

Can Generative Artificial Intelligence Write an Academic Journal Article? Opportunities, Challenges, and Implications

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Abstract

This article offers an in-depth reflection on the author's experiences with Generative Artificial Intelligence (Gen AI), ChatGPT 4.0. The author started the journey from their initial need for software for English proofreading and editing services to their interest in exploring pre-service teachers' application of Gen AI in lesson planning. Based on prompt engineering techniques, an iterative three-stage manuscript generation process—brainstorming, refinement, and writing—with ChatGPT is detailed. A short paper generated by ChatGPT is presented. Although Gen AI is a valuable tool in providing insights and assistance in research idea generation and design, academic writing, and English writing learning, the author cautions that critical thinking plays a vital role in ensuring accuracy, ethical considerations, and the preservation of rigorous scholarly standards. As Gen AI emerges as a game-changer in academia and education, this article highlights the importance of balancing its emerging capabilities with maintaining traditional academic and educational values.

1. Introduction

I connected with Gen AI because of my constant need for English proofreading and editing. After exploring ChatGPT 3.5, I was impressed with its proficiency in proofreading and editing English text. As an academic for whom English is a second language, I often rely on English proofreading and editing software, such as Grammarly, particularly for frequent email communication. Before discovering ChatGPT, I had to spend significant time drafting, refining, and revising emails to maintain professionalism, even with the help of Grammarly. With the help of ChatGPT, it requires less effort to efficiently craft emails that do not contain personal or sensitive information, although minor grammatical and readability issues may persist.

Additionally, thanks to its conversational user interface, ChatGPT feels like a private tutor with whom I can converse and ask further questions to learn vocabulary and phrasing to enhance my English writing. This is in line with the suggested learning strategy by Shemesh (2023). Building upon this foundation, my exploration of ChatGPT's potential has expanded

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into teacher education. To outline the structure of this article, I will first describe the topic I utilised ChatGPT to develop a manuscript and the strategies I employed in prompting it. Subsequently, I will present the short report generated by ChatGPT, followed by a critical reflection on the process and its educational implications.

1.1 The Short Report Topic

The research topic I asked ChatGPT to generate concerns the investigation of pre-service primary teachers' perceptions of Gen AI in lesson planning, taking the impacts of gender, academic level and daily use of Gen AI into account. The rationale for choosing this topic stems directly from my professional placement supervision in the Bachelor of Education programme. One of the recurring challenges they expressed during post-observation discussions is the creation of lesson plans, especially within tight timeframes and in fast-paced school environments. A lesson plan is essential for teachers to prepare, organise, and conduct lessons, and also serves as a means of evaluating a teacher's instructional skills (Liu & Zou, 2014). Drafting lesson plans is a standard requirement in teacher education programmes. However, constructing lesson plans is often seen as challenging and time-intensive (Alanazi, 2019; Colaco & Antao, 2023). Although some studies have emphasised the efficacy of technology-integrated approaches in assisting student teachers with lesson planning, like Google Docs (Colaco & Antao, 2023) and mobile learning applications (Susantini et al., 2022), there is also a proposal to use Gen AI for lesson planning (Bonner et al., 2023). However, pre-service teachers' practical use of Gen AI still awaits more empirical research. Thus, I applied ChatGPT to bridge the gap because of my familiarity with it.

1.2 Prompting Strategy

ChatGPT 4.0 Plus (Open AI, 2023), the September 25 version, was utilised for generating the short paper and proofreading this manuscript's abstract, introduction, and critical reflection sections. This paid version requires a monthly subscription of \$20. The short paper generation encompassed three stages: brainstorming, refinement, and writing. All prompts are shown in the table 1. The techniques of prompt engineering were employed to ensure accurate and logically consistent responses (Ali et al., 2023; Bozkurt & Sharma, 2023; L. S. Lo, 2023). The prompt engineering technique refers to the three fundamental components: content knowledge, critical thinking, and iterative design (Cain, 2023). The content knowledge involved my expertise and experience in teacher education, quantitative research methods and academic writing. Critical thinking skills were applied to evaluate the responses generated by ChatGPT critically. Additionally, the short paper generation process features an iterative design, meaning that its three stages are not linear but rather iterative. For example, I realised the literature review section lacked an introduction paragraph while writing. To address this, I turned to ChatGPT for suggestions during the brainstorming stage and asked it to refine a few sentences during the refinement stage.

Table 1: Prompt and explanation

Stage	Prompt
Brainstorming – establish outline	<ul style="list-style-type: none"> • You are a professor with great expertise in qualitative, quantitative and mixed-method research design and the application AI in education. • I want to conduct a mixed-method study to investigate pre-service primary teachers’ perceptions of using Gen AI for lesson planning, referring to their gender, levels in the teacher education. programme and daily use of Gen AI for personal and professional purposes. • Could you suggest a theoretical framework for my research? • Thank you. I like to use the technology acceptance model (TAM) as the primary theoretical framework of this study. • Sorry, I think you have forgotten my original focus on the impacts of primary teachers’ gender, levels in the teacher education programme and daily use of Gen AI on their perceptions of using Gen AI for lesson planning.
Refinement – specify details	<ul style="list-style-type: none"> • Could you be more specific about the Quantitative Analysis? • I like to you to regenerate a response after taking the variable of actual system from the theoretical framework. • Could you suggest a questionnaire that measures pre-service primary teachers’ perceptions of using Gen AI for lesson planning? • Could you generate five semi-structured questions for focus group interview? • I like you to rework section 3 by producing more choices and then dividing the generated choices into personal and professional/pedagogical categories. • I’d love you to rework the Professional/Pedagogical Use area by taking the possibility that pre-service teachers might have used Gen AI to do college works (e.g., writing a reading reflection). • I need a question that asks student teachers’ pre-existing use of Gen AI for lesson planning.
Writing – generate the exact short report	<ul style="list-style-type: none"> • Based on what we have discussed so far, could you write a 400-word introduction for my research question. • Could you provide references and reference list to back up the introduction? • Could you write an 800-word literature review with references and a reference list? • I do not need the section on Methodological Considerations in AI Education Research. Instead, I hope you replace this section with a review of the teachers’ application of Gen AI for lesson planning. • Thank you for your work. I like you to rework the literature review by including the following four sections: Gen AI in Education, Pre-service Teachers and Technological Adoption, the impacts of gender, academic level, and daily technology use

on teachers' perceptions of using emerging technologies for lesson planning.

- Could you write a 500-word methodology section for this study?

Table 1: Prompt and explanation (continued)

Stage	Prompt
Writing – generate the exact short report	<ul style="list-style-type: none"> • Please be more specific within the word limit, by considering the following settings: (1) A four-year primary teacher education programme with a total of 1,600 students. Each year has 400 students. 40 students are male while the rest of the 360 students are female; (2) the theoretical framework is TAM; (3) The questionnaire should be done in 10 minutes; (4) The focus group interview should be done in 20 minutes. • Could you provide reference and reference list to back the methodology section? • Could write an 800-word section for expected findings and related discussions? • I think the response has forgotten my interest in relation to the impacts of the level in the teacher education programme and pre-service teachers' personal and professional/pedagogical uses on their perceptions of using AI for session planning. • I am not very happy with the generated response for the section on expected findings and related discussion. Let's restart again.

2. AI Generated Short Report

This section reports on early-stage research pending approval of research ethics and subsequent data collection. The paper's title is 'Gender and Academic Level as Moderators: Pre-service Primary Teachers' Perceptions of Generative Artificial Intelligence in Lesson Planning and its Mediation by Personal and Professional Use.' Please refer to the other file to access the short report generated by ChatGPT.

2.1 Introduction

The incorporation of Generative Artificial Intelligence (Gen AI) into educational contexts, notably within pre-service primary teacher education and lesson planning, presents a complex and multifaceted exploration. This study tentatively seeks to explore and unpack these complexities, encapsulated in the research question: To what extent, if any, do gender and academic level moderate the relationship between pre-service primary teachers' perceptions of Gen AI and its potential application in lesson planning, and is this relationship mediated by their personal and professional use of Gen AI?

Lesson planning is commonly recognised as a critical component of effective teaching, intertwining content knowledge, pedagogical skill, and innovative strategies, often posing

challenges to pre-service teachers (Koehler & Mishra, 2009). Gen AI, with its potential to autonomously create content, may offer support to navigate these challenges, although it is essential to acknowledge that the adoption and application of such technology is potentially influenced by various psychological, socio-demographic, and pedagogical variables.

Gender and academic level have been suggested to influence technological engagement and application among pre-service teachers. For instance, possible differences in approaches and attitudes towards technology between male and female pre-service teachers have been noted in some contexts (Vekiri, 2010). Similarly, academic levels might influence technological self-efficacy and consequently, interactions and acceptance of emerging technologies within educational settings (Tondeur et al., 2016).

As pre-service primary teachers traverse their formative educational journey, interactions and engagement with technology potentially shape their future pedagogical beliefs and practices (Tondeur et al., 2012). Therefore, examining their perceptions and applications of Gen AI may offer insights into their current academic and technological experiences and potentially, into future technology-enriched educational environments (Teo, 2009). Gaining insights into the factors that influence these perceptions and applications may be crucial for supporting their development within technological and pedagogical domains.

Informed by the Technology Acceptance Model (TAM), this study cautiously approaches the understanding that perceived usefulness and ease of use are significant factors in technology adoption (Davis, 1989). It aims to gently probe the relationship between the acceptance of Gen AI and its application in lesson planning amidst the challenges often faced by pre-service teachers, with a mindful consideration of the mediating and moderating effects of personal/professional use, gender, and academic level.

Given this, the research seeks to explore: To what extent, if any, do gender and academic level moderate the relationship between pre-service primary teachers' perceptions of Gen AI and its application in lesson planning, mediated by their personal and professional use of Gen AI? The intention here is not only to explore these dynamics but to contribute to the ongoing conversations about pre-service teacher preparedness and practices in applying Gen AI in lesson planning, offering insights into their practices, beliefs, and future professional contexts.

2.2 Literature Review

In the evolving educational landscape, understanding the technological behaviours of pre-service teachers is becoming increasingly vital. This literature review delves into several interconnected areas. We begin by examining gender and academic progression, investigating how they might influence technology adoption patterns among student teachers. Following this, the Technology Acceptance Model (TAM) is introduced, a renowned framework that provides insights into the factors driving technology acceptance. From there, we navigate to the realm of Gen AI, probing its application in both the personal and professional spheres of pre-service teachers' lives. Concluding the review, we contemplate the potential of Gen AI as a tool to assist these educators in lesson planning. Through this exploration, the intention is to elucidate the nuanced relationships pre-service teachers have with technology, with a particular emphasis on Gen AI.

2.2.1 Pre-service Teachers: Unraveling Gender and Academic Level in Technological Adoption

Engaging with literature around pre-service teachers' adoption of technology, a subtle narrative regarding gender and academic level begins to surface. Previous explorations, such as that by Vekiri (2010), slightly pull back the veil on gender disparities, revealing the possible divergent trajectories in both attitudes and self-efficacy towards Information and Communication Technology (ICT) among male and female pre-service teachers. Similarly, as pre-service teachers traverse through academic levels, their technological interactions might witness variations, suggesting that their year of study might potentially influence their perceptions and uses of technology in educational contexts (Tondeur et al., 2016). Nevertheless, these investigations only partially illuminate the broader tableau, indicating a necessity for a deeper, nuanced exploration that accounts for these variables in the context of Gen AI.

2.2.2 Anchoring Explorations in the Technology Acceptance Model (TAM)

Navigating the ocean of technological adoption research, the Technology Acceptance Model (TAM) often serves as a vessel for researchers, exploring user experiences and engagements with technology. Fundamental to TAM is the assertion that perceived usefulness and perceived ease of use stand as central pillars influencing technology acceptance and usage (Davis, 1989). However, applying TAM to pre-service teachers extends beyond mere application, invoking questions about how these foundational principles might intertwine with pre-service teachers' experiences, motivations, and challenges in their technological and pedagogical journeys (Teo, 2009). The potential symbiosis between perceived utility, ease of use, and individual variables like gender and academic level opens avenues for meticulous exploration.

2.2.3 Gen AI in Dualistic Contexts: Personal and Professional Spheres

The landscape of Gen AI use, especially within pre-service teachers' experiences, extends across two realms: personal and professional. It's implied that their engagements with Gen AI could be shaped by an amalgamation of intrinsic and extrinsic motivations (Wang et al., 2020), which could be distinctly different in personal versus professional contexts. Their personal use might be guided more by intrinsic motivations and interests, while professional usage could be tethered more to perceived utility and extrinsic motivations, like curriculum demands and pedagogical efficacy. Yet, this dichotomy is speculative at best and demands a more deliberate investigation into its reality and repercussions in the context of lesson planning.

2.2.4 Gen AI: A Tentative Bridge in Lesson Planning for Pre-service Teachers

Pre-service teachers, often navigating the tempestuous seas of lesson planning, might find an ally in Gen AI. The potential of Gen AI in mitigating challenges inherent in lesson planning is not fully unveiled, yet it is tempting to envisage its capacity to bridge gaps between theoretical knowledge and practical application (Zawacki-Richter et al., 2019). While the hypothetical benefits, such as automated content generation, personalised resource suggestion, and augmented content creation, are attractive, the actual perceptual and practical

dynamics among pre-service teachers remain in shadows. The complexity of their psychological, pedagogical, and technological interactions with Gen AI, especially in the context of their gender and academic progression, requires a more profound exploration, deeply embedded in their lived experiences and perceptions.

In wrapping up this literature review, it's evident that the intersection of technology and pedagogy, particularly with the advent of Gen AI, is reshaping educational paradigms. Our exploration underscores the nuances that gender and academic stages introduce to the technology adoption patterns among pre-service teachers. The insights offered by the Technology Acceptance Model (TAM) further contextualise these patterns, offering a framework for understanding their technological inclinations. Gen AI stands out with its potential in both personal and professional contexts, notably in the realm of lesson planning. However, there's a clear gap in fully comprehending its implications and applications. Future research must delve deeper, ensuring that our understanding evolves in tandem with the technological advancements, aligning them with the broader educational goals.

2.3 Methodology

2.3.1 Research Design

This study utilises a mixed-methods approach, employing a sequential explanatory design, to meticulously investigate pre-service primary teachers' perceptions and applications of Gen AI in lesson planning. With the Technology Acceptance Model (TAM) as the theoretical framework, perceived usefulness and perceived ease of use are pivotal variables.

2.3.2 Participants

Participants are pre-service teachers from a four-year primary teacher education programme with 1,600 students (40 males and 360 females per year). Quantitative phase participants will be stratified randomly selected, ensuring representative sampling across all academic years and genders (n=200). For the qualitative phase, 20 participants will be purposively selected based on their questionnaire responses to ensure diverse insights.

2.3.3 Instruments

2.3.3.1 Questionnaire. A 10-minute online questionnaire will collect data on demographics, perceptions, and use of Gen AI, informed by TAM's constructs. It includes sections on perceived ease of use, perceived usefulness, and behavioural intention to use Gen AI, measured through Likert-scale items, and sections querying the frequency and type of Gen AI use. Reliability and validity will be established via a pilot test and expert review.

2.3.3.2 Focus Group. Subsequent 20-minute focus group discussions will explore deeper insights into participants' perceptions and experiences, employing semi-structured questions derived from quantitative results and the TAM framework, focusing on practical and perceptual aspects of Gen AI use in lesson planning.

2.3.4 Data Collection

2.3.4.1 Quantitative Phase. A stratified random sample of students will be invited via email to participate in the online questionnaire, ensuring ethical adherence through informed consent and maintaining anonymity.

2.3.4.2 Qualitative Phase. Participants for focus groups will be selected based on interesting or divergent questionnaire responses to ensure varied perspectives. The discussions will be conducted virtually, recorded, and transcribed, respecting ethical protocols, and participants' consent and confidentiality.

2.3.5 Data Analysis

2.3.5.1 Quantitative Analysis. For this research, we will conduct both mediation and moderation analyses to discern the intricacies of the relationships among the variables. Mediation analysis will delve into the mechanism of how pre-service primary teachers' perceptions of Gen AI (Independent Variable) influence its application in lesson planning (Dependent Variable). We hypothesise that this relationship is mediated by their personal and professional use of Gen AI (Mediator Variable). Moderation analysis will scrutinise how gender and academic level (Moderator Variable) influence the strength or direction of the relationship between pre-service teachers' perceptions (Independent Variable) and the application of Gen AI (Dependent Variable). In a nuanced moderated mediation analysis, we'll investigate if the mediating effect of personal and professional use of Gen AI differs across gender or academic levels. The hypotheses will test if, for instance, the mediation effect is more pronounced for final-year students compared to first-year students or differs between male and female pre-service teachers. Prior to in-depth analyses, assumptions for mediation and moderation, such as linearity and absence of multicollinearity, will be tested to ensure the robustness of the findings.

2.3.5.2 Qualitative Analysis. Data from focus group discussions will undergo inductive thematic analysis, focusing on identifying themes that elucidate the quantitative findings, specifically around the practical and perceptual aspects of Gen AI use and its alignment with TAM's constructs.

2.3.5.3 Ethical Considerations. Ethical diligence will be paramount, involving obtaining informed consent, ensuring participant anonymity, and the secure storage and handling of data. Ethical approval will be sought from the relevant institutional ethics review board.

2.4 Possible results and implications

This study anticipates noticeable variances in the acceptance and use of Gen AI in lesson planning among pre-service teachers, influenced by their academic progression and gender. Male and female pre-service teachers might display distinct patterns of Gen AI adoption. The depth of personal use of Gen AI is predicted to correlate with its integration in professional settings, suggesting that familiarity might bolster confidence in its pedagogical applications. A strong intrinsic connection is expected between the perceived usefulness and ease of Gen

AI use and its intended implementation in lesson planning. Exploring these perceptions, aligned with the Technology Acceptance Model (TAM), will provide insights into potential facilitators or hindrances for its adoption. Ethical concerns and practical challenges might arise, emphasising a tension between pragmatic AI adoption and traditional planning values. Ultimately, this research aims to deepen understanding of Gen AI adoption among pre-service teachers, offering valuable insights for educational stakeholders.

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3. Critical Reflection

3.1 Reflection on Process

The whole process took approximately twelve hours. Four challenges were identified. The initial challenge involved consistently reminding ChatGPT of the primary research objectives in the context of the hypothetical study. I examined the impacts of three variables on pre-service teachers' perceptions of using Gen AI for lesson planning: gender, academic level, and personal and professional use of Gen AI. Essentially, the longer the conversation, the more likely ChatGPT was to omit these three variables from earlier in the thread. The second challenge pertained to inconsistency in ChatGPT's responses. For instance, when ChatGPT was requested to suggest a quantitative data analysis technique suitable for the hypothetical study, it initially outlined relevant statistical variables based on the technology acceptance model (Davis, 1989) and proposed five analytical steps: pre-processing, descriptive analysis, inferential analysis, model testing, and interpretation. After I requested the removal of a particular variable from the TAM framework, ChatGPT generated a new response. However, the suggested analytical steps decreased from five to three—particularly omitting the critical Interpretation step. It is reasonable to assume that the interpretation step should have remained after removing a single variable from the TAM statistical model. The third challenge has been widely documented: ChatGPT may produce correct-sounding but logically incorrect results (Dwivedi et al., 2023; National Academic Integrity Network, 2023). Finally, concerning citations and references, ChatGPT may generate a response with

in-text citations but does not necessarily include the citations in the references. This finding is consistent with the finding made by Walters and Wilder (2023).

In terms of ChatGPT's strengths, it was found that ChatGPT can recommend appropriate research questions and suggest potential research design ideas after being prompted with a few keywords (Sallam, 2023). It also excels at recommending data analysis techniques (Rahimi & Talebi Bezmin Abadi, 2023). In other words, using Gen AI could benefit researchers aiming to identify a viable research question and subsequently outline a fitting research design (Rahman et al., 2023). ChatGPT's feature for generating lengthy content has been articulated in enhancing academic writing efficiency and quality (Huang & Tan, 2023). In addition to its value in supporting academic writing productivity, ChatGPT allows for two-way communication, simulating human interaction, for English learners as noted by Imran and Almusharraf (2023). If ChatGPT generates confusing responses, users can ask for further clarification or a simplified version. Compared to other online proofreading and editing tools, such as Grammarly, despite their recent integration of Gen AI, it mainly serves as a tool to identify errors and suggest corrections through one-way communication. Therefore, it is less likely to allow users to ask further questions.

Recognising the aforementioned strengths and challenges, the approach to writing, especially for complex tasks like journal articles, requires a more dynamic strategy. The next time I have the opportunity to write a journal article with the assistance of Gen AI, I will create a guiding map listing the major and minor headings required for each chapter, enabling a visualisation of current progress. This strategy helps clarify my progress in the dialogue with ChatGPT by referencing these headings as I transition between the brainstorming, refinement, and writing stages. Thus, I will be able to identify areas that require further attention. For instance, I should have consulted ChatGPT to refine the focus group interview questions to align with the updated questionnaire items. I failed to recognise this issue until I was deep into writing this manuscript. This experience underscores the challenges of relying solely on Gen AI to craft a journal article. Writing a journal article is not just about writing; it encompasses idea generation, research design (including data collection/analysis), and literature search. While Gen AI can assist in idea production and offer recommendations for research design and literature review (Sallam, 2023), it ultimately falls on us, the scholars, to critically evaluate the results generated by Gen AI, as Rahman et al. (2023) suggested.

3.2 Reflection on Implications

The adoption of Gen AI, particularly ChatGPT, in academic and educational contexts, demonstrates a significant shift across various facets, including knowledge, scholarship, teaching, learning, and assessment. Integrating Gen AI into academia has a great potential to democratise knowledge and scholarship by enabling non-native English-speaking academics to participate in scholarly discourse predominantly conducted in English. This accessibility fosters a more inclusive academic environment but concurrently introduces challenges concerning authorship and the authenticity of ideas (Lund et al., 2023; Morocco-Clarke et al., 2023). Academic communities must emphasise cultivating original thought and critical analysis, fundamental tenets of scholarly work. Discussions regarding the potential for Gen AI to aid the education sector, including teaching, learning, and assessment, were widespread (Barros et al., 2023; Chan & Hu, 2023; C. K. Lo, 2023). However, over-reliance on it may hinder students' critical thinking (Michel-Villarreal et al., 2023) and raise ethical concerns (Elkhatat, 2023). Thankfully, in Ireland, clear guidance has been issued by the (National

Academic Integrity Network, 2023), though periodic reviews may be necessary to accommodate the evolving AI landscape. This proactive approach in Ireland reflects the global academic community's need to balance the transformative potential of Gen AI with its inherent challenges.

Gen AI's emergence offers benefits and challenges for scholars, especially non-native English-speaking scholars. It significantly enhances efficiency in producing and refining content and creating opportunities for English writing learning. While Gen AI assists in research idea generation and design (Sallam, 2023), scholars must critically evaluate these AI-generated outcomes, maintaining their essential role in scholarly work (Rahman et al., 2023). Thus, the value of Gen AI in academia hinges on its utility and scholars' critical engagement with its responses. In conclusion, integrating Gen AI into academia and the education sector is a double-edged sword. While it offers significant benefits regarding efficiency and accessibility, it also challenges us to rethink and redefine the essence of knowledge, scholarship, teaching, learning, and assessment in the Gen AI age. As we navigate this new terrain, we must ensure that Gen AI is used responsibly, complementing rather than supplanting the human elements of scholarship and education.

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