of analytical rigour by utilising technology that integrates human skills and artificial intelligence capabilities, in accordance with a standardised future checklist for reporting full process transparency.

(Zhang et al., 2025) [17] According to our research, users' skills in interacting with ChatGPT are greatly improved by increasing transparency, offering rapid advice, and enhancing their comprehension of LLMs' capabilities. After conducting a comparison of the attitudes of researchers towards LLM-supported qualitative analysis before and after the co-design process, we have determined that the primary factors contributing to the shift from a negative to a positive perception are a more comprehensive understanding of the LLM's capabilities and the implementation of prompt engineering techniques that enhance response transparency and, as a result, strengthen trust. This study provides insights for qualitative researchers into how AI is perceived in LLM applications, in addition to emphasising the value of well-crafted prompts. Lastly, we highlight the possible ethical hazards and the influence that researchers—especially novices—have on future advancements in AI research and ethical standards.

(Ofosu-Ampong, 2024) [18] Seeks to find research gaps that might direct further studies. The results demonstrate that the existing literature is biassed towards the frequency of technical problems and draw attention to the comparatively insufficient attention paid to other topics, including conceptualisation, application domains, and contextual knowledge co-creation concerns. In addition, the review discovered that modern AI, which is constantly pushing the limits of computational power to address ever-more complex decision-making problems, differs from previous iterations in two key ways that have a big impact on organisational learning when addressing AI's potential: autonomy and learnability. By facilitating the identification of research spaces for subsequent studies, this study advances the field of AI research by providing insights into "current challenges, research methodologies, degree of analysis and conceptual approaches, and AI framework".

(EnP, 2024) [4] To determine the capabilities and applications of Artificial Intelligence in the development of themes in both quantitative and qualitative analysis. In order to reduce data and extract algorithms, the researcher implemented multistage data mining as an AI data collection tool. This methodology was capable of producing the final themes that pertain to the capabilities and applications of AI models. These topics include insight production, objectivity and bias reduction, effective data processing, sentiment analysis, and sentiment recognition analysis. In the fields of "data mining, data processing, and data analysis", this utilisation of AI models and its capabilities can be employed to underscore the ethical and advantageous implementations of AI in research.

(Christou, 2023) [19] Motivated by conceptualisation and critical methodological dynamics, the goal of this work is to explore the function of artificial intelligence in the process of developing theories. As such, it offers a conceptual map of the relationship between AI and theory formation, critically assesses the potential and constraints of AI in theory construction, and outlines important factors to take into account when using AI to establish new theories or advance current ones. It is debatable if AI tools are

necessary for developing theories since researchers' cognitive and evaluative abilities are seen to be crucial in this process, however the importance of AI in developing theory should not be understated.

(Fridgeirsson et al., 2023) [20] Examine the primary ways that cost, risk, and schedule will be impacted by artificial intelligence (AI) in project management. A set of Master of Project Management degree graduates were evaluated using an online survey that reflected the PMBOK's best practices and the future impact of artificial intelligence on the project management field. Resource cost estimate is thought to have the most impact on project cost management. The use of AI in project risk management will most significantly affect the probability and effect forms.

(Hamilton et al., 2023) [21] Examines how human-centered activities like qualitative study analysis may be enhanced by the AI chatbot ChatGPT. The findings show both parallels and discrepancies between analyses produced by AI and humans, with human coders identifying some patterns that ChatGPT missed and vice versa. According to the study's findings, artificial intelligence (AI) tools like ChatGPT provide a potent way to support intricate human-centered work. It also forecasts that these technologies will eventually be used as a supplementary tool to help with research projects. To help find omissions, different frames, and personal biases, future study should investigate putting raw interview transcripts into ChatGPT and introducing AI-generated topics into triangulation conversations.

(Morgan, 2023) [22] The potential application of artificial intelligence programs, such as a ChatGPT, to analyse qualitative data poses a variety of concerns, chiefly the feasibility of achieving comparable results without the time-consuming and laborious process of manual classification. The findings indicate that ChatGPT performed satisfactorily; however, it was less effective in identifying nuanced, interpretive themes and more successful in reproducing concrete, descriptive themes in both instances. This resulted in a program that was relatively straightforward to operate and necessitated minimal effort in comparison to methods that required manual coding. It is crucial to acknowledge, however, that both artificial intelligence-based processes and coding are merely instruments that must be implemented as part of a more comprehensive analytical process. The results of this investigation indicate that artificial intelligence may have the potential to challenge the dominant paradigm of qualitative data analysis, which is the categorisation of data segments.

(Collins et al., 2021) [23] In recent years, the information systems (IS) research community has directed more of its focus on AI. However, a rising number of people are worried that AI research may not be able to gather up as much information as IS research has in the past. 98 of the 1877 papers that were found using the search approach were deemed main studies, and a summary of the major topics that are relevant to this investigation is provided. Determining the current stated economic worth and contributions of AI, research and practical implications on the use of AI, and the possibilities for future AI research in the form of a research agenda are all significant contributions made by this study.

(Serey et al., 2021) [24] With an emphasis on the most significant and relevant works to date, this study explores the main problems, trends, technological developments, and artificial intelligence strategies developed by emerging machine learning researchers and specialists. In the study of data management

using AI techniques, the four machine learning categories that show symmetry are "unsupervised learning, semi-supervised learning, supervised learning, and reinforced learning". Additionally, K-means, Bayesian approaches, support vector machines, and artificial neural networks are the AI techniques with greater symmetry across all groups. Lastly, five research directions to enhance machine learning prediction are offered.

3 Conclusion

All things considered, this paper highlights how artificial intelligence, and in particular "large language models (LLMs) like Chat GPT", may revolutionise research technique. AI tools streamline data processing, support theme development, and facilitate deeper qualitative analysis, allowing researchers to focus more on interpretation and insight generation. However, for AI to be effectively integrated, it is essential to enhance user transparency, improve understanding of AI capabilities, and provide guidance on prompt design. While AI offers powerful assistance, it should be viewed as a supplement—not a substitute—for human expertise. The synergy between AI capabilities and human judgment is critical for achieving valid, meaningful research outcomes. Tools like Chat GPT can aid triangulation, uncover biases, and offer alternative perspectives, enriching the overall research process. Nevertheless, ethical considerations, transparency in usage, and standardized guidelines are necessary to ensure responsible and effective AI application. The future of AI in research methodology depends on developing frameworks that support critical engagement with AI outputs, fostering both innovation and integrity. As AI continues to evolve, its role in research is likely to grow—comparable to how citation tools or data analysis software have become standard—ushering in a new era of intelligent, efficient, and reflective research practice.

References

[1] İ. Yazici, I. Shayea, and J. Din, “A survey of applications of artificial intelligence and machine learning in future mobile networks-enabled systems,” Eng. Sci. Technol. an Int. J., vol. 44, 2023, doi: 10.1016/j.jestch.2023.101455.

[2] C. Malin, C. Kupfer, J. Fleiß, B. Kubicek, and S. Thalmann, “In the AI of the Beholder—A Qualitative Study of HR Professionals’ Beliefs about AI-Based Chatbots and Decision Support in Candidate Pre-Selection,” Adm. Sci., vol. 13, no. 11, 2023, doi: 10.3390/admsci13110231.

[3] A. M. Saghiri, S. M. Vahidipour, M. R. Jabbarpour, M. Sookhak, and A. Forestiero, “A Survey of Artificial Intelligence Challenges: Analyzing the Definitions, Relationships, and Evolutions,” Appl. Sci., vol. 12, no. 8, 2022, doi: 10.3390/app12084054.

[4] D. M. C. T. J. EnP, “Capabilities and Application of Artificial Intelligence (AI) Models in Qualitative and Quantitative Data Mining, Data Processing and Data Analysis,” Arch. des Sci., vol. 74, no. 3, pp. 198–200, 2024, doi: 10.62227/as/74331.

[5] C. A. Fazakarley, M. Breen, P. Leeson, B. Thompson, and V. Williamson, “Experiences of using artificial intelligence in healthcare: A qualitative study of UK clinician and key stakeholder perspectives,” BMJ Open, vol. 13, no. 12, pp. 1–8, 2023, doi: 10.1136/bmjopen-2023-076950.

[6] S. F. Ahmad et al., "Impact of artificial intelligence on human loss in decision making, laziness and safety in education," Humanit. Soc. Sci. Commun., vol. 10, no. 1, pp. 1–14, 2023, doi: 10.1057/s41599-023-01787-8.

[7] A. M. Vieriu and G. Petrea, "The Impact of Artificial Intelligence (AI) on Students' Academic Development," MDPI, vol. 2, pp. 153–158, 2025, doi: 10.30983/bicc.v1i1.121.

[8] N. H. Patil, S. H. Patel, and S. D. Lawand, "Research Paper On Artificial Intelligence And It's Applications," J. Adv. Zool., vol. 44, pp. 229–238, 2023, doi: 10.53555/jaz.v44is8.3544.

[9] S. A. Z. Zaidi, E. Ahmad, and N. Shukla, "Ethical Considerations in the Use of Artificial Intelligence (AI) for Education and Research : A Review," Int. J. Innov. Sci. Eng. Manag., pp. 156–167, 2024, doi: 10.69968/ijisem.2024v3si2156-167.

[10] Z. Slimi, "The Impact of Artificial Intelligence on Higher Education: An Empirical Study," Eur. J. Educ. Sci., vol. 10, no. 1, pp. 17–33, 2023, doi: 10.19044/ejes.v10no1a17.

[11] M. Chen et al., "Acceptance of clinical artificial intelligence among physicians and medical students: A systematic review with cross-sectional survey," Front. Med., vol. 9, no. August, 2022, doi: 10.3389/fmed.2022.990604.

[12] L. Yu and Z. Yu, "Qualitative and quantitative analyses of artificial intelligence ethics in education using VOSviewer and CitNetExplorer," Front. Psychol., vol. 14, no. March, 2023, doi: 10.3389/fpsyg.2023.1061778.

[13] S. Castagno and M. Khalifa, "Perceptions of Artificial Intelligence among Healthcare Staff: A Qualitative Survey Study," Front. Artif. Intell., vol. 3, no. October, pp. 1–7, 2020, doi: 10.3389/frai.2020.578983.

[14] M. Govindaraj, C. Gnanasekaran, S. Thandayuthapani, S. V. Gnanamanickam, and P. Khan, "Role of Artificial Intelligence across Various Media Platforms: a Quantitative Investigation of Media Expert'S Opinion," J. Law Sustain. Dev., vol. 11, no. 5, pp. 1–14, 2023, doi: 10.55908/SDGS.V11I5.1175.

[15] S. Secinaro, D. Calandra, A. Secinaro, V. Muthurangu, and P. Biancone, "The role of artificial intelligence in healthcare: a structured literature review," BMC Med. Inform. Decis. Mak., vol. 21, no. 1, pp. 1–23, 2021, doi: 10.1186/s12911-021-01488-9.

[16] I. Bennis and S. Mouwafaq, "Advancing AI-driven thematic analysis in qualitative research: a comparative study of nine generative models on Cutaneous Leishmaniasis data," BMC Med. Inform. Decis. Mak., vol. 25, no. 1, 2025, doi: 10.1186/s12911-025-02961-5.

[17] H. E. Zhang, C. Wu, J. Xie, Y. Lyu, J. Cai, and J. M. Carroll, "Harnessing the Power of AI in Qualitative Research: Exploring, Using and Redesigning ChatGPT," Comput. Hum. Behav. Artif. Humans, vol. 1, no. 1, p. 29, 2025, doi: 10.1016/j.chbah.2025.100144.

[18] K. Ofosu-Ampong, "Artificial intelligence research: A review on dominant themes, methods, frameworks and future research directions," Telemat. Informatics Reports, vol. 14, no. March, p. 100127, 2024, doi: 10.1016/j.teler.2024.100127.

[19] P. A. Christou, "The Use of Artificial Intelligence (AI) in Qualitative Research for Theory Development," Qual. Rep., no. September, 2023, doi: 10.46743/2160-3715/2023.6536.

[20] T. V. Fridgeirsson, H. T. Ingason, H. I. Jonasson, and H. Gunnarsdottir, “A Qualitative Study on Artificial Intelligence and Its Impact on the Project Schedule, Cost and Risk Management Knowledge Areas as Presented in PMBOK®,” Appl. Sci., vol. 13, no. 19, 2023, doi: 10.3390/app131911081.

[21] L. Hamilton, D. Elliott, A. Quick, S. Smith, and V. Choplin, “Exploring the Use of AI in Qualitative Analysis: A Comparative Study of Guaranteed Income Data,” Int. J. Qual. Methods, vol. 22, pp. 1–13, 2023, doi: 10.1177/16094069231201504.

[22] D. L. Morgan, “Exploring the Use of Artificial Intelligence for Qualitative Data Analysis: The Case of ChatGPT,” Int. J. Qual. Methods, vol. 22, pp. 1–10, 2023, doi: 10.1177/16094069231211248.

[23] C. Collins, D. Dennehy, K. Conboy, and P. Mikalef, “Artificial intelligence in information systems research: A systematic literature review and research agenda,” Int. J. Inf. Manage., vol. 60, no. November 2020, p. 102383, 2021, doi: 10.1016/j.ijinfomgt.2021.102383.

[24] J. Serey et al., “Artificial intelligence methodologies for data management,” Symmetry (Basel), vol. 13, no. 11, 2021, doi: 10.3390/sym13112040.